Changing sides

The economic and social impact of the ferry services in the Netherlands in 2015/2016

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Thesis: Master

Date: 2017

Abstract

Background
The report “Hoe ver is de overkant?” (Oostinjen, 2004) and “Verdiensten van veerdiensten” (Den Hartogh, 2010) show that the ferry services, that operate throughout the whole year, has a large social and substantial economic impact for the Netherlands. However, both reports state that a stable financial base is lacking, as is a durable policy regarding ferry services. The report of Oostinjen in combination with an amendment of Member of Parliament Van der Staaij (SGP) resulted in a ten million euro fund for the freshwater ferries in 2006, but it was only a one-time intervention and not a stable solution for the problems of the ferry services. In 2004 the ferry services faced an operating deficit of € 18 million. The report of 2010 showed that both the social and economic impact of ferry services has increased, despite the fact that the ferry services still face an operating deficit (€ 6 million).
This research will serve as an update of these two researched and focuses on the fresh water ferry services that are operated the whole year. In addition, the recreational and saltwater ferry services have been investigated, just like the impact of ferry services on the environment.

Economic and social impact
The ferry service sector consists of 313 ferry services, which is an increase of 28% compared to 2010. The ferry services can be categorized in multiple different ways. This research distinguished three different ferry services: utilitarian, recreational and saltwater ferry services. The 94 utilitarian ferry services are operated throughout the whole year and mostly transfer people with a commuter or scholar travel motive. These ferry services have a significant economic impact with a turnover of 33,6 million and 591 FTE. Annually, 46,2 million people have been transferred that is an increase of 13,8 million compared to 2010. Despite the growth in the number of transferred people the operating deficit of the ferry services has stayed more or less the same. The social value of utilitarian ferry services are even higher. To test the social impact a hypothetical market is created in which ferry services have been terminated what will have an impact on the users of ferry services. A user survey has been used to map the impacts for the user and have been quantified by examining the value a person should be compensated with, the Willingness to Accept (WTA), since it can’t use a ferry service anymore. In addition social effects, like noise pollution and traffic injuries, and environmental effects have been quantified. As a result both the social and economic value of the utilitarian ferry services have increased compared to the reports of 2010 and 2004.

The 113 recreational ferry services transfer almost 2,2 million people per year. Jointly the recreational ferry services have a turnover of almost € 4 million. The recreational ferry services are operated by 101,2 FTEs and 842 volunteers. Working with volunteers is key for recreational ferry services since most of the ferry services can’t afford to operate the ferry with employed workers. Almost half of all the ferry services already require a subsidy of the local or provincial government. Despite the absence of a stable financial base the recreational ferry services represent a significant social value. The social impact of the recreational ferry services is obtained by the Willingness to Pay, the provided subsidy and the expenses of users which can be ascribed to the ferry services. The social impact of the recreational ferry services is substantial.

The saltwater ferry services to the Wadden Islands have a significant economic impact, which is assessed by the same aspects: turnover and employment. The social impact is only qualified, but since the ferry services are the only connections with the mainland the impact is evident.

Sustainability
The existence of ferry services prevents a lot of detour kilometers for many people, which saves time and money but also a reduction of the emissions of road traffic. In order to prevent the emissions of road traffic vessels are used which also emits. The external cost of the emissions of ferry services is set at € 10.9 million. The preservation of the environment is not only looked at because of forthcoming legislation. Sustainability is also an issue for the ferry owners themselves. There is a distinction between economic and environmental sustainability. Both the utilitarian a recreational show initiatives to make the ferry more sustainable in an environmental way.

Recommendations
Sustainability is one of the major issues in this research. The sector could capitalize on future laws and legislation and has a clear view on developments to reduce emissions. Investing in sustainable technologies could lead to an improved image of the sector that will lead to financial sustainability. Also on policy level sustainability is needed. The ferry services have a significant impact for the Netherlands, but only two provinces has a long term policy on ferry services. A durable policy, which can be used by all ferry services with a significant impact is advised.

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1. Introduction

1.1 Background

The collision of an inland ship with the weir near Grave, at the end of 2016, was widely reported in the Dutch press. As a result of the collision with the weir the water level in the river Meuse dropped between two and three meters. Logically, much attention was paid to the consequences that this collision had for inland navigation and for the people whom suddenly had to flee their homes. The ferry service between Cuijk and Middelaar, which couldn't operate because of the dropped water level, was hardly ever mentioned in the reports. Approximately 850 persons per day use this particular ferry service. Thanks to the ferry service the distance that must be travelled between both village centers is limited to about 4 kilometers. Because the ferry service was not in service, the people now had to make an 11 kilometer detour to get to the same place. The mobility of the persons who use the ferry connection became affected.

The mobility on roads is at the heart of the Dutch government. The Rutte II cabinet has since they took office ensured 653 kilometers of new asphalt. In addition another 64 km of new lanes will be finished before the end of their term (Rijksoverheid, 2013). Despite the construction of many additional roads and lanes, the amount of congestion is rising. Surprisingly, the mobility of people over water is often overlooked. The report "Hoe ver is de overkant?" (2004) by Oostinjen draws attention to this problem for the first time. This report shows the economic and social impact of ferry services. In the conclusions is stated that either the economic as the social impact of ferry services is significantly high. However, the sector lacks a stable financial basis and a structural, sustainable policy is missing. The report of 2004 was succeeded by the report "Verdiensten van veerdiensten" by Den Hartogh (2010). The report describes that, despite a one-time subsidy provision of the national Government in collaboration with the provinces, still no structural and sustainable policies in relation to the ferry services exist. Furthermore the report by Den Hartogh emphasizes that the economic and social impact of the ferry services has grown compared to 2004. The financial situation of the ferry services has improved, but still a stable financial base isn't in place.

This study will serve as an update of the previous two reports. Just like the researches of 2004 and 2010 the economic and social impact of the ferry services on the Dutch inland waterways will be studied. In the former research the focus was on the ferry services which operate throughout the year. In addition, this research will also draw attention to ferry services which operate only a part of the year. The result of this study will be used to formulate a structural, sustainable policy for the ferry services.

1.2 Problem statement

Since this research is an update of the studies from 2004 and 2010, the focus of this report will be on Dutch ferries that sail on Dutch inland waterways. The most important key figures will be updated and based on those figures a policy proposal will be formulated. This proposal will both have political implications as a social character. These objectives have led to the following problem statement:

"What is the current economic and social impact of the ferry services in the Netherlands, both seasonal and ferry services who operate all year, and what policies could all the different actors within the sector carry out?"

Based on the abovementioned problem definition twelve sub question are formulated in order to answer the main research question.

1) What is a ferry service and what type of ferry services are there?
2) What is the outlook of the ferry service sector?
3) How can social and economic impact be qualified and quantified?
4) What is the current social impact of the ferry service sector?
5) What is the current economic impact of the ferry service sector?
6) What is the impact on the environment of the ferry sector?
7) What is the impact of the salt ferry services?
8) What are the current developments and opportunities in the ferry services sector?
9) What recommendations can be made for the ferry service sector?
10) What vision can be formulated for the ferry industry in the short and long term?

1.3 Problem approach

In order to answer the above main and sub question three different research methods are used. First of all, a literature study has taken place, which gave an overview of the sector and formed a theoretical framework. The researches: "Hoe ver is de overkant?" and "Verdiensten van veerdiensten" served as an important information source. Based on the previous research, scientific papers and additional literature a method is formulated to quantify the economic and social impact of the ferry service sector. Since this research serves as an update, the method that is used for certain categories of ferries hardly differs from the previous reports.

After determining the correct methods, quantitative research has taken place. The quantitative part consists of two different surveys: a survey for the providers of a ferry service and one for the users of a ferry service. The economic impact of the ferries is based on the survey that is sent to the owners/operators of the ferry service is. The social impact of the ferry services is determined based on the user surveys.

The main determinants of the seasonal ferry services are examined through in-depth interviews. This qualitative research method is then also used to outline the ferry sectors in Belgium and Germany.

1.4 Structure

The research report is built on the basis of ten different chapters. Chapter 1 gives an introduction of the research, after which the problem statement follows. After that the methods which are used to approach the problem are showed. Based on this approach ultimately a conclusion will be drawn.

Chapter 2 covers the ferry service sector. First, a definition of the concept of ferry service is given, after which a categorization of the ferry services is outlined. After briefly discussing the history of the ferry services in the Netherlands an overview of the current ferry service sector is presented.

In chapter 3 the theoretical framework is presented. This chapter describes how the social and economic impact of ferry services is qualified and what methods can be used to quantify this.

Chapter 4 elaborates on the methods used to qualify and quantify the impact of the ferry services. After the elaboration on the used methods the quantification of the impact of the utilitarian ferries has taken place.

Chapter 5 firstly gives a description of the methods used to quantify the economic and social impact of the seasonal ferry services. After that the quantification has actually taken place.

In chapter 6 sustainability and market development will be discussed. Here, a distinction is made between economic and environmental sustainability. First of all describes the method used to identify the environmental impacts in order to quantify the pollution of ferry services. Secondly, methodologies are presented that can lead to a more environmentally friendly sector. At last the economic sustainability will be discussed, in which ways are discussed in order to attract potential users.

Chapter 7 describes the economic impact of the salt ferry services in Netherlands.
After discussing all forms of ferry services in the Netherlands, chapter 8 describes the current developments in the industry. Based on these developments opportunities and possibilities are formulated for the entire sector.

In chapter 9 the final conclusion and recommendations will be presented. The recommendations are divided in recommendations for the sector and recommendations for further research.

2. The ferry service sector

The Netherlands is a country which has a lot of inland waterways. Currently, The Netherlands have 313 ferry services that provide mobility over the water. Many villages and towns are held accessible by the ferry services. Each ferry connection is unique, but there are also a lot of comparisons between one another. In order to identify these similarities and differences this chapter will be a framework in which all relevant terms will explained. First of all, the concepts of 'ferry service' and 'ferry' will be discussed, after which a categorization of various ferry services will follow.

2.1 Definitions

In the dictionary a 'ferry service' is described as (Van Dale, 2016):
"A scheduled service of a ferry boat, ship connection between two shores."
or
"A scheduled connection by boat between two places in close proximity."

From an economic perspective a 'ferry service' could be marked as the provision of a service. A ferry service provides a user the ability to be transferred over water, including his/her goods and vehicles. A user of a ferry service 'consumes' the service when he uses the possibility to cross the water. In many cases a person should pay for the transfer. This creates a market where demand (the user) and supply (the ferry service) come together. That means that throughout the whole country at locations where the service is offered, a market has emerged. The sum of all of these small markets combined is the ferry sector.

In this study, the focus is on the ferries that sail on the Dutch inland waterways.

2.2 Categorization ferries

Ferry services are in different ways into any category:

- The transfer possibility per means of transport
- The ownership structure
- The ferry vessel model
- Sailing period and time schedule
- The fulfilled function
- The type of water that is crossed: fresh or salt

The transfer possibility per means of transport
When a classification is made on the basis of the transfer possibility per means of transport than there are three different types. A car ferry can be used by all forms of transport (cars, bicycles and pedestrians). A bicycle-pedestrian ferry transfers bicycles and pedestrian. Finally, a pedestrian ferry only transfers pedestrians.

The ownership structure
One can speak of a 'private' ferry service when the ferry service is owned and operated by a private individual/organization. Municipal ferry services are owned by the municipality. The municipality can own the entire ferry service or it has the, sometimes centuries-old, ferry rights in its possession. Municipal ferry services may be operated by a municipality or by a private operator. The same goes for ferry services which are state-owned or province-owned. In some cases a non-profit foundation is the owner of the ferry service. When it's not entirely clear who is behind the foundation the ferry service will be placed in a separate category.

The ferry vessel model
There are many distinctions regarding the model of the vessels. First of all, there is free floating and non-free floating vessels. The non-free floating ferries are once again divided in three different models: cable ferries, chain ferries and swing ferries. These models have only limited ability to maneuver. The free floating ferries can maneuver freely. Free floating ferries could be distinguished in two ways: sail direction and speed. It is common for ferries to cross the water abeam. However there are a couple of ferries which cross the water in the longitudinal direction of the water. Generally these ferries are able to achieve a higher speed of 30 to 70 kilometers per hour. For the other ferries the maximum speed is limited to 25 km/h (Waterrecreatie Nederland, 2014). The ferry vessel models have been specified in Annex 1.

Sailing period and time schedule
There are ferry services which operate (almost) the whole year and some sail only some months of the year. The sailing period differs per ferry service as a result of supply and demand. The ferry services which only sail some months of the year operate mostly between March and October. These ferry services focus mainly on the recreational/touristic travelers. Ferries which sail the whole year don't really have one focus group although they attract more commuters, business travelers and student. The time schedule differs between almost all ferry services. Just like the sailing period that is a matter of supply and demand. Most of the time the ferry services that sail throughout the whole year start earlier than the other ferries since they transfer a lot of commuters and students. The ferries that focus on recreational travelers therefore start later on the day.

The fulfilled function
Each ferry service has one main function: transferring a person from location A to location B. However, the users of ferry services have different travel motives. These motives can be divided in: commuter traffic, business traffic, student traffic and recreational/touristic traffic. When a ferry service mainly transfers commuters and students, then these ferries have a mainly 'utilitarian' function. These ferry services are generally in service throughout the whole year. Ferry services that mainly transfer recreational/leisure travelers have a mostly recreational function. Since these ferries mainly focus on these travelers they adjust their sailing period to periods with good weather. Even though the utilitarian ferry services focus on commuters and student traffic, it does not mean that they don't have recreational/tourist travelers. Sometimes these kind of travelers have a large impact on the total revenue. For the recreational ferry services it also applies that they also transfer people with another travel motif.

The type of water that the feather bridged: fresh or salt
As mentioned earlier, the research focusses on the ferries that sail on the Dutch inland waterways. For most people rivers, canals and lakes will come to mind when thinking about inland waterways. These waters consist primarily of melting and rain water. For that reason these waters will be called 'fresh' waters. However, the Wadden Sea and the Western Scheldt also belong to the inland waterways.
These waters consist mainly of sea water, which is 'salt'. Therefore we will make a distinction between ferries that sail at fresh and salt water.

2.3 History of the ferry services
"Netherlands won't be Netherlands anymore if ferry services no longer would exist." One of the users of the many ferry services the Netherlands has made this statement. Ferry services are indeed characteristic for the Netherlands. That does not mean that a ferry service is typically Dutch. Anywhere where rivers flow, people have had that urge to cross the water. In ancient Roman times ferries were already used to cross rivers at major trade routes. Therefor it's no surprise that the

Dutch word ‘pont’ is derived of the Roman name for bridge (Rotterdam Openbaar Vervoer Museum, 2012).

For centuries, ferry services offer people the possibility to cross the water. The first report of ferry services date from the year 1300. Nevertheless, it is assumed that ferry services exist much longer in the Netherlands. For all these years the ferries operated decently until the development of the car in the mid-twentieth century. The tremendous economic growth led to an increase in the amount of people that had access to a car. The car made it easy to travel longer distances, which had large implications for ferry services. A lot of them were replaced by bridges.

Up until that moment the ferries were bicycle-pedestrian ferries. The ferries that kept in place were updated to car ferries. Due to the construction of tunnels and bridges a lot of ferry services were ceased to exist. In order to represent the interests of the remaining ferry services the Association of Owners and Operators of Ferry Services in the Netherlands (V.E.E.O.N.) established in 1964 (V.E.E.O.N., 2016). The main goal was to promote the smooth operation of the ferry services in the Netherlands in the broadest sense of the word. In addition to the V.E.E.O.N. another association for the ferry services exists since November 2006. The National Ferry service Platform (LVP) acts as a knowledge partner for the government in which they use their knowledge on those areas where this is missing (LVP, 2016). Objective of the LVP is to represent the collective interests of the ferry services on all relevant areas.

2.4 Current overview of the ferry service sector

Currently, the Netherlands has 313 ferry services. Compared with the previous research of 2010 this is an increase of more than 28%. This increase is mainly due to the emergence of new bicycle-pedestrian ferries. As mentioned earlier, ferry services can be categorized in many different ways. Within the Netherlands there are 65 car ferries, five of which are beyond the scope of this research. These five car ferries are excluded since they don’t operate on the Dutch inland waterways and sail to destinations in the U.K. or Germany.

58 of the 60 car ferries, which are within the scope of the research, are operated throughout the whole year. Five of them sail between the mainland and the Wadden Isles. At the isles of Vlieland and Terschelling it is prohibited for visitor to use the car. However for residents and suppliers it is possible to go to the isles by car so these ferry services will be included in the car ferry category. Since these ferries sail across salt water these ferries will from now on be called ‘salt ferries’.

In addition to the 65 car ferries there are 173 bicycle-pedestrian ferries. Only 41 of them are operated throughout the whole year. One of the remaining 132 is excluded from the research, because it finds its destination in Germany. In total 131 bicycle-pedestrian ferries remain, of which 32 are self-service ferries. The 99 bicycle-pedestrian ferries have a sailing period which is limited between March and October. Six ferries are special compared to the other recreational ferries since they sail in the longitudinal direction of the water.

At last the Netherlands has 75 pedestrian ferry services, of which 56 self-service ferries. In total there are 88 self-service ferries.

Table 2.1: Overview ferry service by sailing period, including ferries beyond the scope of the research

Means of transport	Sailing period	Number of ferry services
Car ferries	Whole year	63 58 within scope
	Seasonal	2
Bicycle-pedestrian ferries	Whole year	74 (32 self-service, 1 beyond scope)
	Seasonal	99
Pedestrian ferries	Whole year	63 (56 self-service)
	Seasonal	12

In addition to this categorization, another form of categorization has taken place. Within the research the water taxis, 'salt' ferries and public transport ferries will not be discussed. In total there are 18 ferries which cross the salt water. Six are excluded, because they don't sail on the inland waterways. Three are seasonal ferries so these will be discussed in the chapter regarding recreational ferries. The remaining ferry services are the ferry connections to the Wadden Islands and the ferry between Vlissingen and Breskens. The ferry between Vlissingen and Breskens differs from the others since it is operated on the "Wet Openbaar Vervoer 2000". This means that this ferry service is part of the public transport (PT).

In total three ferry service providers operate based on the aforementioned law:

-Vlissingen-Breskens (Westerschelde Ferry BV)
-Hoek van Holland-Maasvlakte (RET)
-Aquabus BV

Aquabus BV is a combination of Aqualiner and Waterbus. Aquabus operates the public transport ferry services in the regions of Rotterdam and Dordrecht. Aquabus is good for a total of eight connections within these regions. In relation to the research from 2010, this means an increase in the number of connections. However, one public transport connection is lost: Fast Flying Ferry, the connection between Velsen Zuid and Amsterdam Central Station.

In addition to the 'salt' and public transport ferry services, there are also providers of water-taxi services and express service connections. They will be discussed separately in this study. An overview of the distribution of the ferry services can be found in the table below.

Tabel 2.2: Overview ferry services

Category	Mean of transport	Number of ferries	Ownership structure
Utilitarian ferries			
'Normal ferries'	Car ferries	53	30 Private 20 Municipality 3 Provincial
	Bicycle-pedestrian ferries	31	8 Private 22 Municipality 1 state-owned
PT ferries	Bicycle-pedestrian ferries	10	10 Province/ Metropoleregion
Recreational ferries			
	Car ferries	2	1 Municipality 1 Foundation
	Bicycle-pedestrian ferries	93	49 Private 32 Municipality 5 Province 13 Foundation
	B-P in longitudinal direction	6	
	Pedestrian ferries	12	6 Private 4 Municipality 1 Province 1 Foundation
Salt ferries			
	Car ferries	5	Private
	Express service	4	Private
	Water taxis	1	Private
Water taxis			
	Pedestrian ferries	2	1 Private 1 Municipal
Self service ferries			
	Bicycle-pedestrian ferries	32	
	Pedestrian ferries	56	
Excluded			
	Car ferries	5	Private
	Bicycle-pedestrian ferries	1	Private

3. Theoretical Framework

This chapter describes how the economic and social impact of ferry services will be operationalized. Since this research is an update of two previous studies, from 2004 and 2010, the same method will be used in order to achieve a correct comparison. At first the method which is used to obtain the social impact will be discussed followed by the method to obtain the economic impact.

3.1 Social impact

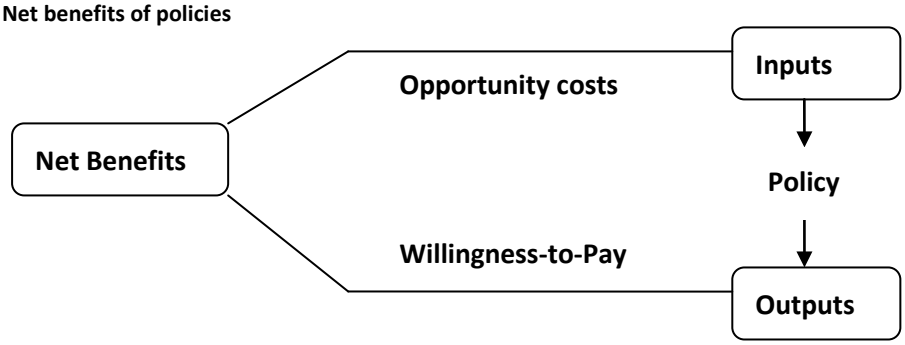
The social impact of ferry services has multiple effects. Users of ferry services derive utility from the transfer with a ferry. The ferry service supplies time gains compared to alternative routes users can travel by bicycle instead of by car. This utility is only gained by one individual, so what is the benefit for society as a whole? In many cases people forget that the choice of one person affects the utility of another individual. These aforementioned examples are direct effects of impact. However ferry services also provide indirect utility effects, for example contribution to accessibility, the environment and road safety. In most cases the direct effects can be monetarized in economic value in euros. The indirect utility effects are a lot harder to monetarize. Nevertheless, over the years several methods are developed to give a value to these indirect social effects.

3.1.1 Social cost-benefit analysis

A social cost-benefit analysis is an integral balancing instrument which is used to assess all current and future pros and cons against each other by putting a monetary value on them. The essence of a SCBA is that project- or policy alternatives can be balanced out on the basis of consequences to the prosperity of society as a whole: the social costs and benefits (Romijn & Renes, 2013). In a SCBA the valuation of non-valuable goods/services or effects is key. Within a SCBA someone tries to value the social impact of a good or service by expressing both price and non-price effects in a monetary value. At first, one has to wonder what this has to do with ferry services, since an individual usually has to pay for a transfer by ferry. The direct effect, the utility that's satisfied by the transfer, is quantified by demand and supply. However, ferry services also have an indirect effect. In many cases these indirect effects are non-valuable effects. The possible costs and benefits of congestion and nature could serve as an example (Ruijgrok, Brouwer, & Verbruggen, 2004).

The Dutch ferry services have long been in financially difficult times. In order to measure the effects of losing a ferry services a SCBA could be used. In addition a SCBA could outline the costs and benefits of the free ferry services. From an economic perspective these ferry services won't make sense but in a SCBA all the advantages and disadvantages, including the indirect non-valuable effects, are outlined. This analysis could show why it's beneficial for some products or services to exist. In order to maintain these services or goods, policymakers could intervene in the market to solve the market failure (Boardman, Greenberg, Vining, & Weimer, 2009). Market intervention should only take place when at least one person benefits without harming someone else, better known as a Pareto-improvement (Forsund & Hernaes, 1994). The net benefits of market intervention is then positive.

Figure 3.1: Net benefits of policies



Source: (Den Hartogh, 2010)

As mentioned above the net benefits are a result of all the advantages and disadvantages combined in which all these advantages are transferred into monetary values. In Figure 3.1 the opportunity costs represent the value of using the money for market intervention on the second best option, because the money could only be spend once. The benefits of the policy are expressed by the Willingness to Pay. The Willingness to Pay (WTP) represents the maximum value an individual is willing to pay to be indifferent between the current status and the situation where the policy is introduced (Boardman, Greenberg, Vining, & Weimer, 2009). The WTP is measured when a policy leads to an improvement of a service or good. The Willingness to Accept (WTA) is the counterpart of the Willingness to Pay. The WTA represents the amount of money an individual should be compensated with in order to no longer consume a good or service as a result of the policy.

The downfall of a SCBA is that it is mostly used when the behavior of persons is observable. The behavior of ferry service users, however, is hardly observable. As a result the valuation of a good or service is hardly possible. In order to be able to assign a value to a good or service there are different methods which can be used, direct or indirect. An examples of the direct approach is the Contingent Valuation Method. The Hedonic Pricing Method, Travel Cost approach and Averting Behavior method all are examples of the indirect approach. These indirect methods all focus on the behavior of people when there is a change in the environment. Because these changes in behavior are not observable these methods are less suitable to quantify the economic and social impact of the Dutch ferry services (Romijn & Renes, 2013). As the indirect approaches are not easily applicable, the focus will be on a direct approach, more specific the Contingent Valuation Method (CVM). This direct approach uses stated preferences which are not based on real market behavior, but on behavior under hypothetical conditions. These stated preferences are gained by using surveys. Therefore the Contingent Valuation Method suits the best in this research. This method is also used in the previous researches of Oostinjen (2004) and Den Hartogh (2010). As this research will be an update of these two reports it would be beneficial if the outcomes of the researches could be compared. So comparability also influenced the choice for this method. In the next paragraph the Contingent Valuation Method will be further amplified.

3.1.2 Contingent Valuation Method

The Contingent Valuation Method makes it possible to give a value on non-valuable goods and services. This value is based on the Willingness to Pay or Willingness to Accept of individuals. These individual values are obtained by conducting a survey. This survey can be conducted at three different ways. Respondents can be contacted either by phone, in writing or by a one-on-one interview. The most reliable source of information is the one-on-one interview. However, the disadvantage of this method is that it's very time consuming and costly. Written surveys on the other hand are fairly easy to conduct, only it's difficult to recruit enough respondents since the willingness to participate is rather low. Eventually the people who participate will produce a value,

expressed by the WTP and/or WTA, the non-valuable service. The structure of the conducted surveys is very important (Whitehead & Haab, 2013).

As written before, in the direct method the stated preferences of people will be revealed. In order to get the stated preferences a hypothetical market should be created, because under normal circumstances there is no such market for this non-valuable good. In this hypothetical market the good/service will either be present or absent. In the Dutch ferry service case these services will be absent. As a result a new market will be created where supply and demand will come together. An over- or underestimation of the value must be prevented so the design of the survey should be appropriate. So the questions must be clear and couldn't be interpreted in multiple ways. When sufficient attention to the design and structure of the survey is payed the valuation of a non-valuable good could be done. The central question in these surveys is either:
"What is the maximum amount of money you are willing to pay in order to maintain using the, hypothetically, absent good?" (better known as the Willingness to Pay (WTP))
or
"What is the amount of money you should be compensated with in order to no longer be able to use a good?" (Willingness to Accept (WTA))

After creating a hypothetical market and assigning the correct method, the valuation of the WTP and/or WTA should be determined. There are four different methods which can be used to assign a value: open-ended questions, closed-ended questions, payment card and bidding games. In an open-ended question the respondent is asked to give a value all by himself. In many cases this is difficult since a reference framework is missing. In case of a closed-ended question the respondent only gets one value which leads to a go or no-go choice. With a payment card the respondent gets multiple options. The respondent picks the option that represents the maximum value he/she is willing to pay for the good/service. In some cases the represented values are income dependent. Finally there is the bidding game. The respondent are offered progressively higher bids until they reach their maximum WTP. When the research is looking for the WTA the bids will progressively be lower until they reach their minimum. (Asafu-Adjaye, 2000)

In this research the open ended question method will be used, since the user could assign a value which is relevant for them. For the utilitarian ferry services the WTA is calculated and for the recreational ferry services the WTP.

When the design of the research is accurate the average WTP and/or WTA can be calculated. One can also distinguish between the average and the median. When the median is selected extreme observation don't influence the outcomes, which is the case when the average is used. In order for the results to be compliant the appropriate population should be contacted. In this case the representative sample are the people who currently use a ferry service, since they have to change their behavior when the ferry service will no longer be available in the hypothetical market.

The Contingent Valuation Method also has its downfalls. When people are insufficiently informed the WTP/WTA will be displayed incorrectly. The effect could be two-folded: either there is an undervaluation since not all the alternatives are taken into account or an overvaluation because people aren't aware of the actual costs of the alternative. For ferry services this under- or overvaluation probably will be there to a lesser extend since most people are aware of the costs of the alternatives.

Another disadvantage could be that the respondents will give a strategic response to the raised questions. The strategic response can either be socially acceptable or the respondent benefits from over- or undervaluation of their answers (Mitchell & Carson, 1989; Venkatachalam, 2004). In

addition the way of interviewing might affect the provided answers. Therefor a lot of attention is payed to the questions and the way these questions are presented.

3.1.3 Qualitative aspects

The social impact doesn't only consist of quantitative aspects. Ultimately the qualitative aspects should be quantified based on key figures. The qualitative aspects could be subdivided by social aspects, traffic aspects, environmental aspects and other aspects.

Social aspects

Besides the economic aspects, the social aspects of transport might be the most important. Nowadays everyone relies on transportation. However for certain people the accessibility to some means of transport differ. This degree of accessibility can either have positive or negative social effects. The social effect of transport is defined as: "The social effects of transport are changes of utility due to the movement and/or (potential) presence of vehicles on a piece of infrastructure (or the pure presence of infrastructure), which positively or negatively influence the needs of the whole community, groups within the community, social groups or individuals whom are satisfied on certain destinations" (Boon, Geurs, & Van Wee, 2003).

As mentioned earlier in this study, a hypothetical market will be created in which ferry services will be absent. The sheer absence of this type of infrastructure will affect individuals, but also whole social groups. In many parts of Europe the population is ageing. Many trend studies expected that the elderly will make additional transport movements, especially outside the rush hours (SWOV, 2013). The extent to which these people have access to transport plays a very important role in their social life. In addition, there are social groups that have a moderate level of access to certain means of transport such as a car: children, poor people, disabled people and people without a driver's license. For these people problems arise when they are no longer able to fulfill their needs (Eenink & Vlakveld, 2013). One of the most important components is accessibility. The, hypothetical, loss of ferry services has a great impact on the lives of the aforementioned social groups. Ferry services increase the accessibility of neighborhoods, city districts and villages which satisfies the transportation needs of these social groups. When these groups are no longer able to satisfy their needs this becomes a problem for the community as a whole.

Traffic-related aspects

Recent studies show that mobility becomes more and more important (Eenink & Vlakveld, 2013; Kiel & Maurer, 2012; Harms, Jorritsma, 't Hoen, & Van de Riet, 2011). These studies are based on developments in society. Currently they notice an individualization, informalization and intensification. Individualization relates to the increase in single households. Informalization and intensification lead to an increase in the amount of transfer movements, since people intensify the number of appointments out of the house. Many of these movements are taking place by car. Besides the increase in the movements for work and school, the number of social and recreational journeys increases as well. This increase in mobility is accompanied by the increase in the number of road accidents. The increase of car movements is accompanied by the upcoming popularity of the electric bike which enlarges the action radius of cyclists, which has a negative effect on the road safety. Especially since the elderly are now able to maintain their mobility either by car or by bicycle (Harms, Jorritsma, 't Hoen, & Van de Riet, 2011). The initial increase in the number of transport kilometers, based on current trends, is enlarged when people, hypothetically, would no longer be able to use a ferry service. The increase in the number of transport kilometers lead to an increase in traffic congestion and deterioration in accessibility.

The increase in traffic will lead to an increase in the number of road accident. The increase in the number of hospitalizations and death depends on many factors. Detours, what explains the increase of vehicle-kilometers, doesn't necessarily mean that the number of road accidents increases. A strong dependency is on the function that the road that is travelled holds. When the road is located within a built-up area the chance of a traffic accident is larger compared to a road outside the built-up areas, because there are more potential victims within the built-up area (Dijkstra , 2014). In this research statistical data of the SWOV will be used. As in the previous research the number of traffic injuries per million vehicle-kilometers will be used to calculate the additional number of traffic injuries (SWOV, 2005). The current and previous figures are exactly the same, because for years no update has been made to these exact figures. Nowadays, the method which is used is significantly different which makes the comparability between the researches impossible. Even though these figures haven't been updated for years the SWOV examined that the risk figures have been rather stable for years. Therefore this dated data is used anyway (SWOV, 2013).

Noise pollution

The increase in the number of vehicle kilometers also provides noise pollution. The noise pollution from additional sound is two-folded: an increase in sound leads to nuisance and it has some health risks. The nuisance can arise, because an increase in traffic will reduce the possibility of relaxation or it brings a feeling of displeasure. Noise could also lead to hearing impairment, cardiovascular disease and sleep disturbance (Rijksoverheid, 2016). Based on Dutch noise maps the number of noise exposed people per means of transport has been determined. Based on those numbers a value could be assigned to noise pollution. The costs of noise are determined based on relevant shadow prices. These shadow prices are multiplied by the number of noise exposed people, after which an average will be calculated by dividing the total cost by the total number of vehicle-kilometers (Schroten, Van Essen, Aarnink, Verhoef, & Knockaert, 2014). However, this research will not use the average cost of noise but the marginal costs of noise, since the noise pollution will be on top of the current noise pollution. This figures are published by the CE Delft in 2014.

Environmental effects

The traffic related aspects and the noise pollution are aspects which are directly visible/audible. However there are also aspects which are less observable. Hypothetically terminating ferry services will lead to an increase in the vehicle-kilometers. An increase in vehicle-kilometers will lead to an increase in the emission of road traffic. These extra emissions will have effects on the air quality and the environment. The air quality is affected by various types of emission: particulate matter (PM_{10}), nitrogen oxides (NO_x) and sulphur dioxide (SO_2). The climate is affected by greenhouse gasses which will be represented by carbon dioxide (CO_2).

Particulate matter is the collective name for the emissions of a large number of solids that float in the air. Most of the time the amount of PM_{10} is measured. The 10 stands for the diameter of the particle, in this case up to 10 micrometers. However, there is a shift going on towards measurements of $PM_{2,5}$. These particles have a diameter of 2,5 µm, but prove to be more harmful to people's health than the particles that are larger than 2,5 micrometers (RIVM, 2013).

Nitrogen oxides (NO_x) are building blocks for particulate matter and ozone. A car emits nitrogen monoxide while driving as a result of the combustion processes that are taking place in the engine. Nitrogen monoxide is for people only very limited harmful. However, in the atmosphere the nitrogen monoxide is converted into nitrogen dioxide (NO_2). This substance is harmful to health, as it can cause irritation to the respiratory. In addition to the effects on human health nitrogen dioxide, together with sulphur oxide, contribute to the formation of acid rain and smog, which has negative consequences for the environment (Milieudefensie, 2015).

Road traffic has little influence on the emissions of sulphur dioxide (SO_2). Shipping (and therefore also ferry services) however, to a greater extent has. Sulphur dioxide will therefore get some more attention later on in the research. Sulfur dioxide can cause local problems such as respiratory problems, eye irritation and lung problems. Just as nitrogen oxide, sulphur dioxide contribute to the creation of smog and acid rain (Milieudefensie, 2015).

The last important form of emission is carbon dioxide (CO_2). CO_2 is known as one of the major causes of climate change. The CO_2 concentrations in the atmosphere were never as high as it is today. Compared to the time of the industrial revolution, the average temperature increased with 1.5 degree Celsius. The Netherlands belongs to one of the largest CO_2 emitting countries of the world (Wageningen University, 2016). The traffic and transport secto in the Netherlands is responsible for more than 20% of the total Dutch CO_2 emissions. Road traffic is responsible for almost 80% of the emissions of the traffic and transport sector (Centraal Bureau voor de Statistiek, 2015). When the access to some areas is reduced, by the hypothetical termination of the ferry services, one will have to travel further so additional travel will lead to more emissions from road traffic. The following table shows the additional emissions.

Table 3.1: Emissions of road traffic (g/km), per road type

Emission	Built-up area	Provincial road	Highway	Totaal
CO_2	255	170	242	**220**
NO_x	0,6	0,4	0,7	**0,6**
SO_2	0,002	0,001	0,001	**0,001**
PM_{10}	0,023	0,012	0,017	**0,017**

In order to quantify the extra emissions of road traffic the prevention- and pollution cost will be used. The pollution cost consist of the costs concerning health, damage to buildings and materials, and loss of agricultural vegetation and the impacts on biodiversity. The costs of extra emissions will be quantified per mean of transport. The weighted cost, in eurocents per kilometer, per mean of transport will be used.

Other effects

The hypothetical termination of ferry services also has some impacts which only limitedly could be valued. Nevertheless it is worth mentioning these effects.

Ferry services supply the need of mobility. For some people, however, the crossing by ferry fulfills the actual need. Certainly the recreational/touristic users of the ferry derive utility from using the ferry. The transfer provides an ´experience' which users sometimes have when using a product or service. When the experience is correctly materialized, there are opportunities for economic output (Pine & Gilmore, 2011). In the chapter of recreational ferry services the economic output will be mapped.

The qualitative aspects, associated with the experience of a ferry service, will be further explained. The chance of **social interaction** while using a ferry service is rather big. The way of transport is slower than other forms of transport. The advantage of this is that one has time to start a conversation with another passenger. This not only brings benefits to the user, but also the ferryman and ticket salesperson could benefit from this fun form of interaction. In addition almost everywhere near a ferry service a restaurant or bar is located. That offers additional possibilities for social interaction.

In addition to the possibility of social interaction the slower mode of transport provides possibilities for **relaxation**. Cyclists and pedestrians experience the ferry service as a nice break of their journey. For motorists a ferry service offers a possibility to escape from the rush at the highways.
In addition to relaxation a ferry service also provides **physical exertion**. More and more ferry services are part of walking or cycling routes. Therefore, many recreational/touristic travelers deliberately choose to use the ferry.
As previously described, the history of some ferry services date back to Roman times. That means that people also derive **historical value** of ferry services. The thought that centuries ago people already used ferry services creates value for some people.

3.2 Economic impact

The Economic Impact Study method is used to identify the economic impact of the ferry service sector. The EIS-method measures both direct and indirect effects of a sector. Originally the EIS-method is developed to measure the economic outcomes of a policy or strategic decision (Peeters, Joos, Webers, & Lefever, 1999).

3.2.1 EIS-method

The social-economic significant of a sector, in this case the ferry service sector, is easily outlined when using the EIS-method. The central question within this method is: “What is the contribution of the sector to the economy as a whole and to a society?”. As appointed previously there are direct and indirect effects. The effects can be displayed by employment, turnover and added value. The total value of the production will be expressed by turnover out of ticket sales. In this research only the direct effects will be measured.

The EIS-method uses a bottom-up approach, which is a huge advantage. In this approach the information is gathered at individual level. In order to make statements on sectoral level all the individual information is added together. This ensures a bigger reliability of the outcomes (Peeters, Joos, Webers, & Lefever, 1999). The added value will only be partially specified. The calculation of the added value requires a lot of business sensitive information. The delivery of, especially financial, data is not always considered desirable from within the sector. In addition the allocation of added value to a ferry service is rather difficult, since this could be allocated differently per individual. Since recreational and touristic travelers, most of the time, deliberately use a ferry service the route of the trip is adjusted to their needs. A part of the expenditures on one day could indirectly be allocated to the ferry services.

The required information is gathered by using a survey which is sent to the owner/operators of the ferry service. The financial questions are limited to the turnover, possibly obtained subsidies and the total operating cost. The total turnover is defined as the sum of the ticket sales per ferry service. Other incomes, such as sales of coffee and tea, are not included.
Employment is expressed in Full Time Equivalent units, where 1 FTE is equal to a 40 hour workweek. A part timer that 'only' works 10 hours a week is equal to 0,25 FTE. Many recreational ferry services are dependent on volunteers. The activities of a volunteer, however are not expressed in FTEs since they offer their services on a voluntary basis. Volunteers do get a fee for their work. The volunteer can get a fee up to € 4,50 per hour, with a maximum of € 150 per month and € 1.500 on an annual basis (Belastingdienst, 2016).

3.3 Conclusion

This chapter describes the method by which the impact of ferry services is qualified and methods are presented to quantify the impact of the sector. The impact is two-folded since there is an economic and social impact. The ferry services satisfy social needs which represents the social impact. The social impact is divided into a direct and an indirect effect.

In a Social Cost-Benefits Analysis the direct effects can be valued. Therefore, the Contingent Valuation Model will be used to quantify both the direct and indirect effects. The advantage of the CVM is that it can either value the valuable and non-valuable goods and/or services. In order to quantify the effect a hypothetical market is designed in which the good/service either will be present or absent. After designing an appropriate hypothetical market, the relevant target group is asked to conduct a survey. Eventually either the Willingness to Pay (WTP) or Willingness to Accept will come out. At first an average per person which will be used to value the impact of the ferry services. The Willingness to Pay expresses the maximum value a person is willing to pay for the good or service. The Willingness to Accept is the minimum amount a person needs to be compensated with when he/she can't use a good or service (anymore).

In this research the ferry services will hypothetically be terminated. This situation affects the accessibility of certain places and regions and has its impact on the mobility of some individuals or social groups. The effects, associated with the loss of ferry services, can be divided into social-, traffic related, and environmental impacts. The termination of ferry services results in an increase of the number of vehicle-kilometers in the Netherlands. The increase of the number of vehicle-kilometers is accompanied by an increase of the road unsafety, which will be expressed by the increase of traffic injuries, noise pollution and extra emissions of road traffic. The cost of additional emission will be quantified by the prevention- and pollution costs.

The economic impact of the ferry service sector will be quantified by the Economic Impact Study method. This method focuses on three aspects: employment, turnover and added value. Characteristics for the EIS-method is that it uses a bottom-up method. The obtained information on individual level, per ferry service, is added up on which statements concerning the whole sector could be made. In this research the focus will mainly be at employment and turnover. Employment is expressed in Full Time Equivalent units and turnover is defined as the revenues from ticket sales.

4. Utilitarian ferry services

4.1 Economic impact of utilitarian ferry services

The economic impact of the Dutch utilitarian ferry services will be outlined by the direct economic relevant factors: the number of transferred people, turnover and employment based on FTEs. This chapter will only discuss the utilitarian ferry services. A utilitarian ferry service is a ferry service which operates (almost) throughout the whole year. Characteristic for these ferry services is that they are mainly used by commuters and students. Within this chapter a distinction is made between different categories of ferry services based on ownership structure, whether a person should pay or not and by transfer possibility per mean of transport.

4.1.1 Method

In total there are 313 ferry services within the Netherlands. This chapter will only focus on the utilitarian ferry services, which operate throughout the whole year, in order to keep a good comparability with the researches of 2004 and 2010 (Oostinjen, 2004; Den Hartogh, 2010). Some of the ferry services whom operate the whole year however are withdrawn from the sample. The ferry services with a schedules service to England and Germany are excluded from the sample since they don't operate on the Dutch inland waterways. The self-service ferries will be discussed in a separate chapter, as will the salt ferries.

The number of sweet utilitarian ferry services is set at 94. Compared to the research of 2010 the number of ferry services has increased by one ferry service. However, that doesn't mean that no further changes have taken place. The 'operators' survey' is sent to all the 94 ferry services by email. The survey is used to determine the direct economic impact of this part of the sector. At a later stage this survey is used to determine how ferry services are dealing with sustainability, either financial and environmentally. The response rate is equal to 85%, which is higher compared to the research of 2010 (69%) but lower compared to the research of 2004 (97%). The missing values will be extrapolated using the previous researches and information provided by newspapers, webpages of the ferry services and other news messages. Based on the transfer possibilities per mean of transport, the location of ferry services and working with averages the missing values are acquired. Furthermore, the tariff structure of the missing ferry services is used to calculate the turnover.

Not all ferry service owners/operators filled out the complete survey. Mostly, the financial questions were not completely answered since this information is described as 'business sensitive'. In comparison to the former two researches the questions regarding the operations cost and turnover were adjusted to overcome this problem. In retrospect, this approach proved not to have the desired outcome. The missing values are extrapolated and to check whether these values are correct these values are partially checked by the owners/operators.

4.1.2 Direct economic impact

At first the data provided by the sector will be displayed in table 4.1 and 4.2. A distinction is made between normal ferries and public transport ferries and whether or not a person is charged for the crossing. As described before, the number of transferred people, turnover and employment will be shown. Table 4.3 and 4.4 show the outcomes including the extrapolated missing values.

Table 4.1: response freshwater ferry services (charged ferry services)

		Population	Respon se	Transferred people per year	Turnover (€)	FTE
Normal ferries	Car ferries	50	41	20.163.500	20.096.225	253.85
	Bicycle-pedestrian ferry	20	16	1.857.000	2.332.815	50.8
PT-ferries	Bicycle-pedestrian ferry	10*	10	2.605.000	7.700.000	121
Total		**80**	**67**	**24.625.500**	**30.129.040**	**425.65**

** Aquabus NV is one operator who provides eight different ferry connections.*

Table 4.2: response freshwater ferry services (Free of charge ferry services)

		Population	Response	Transferred people per year	Turnover (€)	FTE
Free ferries	Car ferries	3	3	1.500.000	0	25
	Bicycle-pedestrian ferry	11	9	16.165.000	0	79.5
Total		**14**	**12**	**17.665.000**	**0**	**104.5**

Almost all categories have missing values. Based on averages the missing values are extrapolated, which leads to the total direct economic impact of the utilitarian ferry services.

Table 4.3: Direct economic impact charged utilitarian ferry services 2015/2016

		Population	Transferred people per year	Turnover (€)	FTE
Normal ferries	Car ferries	50	22.913.500	23.193.475	292.85
	Bicycle-pedestrian ferry	20	2.326.500	2.666.065	64.8
PT-ferries		10	2.605.000	7.700.000	121
Total		**80**	**27.845.000**	**33.559.540**	**478.65**

Table 4.4: Direct economic impact free of charge utilitarian ferry services 2015/2016

		Population	Transferred people per year	Turnover (€)	FTE
Free ferries	Car ferries	3	1.500.000	0	25
	Bicycle-pedestrian ferry	11	16.865.000	0	86.5
Total		**14**	**18.365.000**	**0**	**111.5**

The tables show that on a yearly basis almost 28 million people use the charged utilitarian ferry services in the Netherlands. More than 18 million people cross the water on a ferry service which is free of charge. On an annual basis 46,2 million people are transferred by the utilitarian ferry services. Compared to the research of 2010 this is an increase of 13,8 million people, which is largely

explained by the extreme increase in the number of users of the free ferry services in Amsterdam. In order to compare the results of this research with the previous the financial position per category will be calculated. But first the dependency on subsidy will be highlighted.

4.1.3 Subsidy

Based on the acquired information from the owners/operators, 42 million people are transferred on an annual basis. After extrapolation this number is embanked to 46,2 million people. The charged ferry services have a turnover of € 30,1 million from ticket sales. After embankment this number is € 33,6 million. Despite these, jointly, high turnovers 42 ferry services are dependent on subsidies. These subsidies are provided in four different ways to the ferry services:

- Covering of the operating deficit
- Replenishment based on the achieved yield and/or the number of transferred people
- Fixed subsidy contribution based on supply criteria
- A one-time investment subsidy

Subsidies appear to be important for the utilitarian ferry services. For the ferry services which don't charge a fee this is evident. However, the incurred expenses should be covered. In many cases municipalities deliberately offer these ferry services for free. The expenses of municipalities which are accompanied by this type of operation will be seen as subsidy.

The charged ferry services mostly require a subsidy which covers the operating deficit. The grant issuer acknowledges the impact of the ferry service which keeps the ferry service in place.
For the owners who get a fixed subsidy contribution there still is a possibility to gain a profit at the end of the year. The issuers of the subsidy recognize the impact of the ferry service for the region and are willing to contribute. However they still give an incentive to the operator to operate the ferry service efficiently. The operator is responsible for the operating result.

Public transport ferries get a yearly contribution to operate the ferry service. The operator acquired the service based on a concession which provides the rights to operate the ferry service. The operator indicated the amount of money which is necessary to operate the ferry service. The contribution by the government ensures that the operator can offer the service under cost price. However the operator is still able to gain a profit, when the actual costs are lower than the estimated costs of the operation.

4.1.4 Financial position per category

The financial analysis per category is displayed based on the information submitted by the owners/operators, because this information is the most reliable. The results from the operator survey indicate that 35 ferry connection face an operating deficit. This includes the ferry services which are free of charge. As the owner of the ferry deliberately chooses to operate the ferry service like this, these cost will not be accounted for in the total deficit for the utilitarian ferry service sector. As a result 23 ferry services remain with an operating deficit. However, the design of the survey wasn't optimal since operators with multiple ferry services had the opportunity to conduct the survey for all the ferry services at once. The downfall is that it doesn't become completely clear whether one or multiple connection have a deficit or not. Three municipal ferry operators, jointly good for ten connections, state that they have an operating deficit. However, it doesn't become completely clear if all the connections suffer a deficit. Additional information is requested, but the owners were not willing to share the sensitive information. Based on the information sources it became clear that at least seven of the connections have a deficit. For the other three it's not completely clear. On the other hand there is the possibility that multiple connections jointly gain a profit but at individual level could have a deficit. The exact number of ferry services facing a deficit could not be obtained.

The total operating deficit is equal to € 6.589.699, which is without the free ferry services but it includes the public transport ferries. Since they operate below cost price they get a contribution. The public transport ferry obtain a subsidy of almost € 5 million. However most of the operator's state that the operating cost are equal or lower than the revenues so the deficit is largely outbalanced. A deficit of € 1,6 million remains. Only three private ferries suffer from an operating deficit.

A breakdown of the financial position per category will be presented below. Just like the previous researches, because of comparability, the revenue and exploitation cost per person will be displayed. Furthermore, a distinction will be made based on the mean of transport and ownership structure. The presented figures are obtained by the operators' survey.

Car ferry services

Within this category three different ownership structures could be distinguished: private-, municipal- and provincial ferry services. The free ferry services are not included in this analysis since they don't obtain revenue from ticket sales, but they do have exploitation costs which will lead to skewed overall results.

Table 4.5: private car ferries

Private car ferries	2015/2016
Number of ferries	23
Number of FTEs	135,55
Transferred people	14.188.500
Transferred people per FTE	104.674
Revenue per transferred person	€ 0,93
Exploitation cost per transferred person	€ 0,85

Generally speaking, the private car ferries have a positive result of operation. In total, almost, 14,2 million people are transferred on a yearly basis. The number of FTEs required to transfer these people is equal to 135,55. The transfer performance per FTE is almost 105.000, which makes the private car ferries the most efficient category of all the ferry services. The revenue per transferred person is equal to € 0,93 and the exploitation cost per transferred person is € 0,85. As stated before the revenue is equal to the revenue of ticket sales.

Table 4.6: Municipal car ferries

Municipal car ferries	2015/2016
Number of ferries	16
Number of FTEs	97,3
Transferred people	4.965.000
Transferred people per FTE	51.028
Revenue per transferred person	€ 1,21
Exploitation cost per transferred person	€ 1,41

The municipal car ferries offer employment to 97,3 FTEs, which transfer nearly 5 million people on an annual basis. The transfer performance per FTE is equal to slightly more than 51.000 people per FTE. That means that the municipal ferries are half as efficient as the private ferries. Despite the lower efficiency, the revenue per transferred person is higher compared to the private car ferries (€ 1,21 over € 0,93). On the other hand the exploitation cost per person are significantly higher € 1,41. A part of the difference could be explained by the efficiency, since the performance per FTE is lower. Another explanation is that municipalities allocate more costs to the ferry services than other ferry services. Extra overhead costs, like the maintenance of access roads and ferry slips, are assigned to the ferry services which is not the case at other ferry services. When the cost allocation would be different the operational results of municipal ferry services would be different.

The two provincial car ferries transfer slightly more than one million people on an annual basis. The employment is equal to 21 FTE, which results in an efficiency of 48.000 people per FTE. The provincial car ferries are the least efficient in their category. The revenue per transferred person is also the lowest € 0,89. The exploitation cost per transferred person is equal to € 1,03, which is lower compared to the municipal car ferries. This could be explained by the differences in cost allocations. The provincial car ferries could perform better at both the revenue and cost sides.

Table 4.7: Provincial car ferries

Provincial car ferries	2015/2016
Number of ferries	2
Number of FTEs	21
Transferred people	1.010.000
Transferred people per FTE	48.095
Revenue per transferred person	€ 0,89
Exploitation cost per transferred person	€ 1,03

Bicycle-pedestrian ferry services

The category bicycle-pedestrian ferries has two different ownership structures: private and municipal. The public transport ferry services are also bicycle-pedestrian ferries, but these will be mentioned separately.

Table 4.8: Private bicycle-pedestrian ferries

Private bicycle-pedestrian ferries	2015/2016
Number of ferries	4
Number of FTEs	11,3
Transferred people	506.500
Transferred people per FTE	44.823
Revenue per transferred person	€ 0,99
Exploitation cost per transferred person	€ 0,97

The four private bicycle-pedestrian ferries transfer 506.500 people annually. The private bicycle-pedestrian ferries offer employment to 11,3 FTE. The transfer performance is almost 45.000 per FTE. Just like the private car ferries the private bicycle-pedestrian ferries are the most efficient. The revenue per transferred person is € 0,99. On average these ferry services gain a small profit, since the exploitation cost per transferred person is equal to € 0,97. This means that the margins are very tight for the private ferries.

The twelve municipal bicycle-pedestrian ferries transfer more than 1,35 million people per year, with 39,5 FTEs. The number of transferred people per FTE is slightly over 34.000. The municipal bicycle-pedestrian ferries have a revenue of € 1,32 per transferred person. This is € 0,33 per person more than the private ferries. Despite the higher revenues per person also the exploitation cost per person are higher, which results in an overall negative operational result.

Table 4.9: Municipal bicycle-pedestrian ferries

Municipal bicycle-pedestrian ferries	2015/2016
Number of ferries	12
Number of FTEs	39,5
Transferred people	1.350.500
Transferred people per FTE	34.190
Revenue per transferred person	€ 1,32
Exploitation cost per transferred person	€ 1,53

Public transport ferry services

The Netherlands has three different operators which offer a public transport ferry service: Westerschelde Ferry, RET and Aquabus NV. Westerschelde Ferry and RET both operate one ferry and Aquabus NV operates eight ferry connections. Jointly these operators transfer more than 2,6 million people with 121 FTEs. The transfer performance is 'only' 21.500 per FTE, which is the lowest of all the utilitarian ferry services. However, the revenues per transferred person are by far the highest. The explanation is that public transport ferries travel a longer distance compared to the other utilitarian ferry services. The longer the ride, in distance, the higher the price of a transfer. Not only the revenues are significantly higher, also the exploitation costs per transferred person is significantly higher. Distance is one of the explanations as well, but the major explanations are the vessel model and the employment.

Table 4.10: Public transport ferries

Public transport ferries	2015/2016
Number of ferries	10
Number of FTEs	121
Transferred people	2.605.000
Transferred people per FTE	21.529
Revenue per transferred person	€ 2,96
Exploitation cost per transferred person	€ 4,73

The public transport ferries use Catamaran and Swath vessels. These vessels are a lot more expensive in the operations, because of the required engines for the vessels. These vessels can achieve a speed of 40 km/h, which requires engines with a higher motorial output. In addition, the public transport ferry services employ a lot more people compared to other ferry services. Public transport ferry services are required to have a bigger customer service, since the use of the public transport card (OV-chipkaart) has some major implications for some users. Besides that, public transport operators are obliged to provide up-to-date travel information to their customers which requires additional IT facilities. This leads to additional employment ashore (Rijksoverheid, 2009).

4.1.6 Comparison with previous researches

The direct economic impact of the utilitarian ferry services, after extrapolation, are displayed in table 4.3 and 4.4. As like in this research extrapolation was necessary in the research of 2010 in order to make a statement about the sector as a whole. Therefore the only comparison between these two researches is possible on sectoral level.

The number of transferred people raised by 13,8 million, from 32,4 to 46,2 million. This is primarily explained by the large increase of users in Amsterdam. The number of free ferry services has expanded, because of the evolution of Amsterdam-Noord. In addition the number of people transferred by charged car- and bicycle-pedestrian ferry services has increased as well. Even though the number of connections has increased the amount of people transferred by public transport ferry services has decreased.

The increase in transferred people results in an increase of the total turnover as well. Because of a difference in response it isn't possible to give a statement per ownership structure. However, statements will be made per transfer possibility per mean of transport and per full category. The results of this and the previous researches will be shown in table 4.11

Table 4.11: Comparison direct economic impact

			Population			Transferred people per year (in millions)			Turnover (x million euros)			FTE		
			2015	2009	2004	**2015**	2009	2004	**2015**	2009	2004	**2015**	2009	2004
Charged ferries														
	Normal ferries	Car ferries	50	50	50	22,9	18,7	20	23,2	20,7	16,4	293	311	352
		Bicycle-pedestrian	20	27	17	2,3	2,2	1,6	2,6	1,8	1,3	65	75	54
	PT ferries	Bicycle-pedestrian	10	7	5	2,6	2,9	2,8	7,7	4,9	3,7	121	142	151
Free ferries														
		Car ferries	3	3	3	1,5	1,5	0,9	0	0	0	25	16	16
		Bicycle-pedestrian	11	6	7	16,9	7,1	7,5	0	0	0	87	68	68
Total			**94**	93	82	**46,2**	32,4	32,8	**33,5**	27,4	21,5	**591**	612	641

Annually the charged car ferries transfer almost 23 million people, which is an increase of more than 4 million people. As a result of the increase in transferred people the total turnover increased as well, however with 'only' 2,5 million. The revenue per transferred person has decreased from € 1,11 in 2010 to € 1,01 in 2015/2016. The employment has decreased as well, which means that the sector has become more efficient compared to the previous researches.

The charged bicycle-pedestrian ferry services have declined in the number of connections, from 27 to 20, but the number of transferred people has increased just like the turnover. So there is a decrease in the number of connections but an increase in the transferred people which means that these ferries have increased their margins. In addition to the decline in connections also the number of FTEs declined.

The number of public transport connections increased by one compared to 2010. The number of people transferred has declined, which could be explained by the termination of the Fast Flying Ferry (FFF) between Velsen Zuid and Amsterdam CS. Aqualiner, the operator of Fast Flying Ferry, moved to Rotterdam and later merged with Waterbus. The termination of FFF and the merge between Aqualiner and Waterbus, results in a decline of the number of FTEs. Despite the decrease of the number of FTEs, the employment within this part of the sector is rather high.

The free car ferries still transfer 1,5 million people, but the employment has increased. The employment raised at the free bicycle-pedestrian ferry services as well, which is understandable since the number of connections has increased from six to eleven. De evolution of Amsterdam-Noord is one of the drivers of this increase. Since Amsterdam Noord evolved the number of transferred people has significantly increased. In the near future the municipality expects a further increase in the number of transferred people (Gemeente Amsterdam, 2015).

4.2 Social impact of utilitarian fresh ferry services

The paragraph describes the social impact of the freshwater utilitarian ferry services, both quantitative and qualitative. The Contingent Valuation Method is used to quantify the social impact. Based on qualitative aspects statement will be made regarding the social impact.

4.2.1 Method

The social impact is quantified based on a hypothetical market in which ferry services will be absent. The effects of the hypothetical termination of ferry services on current users is determined based on the 'user survey'. In order to compare the outcomes of this research with the previous researches in 2004 and 2010 the same aspects are used to quantify the social impact. In order to generate enough response the user survey is distributed both in real life and online. In total, response is generated from 54 different ferry services. The completed surveys form a representative sample of all the ferry service users.

In total 1287 surveys have been returned, however 122 had too many missing values. Therefor these responses were excluded from the sample. 875 of the remaining 1165 surveys have been conducted during weekday and 290 during the weekend. Within the sample the assumption is made that the acquired surveys have been distributed equally over the week. In order to check whether or not this is actually true a Pearson Chi-square test has been performed. As such five of seven surveys should be conducted during weekdays and two of seven during weekends. From the Chi-square test it becomes clear that the observed number of surveys conducted during weekdays significantly differs from the expected number. The results of the Pearson Chi-square test are displayed in the table below.

Table 4.12: Weighting factor user survey

	Observed	Expected
Week days	875	832,1429
Weekend	290	332,8571
Chi-square	7.725	
Degrees of freedom	1	
P-value	0,005445	

The sample is not equally distributed throughout the week (p-value is lower than 0,05). As a result the surveys which have been conducted on weekdays get a weighting factor assigned of 0,82857. This weighting factor will be used in the calculation of the Willingness to Accept (WTA).

4.2.2 Willingness to Accept

The social impact of the utilitarian ferry services is quantified using the Contingent Valuation Method. This method requires that four steps need to be executed after which quantification is possible. At first, a hypothetical market should be created in which ferry services will be absent. Secondly, this situation needs to be described to the interviewee. Within this research two different methods have been used: verbally surveying on board of a ferry vessel and a written survey online. There is no difference between the two surveys. Thirdly, a method is determined to get an average Willingness to Accept. Lastly, the average WTA will be assigned to the whole sample.

The hypothetical termination of the ferry service will have an impact on the current users of ferry services. The users would like to be compensated for the loss of the ferry services. The value of the minimum compensation will be assigned by calculating the costs of additional travel time and additional travel costs.

WTA = costs additional travel time + extra travel costs

Additional travel time

The costs of additional travel time is dependent on the travel motive and the value of time which corresponds with that travel motive. The value of time is multiplied with the number of additional travel time in minutes. The additional travel time is obtained by the user survey.

Additional cost of time = Value of time per minute * additional time in minutes

The value of time is categorized per travel motive. A distinction is made between commuter traffic, business traffic, commercial traffic and other traffic. The user survey also categorizes the 'social' and 'student' travel motive which will get the value of the category 'other'. Table 4.13 displays the value of time per travel motive

Table 4.13: value of time per travel motive (price level 2015)

Travel motive	Value of time in €/hour	Value of time in €/minute
Commuter	€ 10,18	€ 0,17
Business	€ 28,88	€ 0,48
Commercial	€ 42,20	€ 0,70
Other	€ 8,25	€ 0,14

Source: (Ecorys, 2015)

Extra travel cost

The calculation of the extra travel costs depends on multiple factors. At first it is important to know which mean of transport the user of a ferry service will use when he won't be using the ferry service. As an example the (extra) distance could be travelled by car, moped/scooter, bicycle or by public transport. For some users it would be beneficial to use another ferry service or even cancel the whole trip. Each different mean of transport has another corresponding cost so the valuation of the extra travel costs differs. The extra travel costs will be diminished by the costs of one single transfer by ferry service. De costs of a single transfer are equal to the revenue per transferred person of a private car ferry: € 0,93.

Extra travel cost = (costs of alternative per km * number detour km's) – costs ferry service

In the user survey the user is asked to address the mean of transport when the user would make a detour. Per alternative the costs per kilometers are calculated based on sources of public transport operators, the ANWB and the Fietsersbond. These costs per kilometer will be multiplied by the amount of extra kilometers a person has to drive. These additional kilometers, which are the result of a detour, are obtained by the user survey. In case a person didn't know the amount of detour kilometers the value of 11,87 kilometers was assigned. This is equal to the researches of 2004 and 2010 (Oostinjen, 2004; Den Hartogh, 2010).

Table 4.14 Detour kilometers

Category	Number of km
0 – 5 Km	2,50
5 – 10 km	7,50
10 – 20 km	15
> 20 km	25
Unknown	11,87
Exact	…….

Table 4.15: Costs per alternative (€/km)

Alternative	Costs in €/km
Detour by bike	€ 0.10
Detour by car	€ 0.37
Public Transport	€ 0.15
Not make a trip	-

The costs for a detour per bicycle are equal to 10 cents per kilometer. The costs per kilometer contain the purchase cost, insurance cost, maintenance costs and the costs of rainwear. No distinction is made between a normal bicycle and an electric bicycle (Fietsen scoort, 2016).

The costs of a detour by car is valued at 37 cents per kilometer. These costs are based on a new car which travels 30.000 kilometers per year and will be used for four years. The costs include maintenance, insurance, tax and fuel (ANWB, 2016).

A detour by public transport is valued at 15 cents per kilometer. Two assumptions are made: everyone has an OV-chipkaart so no additional costs will be assigned and no additional costs for entering a public transport vehicle. The cost per kilometer is an average of various public transport operators (Connexxion, Arriva, GVB, GVU and RET).

4.2.3 Social impact of freshwater utilitarian ferry services

The extra travel cost are dependent on the costs of the alternative per kilometer, the number of detour kilometers (both positive and negative) and the costs of a ferry service. Compared to the previous research the cost of a ferry service has decreased from € 1,25 to € 0,93. The average detour kilometers have increased from 13,5 kilometer to 16,9 kilometer. This could partly be explained by the use of a different approach. Users with recreational and touristic travel motives did get a partly different survey which could skew the results. These results will be presented in the next chapter. These users may be underrepresented in the sample. Another explanation could be that there is an increase in the number of traffic jams compared to 2010. To avoid the congestion people may be willing to get of the highway, which was faster in the past, to make a shortcut.

Results

Compared to the research of 2010 a lower percentage of the respondent will make a detour by car. In the current sample 58% of the respondent will make a detour by car, which was 61% in the research of 2010. The percentage of people that will make a detour by bike is increased from 12 to 19%, however this percentage is still lower compared to the research of 2004. In 2004 the number of people that would make a detour by public transport was 10%, in 2010 this significantly decreased to 1,9% which has now slightly increased to 2,1% (Oostinjen, 2004; Den Hartogh, 2010).

Table 4.16: WTA calculation divided by extra travel cost and additional travel time

Type of costs	Average costs per transfer per user	Average cost per user per year	Total number of transfers per year (43.605.000)
Extra travel cost	€ 3,97	€ 1.188,52	173,1 million (€ 173.111.850)
Additional travel time	€ 4,38	€ 1.454,57	191 million (€ 190.989.900)
WTA	**€ 8,35**	**€ 2.643,09**	**364,1 million (€ 364.101.750)**

The costs of additional travel time have decreased from € 5,69 to € 4,38 per user per transfer. The user frequency however has increased compared to 2010. An explanation could be related to the design of the research since the recreational and touristic users may be underrepresented. Their frequency is usually lower, which may skew the results but additional research will only lead to minor adjustments. Another explanation could be that due to an increase of the traffic jams more people feel the need to use a ferry service. The increase of the user frequency leads to an increase of the average costs per user per year.

Compared to 2010 and 2004 the total WTA has increased as well, which is primarily explained by the increase in the total number of transferred people from 30 million to 43,6 million. The costs per kilometer per alternative mean of transport have been rather stable compared to the research of 2010. The decrease in the costs of additional travel time could be explained by the travel motive, but accurate data of the research of 2010 aren't available. Data provided by the Central Bureau of Statistics show that more and more people have a different travel motive during rush hours. Many of the surveys have been conducted during rush hour. Especially during the evening rush hour people have a different travel motive (CBS, 2016). The 'social' travel motive has a lower value of time compared to the 'commuter' or 'business' travel motive which could explain this decrease in the average costs per user per transfer.

Compared to the researches of 2004 and 2010 the social group of students are much more represented, which is more compliant to the real situation. In the current research 17% of the respondent are students, compared to only 1,1% in 2010. Students have a lower value of time compared to the other travel motives as well which could be another explanation. Despite the increasing number of traffic jams the average detour time is equal to the previous research (22 minutes). In 2004 the additional detour time was equal to 26 minutes (Oostinjen, 2004; Den Hartogh, 2010).

In the table below the social impact of 2015, 2009 and 2004 is displayed. The major differences in WTA originate from the differences in the total number of transferred people per year. In 2004 the number of transferred people was 32,8 million, in 2010 the total number of transferred people was 32,4 million. In the current research the total number of transferred people is slightly over 43,6 million. When the number of transferred people would be equal to the previous the total WTA would be almost equal to the total WTA of 2010.

Table 4.17: Comparison of WTA with 2004 and 2010

Type of costs	Year	Average cost per user per year	Average costs per transfer per user	Total number of transfers per year
Extra travel cost	2015	€ 1.188,52	€ 3,97	173,1 million (€ 173.111.850)
	2009	€ 543,54	€ 2,78	88,3 million (€ 88.332.187,46)
	2004	€ 346,58	€ 1,55	46 million (€ 46.462.190,85)
Additional travel time	2015	€ 1.454,57	€ 4,38	191 million (€ 190.989.900)
	2009	€ 1113,88	€ 5,69	170,6 million (€ 170.561.203,83)
	2004	€ 1515,79	€ 6,17	185 million (€ 184.949.495,19)
Total WTA	2015	€ 2.643,09	€ 8,35	364,1 million (€ 364.101.750)
	2009	€ 1657,42	€ 8,47	258,9 million (€ 258.893.391,29)
	2004	€ 1862,37	€ 7,72	231 million (€ 231.411.686,04)

4.2.4. Social effects

The hypothetical termination of ferry service doesn't only affect the users of a ferry service. Only 3% of the respondents state that they wouldn't make their trip anymore. This means that 97% of the users will have to make a detour in order to complete their trip, according to the user survey. What is even more striking is that 11% of the respondents would like to make a detour by using another ferry service. For these users the termination of a ferry service will have an even larger impact. A majority (58%) of the respondent will complete their trip by car. Since the sample is obtained to be representative for society as a whole, therefore 58% of the 43,6 million people will complete their trip by car. As a result 25,3 million people will have to make a detour and will use a car or another motorial vehicle to do that. The average additional kilometers transferred by a motorial vehicle is equal to 19,51 km. In total 493,4 million detour kilometers will be added to the current number of vehicle-kilometers travelled on Dutch roads. These extra vehicle-kilometers will result in additional traffic injuries.

For years the Dutch foundation for scientific research on road safety (SWOV) examined the number of traffic injuries per million vehicle kilometers. However since 2010 a fundamentally different research technique is used to determine the number of traffic injuries. In order the compare the current situation with that of the previous researches the exact same statistics will be used, which are displayed in table 4.18. The addition of 493,4 million vehicle-kilometers will lead to 153 extra traffic injuries. A traffic injury is defined (in paragraph 3.1.3) as at least a hospitalization after a road accident. The social material cost per traffic injury is at least equal to € 280.600 (De Wit & Methorst, 2012). On an annual basis this will lead to a social material cost of € 42.931.800, which is an increase of 17,5 million compared to the research of 2010 (Den Hartogh, 2010).

Table: 4.18: number of traffic injuries per million vehicle kilometers.

Road type	Number of traffic injuries (per million vkm's)
Outside built-up area	
Highway	0,06
Provincial road	0,08
Regional road	0,22
Road for all traffic	0,43
Within built-up area	
Main road	1,10
Residential street	0,57
Total Dutch road network.	**0,31**

Source: (SWOV, 2005)

The extra detour vehicle-kilometers also lead to noise pollution. Noise pollution is considered as one of the biggest forms of nuisance. Besides the nuisance it is also one of the sources of health problems. The social costs of noise pollution are displayed by the marginal cost of noise which is acquired from a research of the CE Delft regarding External and Infrastructural cost of traffic (Schroten, Van Essen, Aarnink, Verhoef, & Knockaert, 2014). In this research the cost per mean of transport are weighted to road type and time (during the day or at night).

Table 4.19: Marginal cost of noise per 1.000 kilometer on Dutch soil in 2010 (in €/1000 km)

Mean of transport	Cost in €/1000km	Costs in cents/km	Percentage user survey	Weighted costs in cents/km
Car	2,56	0,256	57,52%	0,14725
Delivery truck	13,9	1,39	6,50%	0,09035
Truck	21,2	2,12	1,63%	0,034556
Motorcycle	4,6	0,46	0,50%	0,0023
Moped	4,0	0,40	1,42%	0,00568
Agriculture vehicle	1,7	0,17	0,60%	0,00102
Total				**0,281156**

Each additional vehicle-kilometer has a social costs of 0,281156 eurocent per kilometer, which is higher compared to the research of 2010 (0,15 eurocent/km) and lower compared to the research of 2004. The difference in costs per kilometer could be explained by the difference in calculation procedure. In the former researches shadow prices were used and in this research marginal costs are used. Shadow prices are an average cost per kilometer. Marginal costs are costs of one additional vehicle-kilometer on top of the current situation, which is more accurate. The extra detour kilometers will lead to a social cost of € 1.387.295.

4.2.5 Environmental effects

Additional road traffic will lead to extra emissions of road traffic. The social cost of emissions are expressed by the external cost of transport related emissions. The exact same research of CE Delft is used as in 2010, however the estimated values of 2020 are used instead of the estimated values of 2010. Other consulted researches all used the calculations of the CE Delft research as a main source. Therefore the research of the CE Delft on the calculations of external costs of emissions divided by different means of transport is used (CE Delft, 2008). The cost per mean of transport are shown in table 4.20.

Table 4.20: External cost of passenger transport 2020 in €cents/km

Emission	CO_2	NO_x	PM_{10}			SO_2	Total
Means of transport			Metropole	Urban	Outside built-up area		(Weighted)
Passenger car	0,73	0,19	0,39	0,12	0,09	0,25	**1,28**
Delivery van	0,76	0,27	2,17	1,54	1,43	0,22	**1,46**
Truck	3,93	2,46	9,76	8,18	7,94	1,07	**8,56**
Motorcycle	0,28	0,19	1,22	0,39	0,24	0,10	**1,01**

All the weighted cost of emission are diminished. Relatively the total social environmental costs will be only slightly higher. The external costs of mopeds and scooters are equal to that of a motorcycles since individual information isn't available. The total costs of extra emissions is € 8.921.774.

Table 4.21: Cost per mean of transport

Means of transport	Percentage	Kilometers	Costs in €cents	Costs in €
Passenger car	73,9%	364.641.414	€ 466.741.010	€ 4.667.410
Delivery van	13,9%	68.586.139	€ 100.135.763	€ 1.001.358
Truck	7,1%	35.033.208	€ 299.884.257	€ 2.998.843
Motorcycle	5,1%	25.164.698	€ 25.416.345	€ 254.163
Total	**100%**	**493.425.459**	**€ 892.177.375**	**€ 8.921.774**

4.3 Social impact of the public transport ferry services

As like the research of 2010 the response of users of public transport ferries is rather low. A total of 52 users of a public transport connection completed the survey, which is statistically not representative. Unlike the previous research most of the 52 surveys are conducted on line 20 of Waterbus, the connection between Dordrecht and Rotterdam Erasmus Bridge. The statements regarding public transport ferries will be given based on the characteristics of the users from the survey of 2004 (Oostinjen, 2004). Table 4.22 shows the social impact of the public transport ferry services. Surprisingly the total WTA has increased even though the average additional travel cost have decreased.

Table 4.22: Social impact of public transport ferry services, 2015

Type of costs	Average costs per transfer per user	Average cost per user per year	Total number of transfers per year (2.605.000)
Extra travel cost	€ 0,16	€ 20,74	417 Thousand (€ 416.800,00)
Additional travel time	€ 7,78	€ 849,94	20,2 million (€ 20.266.900,00)
Total WTA	**€ 7,94**	**€ 870,68**	**20,7 million (€ 20.683.700)**

The study of 2004 showed that on average people had to make a detour of eight kilometers. The detour kilometers are similar in the current non representative sample. The characteristic of the users are exactly the same as the previous researches, so the changes in WTA need to be found elsewhere. As became clear from the 'normal' ferry services there are some changes in the valuation of the alternative transport modes and the value of time has increased. The differences in valuation

of the alternative lead to a decrease of the extra travel cost. The higher valuation of time explains the increase of the costs for additional travel time.

4.3.1 Social effects

The hypothetical termination of the public transport ferry will cause various different forms of nuisance. The users appreciate the fact that they can take their bicycle for free and the relaxing way of transport.

The follow up travel is mostly made by bicycle which explains why people appreciate the fact they can bring their bicycle for free. Since people get the opportunity to travel by bike the ferry services can have a good influence on people's health, because they get some physical exercise.

Like the 'normal' ferry services the hypothetical termination of ferry services has its social consequences, since this will lead to additional vehicle-kilometers which will cause noise pollution and extra traffic injuries. The marginal costs of noise pollution per kilometer are still the same, which is higher compared to the research of 2010 and lower compared to 2004 (Oostinjen, 2004; Den Hartogh, 2010). In order to quantify the social effects the total number of detour kilometers is required. Only 15% of the users state that they will make their trip by car or other motorized vehicle. The number of additional vehicle-kilometers will be over 3,2 million kilometer (3.251.390 km). The accompanied social cost of noise pollution will be € 9.141. Even though the total number of additional vehicle-kilometers is lower compared to the research of 2010, due to the decrease in the total people who use a public transport ferry service, the social cost of noise is higher. The external cost of noise pollution per kilometer is higher which could explain this observation.

The number of additional traffic injuries has slightly decreased. The increase of the vehicle-kilometers still leads to one additional traffic injury annually in absolute numbers, but in relative numbers there is a decrease from 1,29 in 2004, to 1,16 in 2010, to 1,01 in the current research. The explanation is a lower risk level compared to 2004, but the most important explanation is the decrease in the total number of transferred people by public transport ferry services. The material social cost of one additional traffic injury is € 280.600.

4.3.2 Environmental effects

The additional vehicle kilometers will also bring some environmental effects. These environmental effects are the additional emissions to air by road traffic. Annually, the social cost are € 39.017. These costs are lower compared to both researches. In both researches the costs for society are around € 50.000 per year. The explanation of the lower costs has two different components. At first, there is a lower valuation of external emission cost in eurocents per kilometer. Secondly, the total number of additional vehicle kilometers is lower.

4.4 Conclusions

Both the economic and social impact of the Dutch utilitarian ferry services is rather big. The 94 utilitarian ferry services, of which 84 'normal' and 10 public transport ferry services, jointly transfer 46,2 million passengers per year and generate a turnover of over € 33,5 million. The ferry services employ 591 FTEs. In relation to the research of 2010 the number of transferred people increased by 13,8 million and the turnover increased from € 27,4 million to over € 33,5 million. The efficiency of the ferry services has further improved since with less FTEs more people have been transferred. Despite the increase in efficiency and a higher turnover still 42 ferry services require a subsidy and 35 ferry service suffer an operating deficit. Twelve of the 35 ferry services are free ferry services which deliberately choose to operate the ferry service like that. The total operating deficit is € 6,6 million, of which almost € 5 million is caused by the public transport ferry services. Despite their

operating losses they state that they don't suffer of a deficit since they get a contribution by the government in order to maintain the price of a transfer below operating costs.
The normal ferry services face a deficit of € 1,6 million. This deficit is mainly caused by municipal ferry services. One explanation is that these ferry services may be less efficient compared to other ferry services. Another possible explanation is that the municipal ferry services allocate extra overhead costs to the ferry service. This may skew the results.

A stable financial base is still missing for the ferry services, despite the huge social impact of these services. The social impact for the users is quantified by calculating the Willingness to Accept, the amount of which an individual should be compensated with in order to no longer use a ferry service. The sum of the average WTA for all passengers lead to the social impact.

To the Willingness to Accept (WTA) of the users of ferry services is determined by the user survey. The main components of this survey are the cost of (possible) additional travel time and extra travel costs. A distinction is made between the normal a public transport ferry services. The normal ferry services have a social impact of € 417,3 million annually based on 43,6 transferred people per year. On average a person that has to make a detour by car has to travel an addition 19,51 kilometers, which lead to 493,4 million extra vehicle kilometers.

Not only will the users of the normal ferry services be affected by the hypothetical termination of ferry services. The additional vehicle-kilometers have its costs for society as a whole as well. The detours which people have to make provide an extra burden on the environment, additional traffic injuries and noise pollution. The extra emissions of CO_2, NO_x, PM_{10} and SO_2 has a social cost of € 8.921.774. The increase of the vehicle-kilometers will also lead to more traffic injuries. Annually 153 extra injuries will occur, which has a material social cost of € 42.931.800. Noise pollution will create a social cost of € 1.387.295.

The public transport ferry services transfer 2,6 million people annually with a turnover of € 7,7 million. The employment is 121 FTEs. The social impact of the public transport ferry services is € 21 million. The termination of the public transport ferries will raise the total vehicle-kilometers with 3,2 million, which will lead to environmental damage costs of € 39.017. The costs of noise pollution is € 9.141 while the extra vehicle-kilometers will raise the traffic injuries with 1 extra injury, which has a cost of € 280.600.

Table 4.23: Social impact of utilitarian ferry services

	Total WTA	Additional traffic injuries	Costs extra traffic injuries (€)	Noise pollution	Environmental damage (€)
Normal ferry services	€ 364 million	153	€ 42.931.800	€ 1,4 million (€1.387.295)	€ 8,9 million (€ 8.921.774)
PT-ferries	€ 21 million	1	€ 280.600	€ 9.141	€ 39.017
Total	**€ 385 million**	**154**	**€ 43 million**	**€ 1,4 million**	**€ 9 million**

5. Recreational ferry services

5.1 Economic impact of recreational ferry services

As stated before the Netherlands has more than 300 ferry services. 94 of these ferry services are operated throughout the whole year and there are ferry services which are offered at salt inland waters to the Wadden Islands. In addition, there are 113 ferry services which are only operated a part of the year. Within this category the self-service ferry services are excluded. So in this category the ferry services explicitly mentioned are: ferry connections which are only operated during a specific part of the year at least have one person who is in charge of the ferry on board of the ferry vessel. The sailing period is different for all the ferry services. A few already offer their services in March and continue to the end of October, others mostly operate within this timeframe. Characteristically these ferry services focus primarily on the recreational and touristic travelers. For them, the crossing provides a nice break of their trip and is an integral part of their experience. In many cases people deliberately drive towards these ferry services.

The focus of the recreational ferry services is on the touristic and recreational travelers. However, the utilitarian ferry services could also gain a significant part of their turnover from these kind of travelers. As we would not like to overvalue the ferry services, the total turnover of recreational travelers will only be calculated from the ferry services which are operated a part of the year.
In spite of this, travelers with a recreational/touristic travel motif on board of a utilitarian ferry, and conducted the user survey, will be included in the calculation for the social impact of the recreational ferry services.

5.1.1 Method

All the recreational ferry services received a request to fill out the operators' survey. In total 78 of the 113 ferry service returned the survey, which represents a response rate of 69%. Just like the utilitarian ferry services not all owner/operates completed the whole survey. Especially the financial data was sometimes missing. The direct economic impact will be expressed by employment and turnover. A breakdown by ownership structure will be provided.

5.1.2 Direct economic impact

Within this category there are 2 car ferries, 99 bicycle pedestrian ferries and 12 pedestrian ferries. Both owners of car ferries, 66 owners of bicycle-pedestrian ferries and ten owners of pedestrian ferries returned the survey. A distinction is made between charged and free ferry services.

Table 5.1: response charged recreational ferry service

Type of ferry	Population	Response	Transferred people	Turnover (€)	FTE/Volunteers
Car ferry	2	2	58.000	€ 71.000	4 FTEs
Bicycle-pedestrian ferry	96	64	1.188.100	€ 2.357.633	59,75 FTEs/ 415 volunteers
Pedestrian ferry	9	8	63.700	€ 228.500	12,05 FTE / 103 volunteers
Total	**107**	**74**	**1.309.800**	**€ 2.657.133**	**75,8 FTE / 518 volunteers**

Table 5.2: response free recreational ferry service

Type of ferry	Population	Response	Transferred people	Turnover (€)	FTE/Volunteers
Bicycle-pedestrian ferry	3	2	21.500	0	66 volunteers
Pedestrian ferry	3	2	252.500	0	1,5 FTE/ 29 volunteers
Total	**6**	**4**	**274.000**	**0**	**1,5 FTE / 95 volunteers**

Almost all categories have missing values, which means that extrapolation is necessary to make statements for the whole category. The extrapolation is based on news articles, the webpages of the ferry services and other news sources. These sources at least provided the number of transferred passengers. The turnover per ferry services is based on the tariff structure of the ferry services. Based on the ownership structure the employment is extrapolated. In most cases the number of volunteers is stated otherwise these numbers have been estimated by averages of similar ferry services.

Table 5.3: Direct economic impact charged recreational ferry services

Type of ferry	Population	Transferred people	Turnover (€)	FTE/Volunteers
Car ferry	2	58.000	€ 71.000	4 FTE
Bicycle-pedestrian ferry	96	1.761.350	€ 3.640.483	83,2 FTE / 625 volunteers
Pedestrian ferry	9	78.700	€ 243.500	12,5 FTE / 110 volunteers
Total	**107**	**1.898.050**	**€ 3.954.983**	**99,7 FTE / 735 volunteers**

Table 5.4: Direct economic impact free recreational ferry services

Type of ferry	Population	Transferred people	Turnover (€)	FTE/Volunteers
Bicycle-pedestrian ferry	3	26.500	0	68 volunteers
Pedestrian ferry	3	265.000	0	1,5 FTE/ 39 volunteers
Total	**6**	**291.500**	**0**	**1,5 FTE/ 107 volunteers**

Every year, a total of almost 2,2 (2.189.550) million people are transferred by recreational ferry services, of which almost 1.9 million by charged ferry services. These ferry services have a turnover of almost € 4 million. Many of the ferry services use volunteers. All these volunteers are in the possession of a small sailing license and have a large license if necessary. In total there are 842 volunteers, whom almost all receive a voluntary fee. In addition these ferry services create employment to 101,2 FTE. A large part of the employment comes from companies which operate a ferry service in addition to other services, such as boat tours. Some also offer catering on board which provides additional employments.

The use of so many volunteers stated that there is a very small financial base on which a ferry service can operate, since it can't afford to pay a salary. Many of the ferry services couldn't exist if they couldn't use volunteers. A comparison will be made between different kind of categories like type of ferry and ownership structure (private, municipal, provincial and foundation). There is also a distinction between ferry services which use volunteers and FTEs.

5.1.3 Financial position per category

Within this comparison only the information provided by the owners/operators will be used. Based on this information an analyses of the operating result, employment and efficiency will be presented. When a ferry service has paid employment and volunteers a weighted distribution will be presented.

Car ferry services

This category has two ferry services, one of which is a municipal ferry service and one is a ferry service of a foundation. Because this category is limited, no distinction in ownership structure is presented.

Table 5.5: Key figures recreational car ferries

Car ferries	2015/2015
Number of ferries	2
Number of FTEs	4
Transferred people	58.000
Transferred people per FTE	14.500
Revenue per transferred person	€ 1,22
Exploitation cost per transferred person	€ 2,24

Both ferry services are depending on subsidy, since the operating cost exceed the revenue. A recreational ferry often depends on the weather condition. On a day with bad weather there is limited demand, but enough people should be available at the ferry service. The costs of wages stay stable every day but the revenues fluctuate. Maybe there are too many FTEs within this category. Operating the ferry service with less people could lead to efficiency gains and cost reductions. These ferry services are hardly comparable to utilitarian ferry services but we see that the least efficient utilitarian car ferry is more than three times as efficient as these two ferry services.

Bicycle-pedestrian ferry services

Four different ownership structures can be distinguished: private, municipal, provincial and a foundation. The revenue and exploitation costs per transferred person are the highest for the private ferries. A few of the private ferry services travel a longer distance over a lake or in the longitudinal route of a river. As a result the revenues per person will be higher, but the costs increase as well. There are 30 private bicycle-pedestrian ferry services in the Netherlands. Most of them (28) are operated by paid employment, only two are offered with volunteers. Despite the high operating costs the private ferries are able to generate a profit, on average.

Table 5.6: Key figures recreational bicycle-pedestrian ferry services

Bicycle-pedestrian ferry services	Private		Municipal		Provincial	Foundation
Number of ferries	30		23		2	9
	FTE	Volunteers	FTE	Volunteers	FTE	Volunteers
Employment	43,3	20	12,35	198	4,1	197
Transferred people	629.100	15.250	217.750	169.500	16.500	140.000
Transferred people per FTE	14.529	763	17.632	797	4.024	711
Revenue per transferred person	€ 2,69	€ 1,64	€ 0,92	€ 1,19	€ 1,09	€ 1,31
Exploitation cost per transferred person	€ 2,11	€ 2,16	€ 1,18	€ 1,37	€ 1,28	€ 1,53

There are 23 municipal bicycle-pedestrian ferry services, seven of them are operated by paid employment and 16 are operated by volunteers. The municipal bicycle-pedestrian ferry services have lower revenues per transferred person, but also lower costs per person compared to the private ferry services. The efficiency of the municipal ferries is the highest of all the bicycle-pedestrian ferry services (with paid employment). On average these ferry services suffer an operating deficit which could be explained by the extra allocation of costs by municipalities. If possible these ferry services should try to increase the revenues, but the dependency on the weather conditions may be a big bottleneck.

The two provincial bicycle-pedestrian ferry services offer employment to 4.1 FTEs and transfer 16,5 thousand people per year. With an efficiency of 4.000 persons per FTE this category performs well, however it could be improved. Per person these ferry services have a deficit of € 0,19. This could be outbalanced by an improvement of the efficiency or attracting more people.

At last there are nine bicycle-pedestrian ferry services operated by a foundation, with 197 volunteers. Each year these ferries transfer 140.000 people. In general these ferry services perform well. Six of the nine ferries gain a profit or they can cover the costs. The remaining three ferry services have an operating deficit which are quit high. As a result it seems that this category, on average, is very dependent on subsidy, but the results might be a bit skewed by the three ferry services with a deficit.

Pedestrian ferry services

In general the pedestrian ferry services perform well. On average the private pedestrian ferry services gain a profit. Two of the four ferry services are operated over a long distance which explains the high revenues and costs per person. Compared to the other pedestrian ferry services there are a lot of FTEs required to operate these services, which also has to do with the long travel distance.

Table 5.7: Key figures recreational pedestrian ferry services

Pedestrian ferries	Private	Municipal	Foundation
Number of ferries	4	3	1
Employment	11,5 FTE	0.55 FTE + 25 volunteers	78 volunteers
Transferred people	27.200	6.500	30.000
Transferred people per FTE	2.365	254	385
Revenue per transferred person	€ 7,10	€ 1,62	€ 0.83
Exploitation cost per transferred person	€ 7,00	€ 2,31	€ 0.78

The municipal pedestrian ferries perform better when looking at the number of FTEs. However these ferry services require the help of volunteers. Volunteers can't be used too often, because of tax regulations. In order to operate regularly, a lot of volunteers are required, which has a negative effect on the transfer performance per employed person. Despite the use of volunteers the municipal pedestrian ferries are not able to generate a profit.
The foundation is able to generate a gain, by operating the service with 78 volunteers. These 78 volunteers transfer almost as many people as the other 7 ferries combined. Due to the use of volunteers the exploitation costs stay rather low, accompanied by the huge number of transferred people the will generate a profit at the end of the season.

Subsidies
The financial situation of almost all categories is relatively bad. In order to reduce the cost many ferry services already use volunteers. In many cases these volunteers are former inland skippers, who would like to keep sailing but in closer proximity to their house. In addition there are many volunteers who are involved in other work at the ferry service, such as planning and maintenance.

Even with the help of volunteers it turns out that in many cases a recreational ferry service is not profitable. As a result a lot of subsidy is required to keep these ferry services running. These services often go to the local municipalities or to Ferry Funds. Recreational ferry services in the province of Gelderland can rely upon the Gelders Verenfonds. In other provinces there isn't such a fund for recreational ferries. Those ferry services rely on local governments.

In total almost half of the recreational ferry services require a subsidy to keep the ferry in service. The amount and reasons for the subsidy varies per service. In most cases the subsidy is provided to cover a deficit. Other forms of subsidy that are obtained are: the one-time investment subsidy, a fixed contribution, and different contract with local municipalities. A further distribution of the subsidies will be discussed in the social impact section.

Sponsors
Recreational ferry services don't always have to rely on the government. More and more local entrepreneurs are willing to become a sponsor of the ferry service. In return the local entrepreneurs get some space to advertise on board of the ferry. The contributions of these sponsors may not be that high, but it may give a little extra to operate the ferry service cost-efficiently. The local entrepreneurs would like to benefit of the positive atmosphere on and around a ferry service.

5.2 Social impact of recreational ferry services
The 113 recreational ferry services don't only represent an economic impact. They contribute to the welfare of the society as well. The social impact contains of three different aspects: Willingness to Pay, subsidies and expenditures due to the existence of the ferry services. At first the method will be presented after which the social impact will be quantified.

5.2.1 Method
The social impact will be quantified based on the operator- and user survey. The user survey will be used to calculate the Willingness to pay and the expenditures due to the existence of ferry services. The operator survey is used to determine the subsidies.

Persons who have crossed a ferry service with a recreational/touristic travel motif conducted a slightly different user survey compared to people with a different travel motif. In order to get as much response as possible the survey was promoted online by social media to generate the highest possible response. At the same time the survey was promoted and conducted on board of the ferry vessels. In total on 54 different ferry services, spread over the whole country, users conducted the survey. In total 254 surveys are filled out. In addition to the surveys, interviews are conducted with either owners/operators and users of ferry services, which leads to representative and reliable statements of the sector.

Based on the survey the Willingness to Pay will be compared with the actual cost of a crossing. If after deduction of the actual costs of a good/service a positive result remains one can conclude that the good/service has a gain on social welfare. A person is willing to pay extra in order to maintain the service.

After the calculation of the WTP, the subsidies will be obtained from the operator survey. Within the regulations the 'Gelders Verenfonds' describes the terms and conditions which have to be satisfied before an ferry service owner could obtain a subsidy (Stichting Veren Gelderland, 1995). One of the conditions which has to be satisfied is that the ferry service has a social impact. In addition the fund acknowledges that if a ferry service already obtains a subsidy from local municipalities it would be obvious the ferry service has a social impact. This social impact is mostly outlined by the experience and possibility to do leisure activities.

The last aspect will be the indirect economic output of the ferry services. Recreational ferry services are often part of a cycling network or hiking trail. Since travelers follow these routes, they go to places where they otherwise never would have been. As ferry services are an integral part of the network some of the expenditures on the day of the trip could be assigned to the ferry service. Often there is a restaurant or a bar in the near vicinity of a ferry service. These restaurant are dependent on the ferry service. Therefore to a greater or lesser extend the ferry services are responsible for the expenses a person makes during a trip.

5.2.2 Quantification

Willingness to Pay

To obtain the Willingness to Pay a hypothetical market is created. In this hypothetical market the ferry service will no longer be present, which has implications for the users. The user of the ferry service is asked what the maximum price is that he is willing to pay in order to keep the ferry service operational. In this research the direct approach is used. The user has to name their maximum price in which all the relevant factors are incorporated. This approach may have its disadvantages, because a user might not want to show their real WTP or they don't incorporate all the relevant alternatives (Breidert, Hahsler, & Reutterer, 2006). Since a user of a ferry service deliberately chooses to use the ferry all the relevant factors and alternatives will be incorporated in their decision.

The social impact will be displayed by the customer surplus. This valuation method measures the difference between what someone actually paid for a good/service and what he is willing to pay for the service (Bowker, Bergstrom, & Gill, 2007).

Social impact = Customer surplus = (WTP – actual costs) * frequency

Subsidy

Subsidies are assigned to companies of services which suit the goals of projects that the government, either local, provincial or countrywide, would like to stimulate (Overheid, 2016). The government stimulates projects that facilitate outdoor recreation. They serve a social impact, but are not always able to gain a profit. The government subsidizes these projects and companies. The sum of all the subsidies are the social impact.

Expenses due to the ferry services

The presence of ferry services, with or without the help of a subsidy, facilitates the possibility of outdoor recreation and tourism. During these activities people will buy a drink or lunch at places where they otherwise never would have been. The ferry services, to a greater or lesser extent, have a role in the expenditure made in one area. The degree of influence is determined by the user itself. In the user survey several questions regarding the influence of a ferry service on their trip have been asked. At first, the user is asked whether or not the trip would have been made if the ferry service no longer existed. Secondly, the degree of influence of the existence of the ferry service within the total trip could be stated. The options are: no influence, little influence, average

influence, and much influence. The combination of the two answers provides a different allocation of the total expenditures.

Table 5.8: Influence ferry service on the expenditures

Would you make the trip	Degree of influence	Expenditure allocation (%)
Yes	No	0%
	Little	5%
	Average	15%
	Much	30%
No	No	0%
	Little	12,5%
	Average	25%
	Much	50%

If the respondent stated that the ferry service was of no influence on the trip no expenditures have been allocated to the ferry service. When someone would make the trip to the exact same place anyway the expenditure allocation is lower compared to when they wouldn't. Based on the results an average expenditure per user will be assigned to the ferry service.

5.2.3 Social impact

Willingness to Pay

The recreational/touristic traveler pays between the € 0,00 and € 6,00 per transfer with a ferry service. On average the user of a ferry service has to pay € 1,42 per transfer. No distinction is made based on mean of transport. 64% of the users travel by bike, while 16% is a pedestrian and 14% travels by car. The remaining 6% either uses a motorcycle, moped/scooter or wheelchair.

Only 5% of the recreational/touristic users feel that the price per transfer is too high. Slightly more than 21% of the users WTP is equal to the current price, which means that more than 73% of the users is willing to pay a higher price than the current price. The total WTP is € 32,1 million.

Table 5.9: Customer surplus (CS) recreational ferries

Average price per transfer	Average WTP per person per transfer	Average payment per person per year	Average WTP per person per year	CS per person per year	Total number of transferred people (2.189.550)
€ 1,42	€ 2,11	€ 36,15	€ 50,80	€ 14,65	**32,1 million (€ 32.076.907,50)**

Subsidies

The obtained subsidy by ferry services from governments (municipalities, provinces and foundations) are gathered from the operator survey. When a ferry service is operated by a municipality only the expenses to cover the deficit will be mentioned acknowledged as subsidy since the rest of the costs are covered by the revenues of the ferry service. The total amount of subsidy is shown in table 5.10. When the owner/operator didn't state the motif of the subsidy the subsidy contribution is added in the category: cover operational deficit.

Table 5.10: Subsidy contribution

Subsidy motive	Number of ferry services	Total amount
Cover operational deficit	25	€ 433.857
Investment subsidy	3	€ 26.500
Fixed subsidy contribution	6	€ 61.000
Replenishment contribution	1	€ 45.000
POP-subsidy	1	€ 3.400
Totaal	**36**	**€ 569.757**

Not all ferry service owners/operators answered the financial questions, which could implicate that the subsidy contribution by the government is even higher, which means a higher social impact.

Expenses due to the ferry services

Indirectly ferry services can be hold accountable for the expenditures of their users. From the user survey it becomes clear that 52% of the users never would have made the trip if the ferry services wouldn't have been there. Automatically the ferry service plays a bigger role in the trip of these people compared to people who would go anyway. However, there still is a difference in the degree of influence, which has a different allocation factor.

As like the owner/operators of ferry services, the users are reluctant to answer financial questions. From the total of 256 recreational users only 168 users were willing to share their expenditures during a trip. The table below shows a distinction between the degree of influence and whether or not someone would have made the trip.

Table 5.11: Response influence ferry service on expenditures

Would you make the trip	Degree of influence	Expenditure allocation (%)	Number of reactions
Yes	No	0%	8
	Little	5%	13
	Average	15%	24
	Much	30%	17
No	No	0%	1
	Little	12,5%	2
	Average	25%	18
	Much	50%	85
No reaction			88

On average the 168 respondents spend € 21,79. Some respondents however state that the total expenditures are done over multiple days. In order to compare all the answers with one another the total expenditures are calculated per day. The expenditures per day are, on average, € 16,83, which is comparable with the results of other researches where the expenditures per trip were € 13,24 and € 15,39 per day (NRIT, 2015; Eijgelaar, Piket, & Peeters, 2013). On average 33,7% of the expenditures by ferry service users can be assigned to the ferry service, which is € 5,67 per activity per person. The total indirect economic impact is € 12.414.749 annually.

5.3 Conclusions

The Netherlands has 113 recreational ferry service which transfer 2.189.550 people per year and has a turnover of almost € 4 million. In contrast to the utilitarian ferry services are not only operated by paid employment (101 FTE), but also by volunteers. The recreational ferry service are very dependent on volunteers. In total there are 842 volunteers active. Volunteers are used to reduce the operational costs of the ferry services. However still a lot of recreational ferry services are dependent on subsidy. The analyses on the financial position per category showed that only three ownership structure categories on average gain a profit. All other categories are dependent on subsidies. In addition to the subsidy more often recreational ferries get a small contribution from a sponsor. These sponsors, mostly local entrepreneurs, make a small contribution and in return get some advertising space on board of the ferry.

The social impact of the recreational ferry services is based on three pillars. Firstly, the WTP is determined. In this research the maximum amount someone is willing to pay is diminished with the actual price per crossing, which results in the customer surplus. On average the users are willing to pay € 2,11 while the average price is only € 1,42. The total customer surplus is € 32,1 million. Secondly, the subsidies that are assigned to the ferry services are mapped. The government is willing to contribute to projects which facilitate their goals like outdoor recreation. The operator survey showed that ferry service obtains € 569.757 per year.

Lastly, ferry services have an indirect economic output. Since people deliberately travel by recreational ferry service a part of the expenditures per trip could be assigned to ferry services. Per trip users spend € 16,83 of which 33,7% could be assigned to the ferry service worth: € 5,67 per person per trip. The total indirect social value is € 12.414.749.

Table 5.12: Social importance recreational ferry services

	Willingness to Pay (WTP)	Subsidy	Expenses due to ferry service
Recreational ferry services	€ 32,1 million	€ 569.757	€ 12,4 million

6. Sustainability and Market development

6.1 Sustainability

Chapter four discussed the effects of the hypothetical termination of the ferry services. The termination of the ferry services resulted in 493,4 million additional vehicle-kilometers on the Dutch roads. As a consequence the emissions to air by road traffic increased which has a bad influence on air quality and the environment. However, most ferry services emit the same fabrics as well. At first the current laws and regulations will be described after which the pollution of ferry services will be calculated.

6.1.1 Laws and regulations

The European Union issues guidelines, described in the EU Directive 2004/26, related to the maximum emissions for inland ships. The Directive outlines the emission-standards, which depend on the cylinder capacity and motorial output of the engines as of construction year 2007 (European Union, 2004). Furthermore the Central Commission for Navigation on the Rhine (CCNR), since manufacturing year 2003, imposes criteria on the emissions of inland ship engines. The current legislations is based on the CCNR stage two standards. This standard prescribed the maximum emission per Kilowatt-hour of energy per engine. Each engine with a different motorial output has a different standard. The CCNR stage to standards go for engines from construction year 2007 (Central Commission for Navigation on the Rhine, 2012).

As of 2019 the directive will be tightened in order to reduce the emissions of particulate matter and NO_x (Rijksoverheid, 2016). Particulate matter and NO_x are regarded to be the most polluting particles. New shipping engines with a motorial output of less than 300 kilowatt have to meet the standards of the tightened directive by 2019. Engines with an output of more than 300 kilowatt have to meet the standard by 2020. The Non-Road Mobile Machinery regulation states the maximal emissions of engines with different motorial output and applications (European Union, 2016).

The goal of the tightening of the Directive has multiple implications. The European Commission states that it is both good for business and the environment. The reduction of particulate matter and NO_x will:

- protect the health of EU citizens
- protect the environment and improves the air quality in the EU
- ensure the good functioning of the internal market for NRMM engines, avoiding market distortions and market fragmentation in the EU - ensures a level playing field on global markets
- avoid unfair competition from non-compliant low-cost products

6.1.2 Allocating emission to ferry services

All ferry services are different. Almost every ferry vessel is different, which results in different emissions per vessel model and type of engine. Explicit data of emissions by ferry services is absent. Therefore an allocation of emissions to ferry services will be calculated. The allocation will be different compared to the research of 2010 in which partly similar inland ships were used to assign emissions to ferry services (Den Hartogh, 2010). The emissions will be assigned by the fuel consumption. Fuel consumption corresponds with a certain amount of emissions per liter of fuel. A distinction by vessel model will be made. Only the utilitarian ferry services will be used in this chapter.

6.1.2.1 Categorization ferry services

Within the ferry service sector various types of vessels are used. Some vessels are only designed to transfer bicycles and pedestrians, others can transfer cars and heavier vehicles as well. A ferry which transfers cars has to use engines with a higher motorial output than other ferries. And ferries on a chain or cable will need less powerful engines than free floating ferries. A distinction based on vessel model and transfer possibility per mean of transport will be presented. Ferries with more than one engine on board will be classified as large. Ferries with only one engine will be classified as small.

Table 6.1: Categorization by vessel model and mean of transport

Means of transport / Vessel model	Bicyle-pedestrian	Car	Total
Swing ferry	0	14	**14**
Cable-, chain ferry	0	19	**19**
Ferry large	10	12	**22**
Ferry small	10	6	**16**
Ferry boat large	1	0	**1**
Ferry boat small	6	0	**6**
Electric ferry	4	2	**6**
Catamaran, Swath vessel	10	0	**10**
Total	**41**	**53**	**94**

6.1.2.2 Assigning emissions to ferry services

Explicit data on emissions of ferry service are absent. Therefore based on fuel consumption the emission of CO_2, NOx, PM_{10} and SO_2 will be assigned. Two different approaches can be used to assign the emissions: tank-to-wheel and well-to-wheel. The tank-to-wheel approach only assigns the emissions of the vehicle itself. The well-to-wheel approach also includes the emissions of the production process, like the extraction of oil from the ground, the refining process and the production of electricity (CE Delft, 2008). The tank-to-wheel approach will be used.

To estimate the emissions, emission factors are used. The emission factors express the emissions per unit of used fuel. Data provided by the Central Bureau of Statistics (CBS, 2016) depicts the emissions factors to air by mobile sources. A number of assumption have been made to make an estimate of the emissions. Firstly, the emissions factors of ferry services are equal to those of the total group of passenger inland shipping. This group also includes the ferries to the Wadden Isles and passenger boat tours on canals, but these are mostly comparable. Secondly, the emission factors are expressed in grams/kg fuel. The fuel is shipping diesel. Some ferry services use a cleaner fuel, but for the calculations diesel is used. Lastly, is the specific weighting of diesel. At a temperature of 15 °C the specific weighting of diesel is between 0,82 and 0,845 kilogram per liter (Shell, 2016). Therefore the specific weighting of diesel will be assumed at 0,83 kilogram per liter. The emissions factors are displayed in the table below.

Table 6.2: Emission factor in gram/kg diesel and gram/liter diesel

Emission factor	CO_2	NO_x	PM_{10}	SO_2
In gram/kg diesel	3173	50	4	0,02
In gram/L diesel	2633,59	41,5	3,32	0,0166

The six electric ferry services are excluded from the assigning of emissions, since they don't emit these aforementioned particles during transport.

6.1.2.3 Determination fuel consumption

The fuel consumption is determined per vessel model based on the operating hours of the engines and an average fuel consumption per operating hours. Every ferry service has a different time schedule which implies that the transfer frequency is different per ferry service. But every ferry service has a certain number of operating hours of the engine in combination with a fuel consumption. The problem with different time schedules and transfer frequencies is sorted by assigning an average fuel consumption per vessel model per operating hour. The total number of operating hours of the engines is derived from the time tables of the ferry services in combination with information obtained from ferry operators. The average fuel consumption is obtained from the ferry operators. From every category vessel model at least three, if possible, operators have been asked to state the total fuel consumption and the average fuel consumption per operating hour of the engines. The average fuel consumption has been checked by dividing the total fuel consumption by the total operating hours of the engines. The total fuel consumption is displayed in the table below.

Table 6.3: Calculation total fuel consumption

Vessel model	Number of ferries	Total operating hours of engine	Average fuel use in liter/ operating hour of engine	Total fuel consumption in liters
Swing-, cable ferry	33	152.350	7	1.066.450
Ferry large	22	134.900	23,6	3.183.640
Ferry small	16	64.600	5,85	377.910
Ferry boat large	1	3.450	18	62.100
Ferry boat small	6	17.950	12,6	226.170
Catamaran, Swath vessel	10	77.400	90	6.966.000
Total	**88**	**450.650**		**12.324.742**

6.1.3 Total emissions of ferry services

After assigning the fuel consumption per vessel model the outcomes will be multiplied with the emissions factors. Based on the emissions per vessel model the total emissions will be calculated. The costs of environmental and air pollution will be determined by multiplying the external cost of the additional emission of CO_2, NO_x, PM_{10} and SO_2 with the total emissions of the particles. At first the air pollution per vessel model will be presented in table 6.4.

Table 6.4: Environmental and air pollution, emission by vessel model

Emission / Vessel model	CO_2 (mln. kg)	NO_x (ton)	PM_{10} (ton)	SO_2 (ton)
Swing-, cable ferry	2,81	44,26	3,54	0,18
Ferry large	9,55	150,48	12,04	0,60
Ferry small	0,995	15,68	1,25	0,06
Ferry boat large	0,164	2,58	0,21	0,01
Ferry boat small	0,596	9,39	0,75	0,04
Catamaran, Swath vessel	18,35	289,09	23,12	1,16
Total	**32,46**	**511,48**	**40,92**	**2,05**

As can be seen from table 6.4, the Catamarans and Swath vessels are the most polluting vessel models. These vessel models are used by the public transport ferry services. Since these ferry services travel longer distances and cross the water at a higher speed these vessel need engines with a higher motorial output. These engines need more fuel to achieve this higher speed. Especially since the vessels have much more moments during a trip where they have to accelerate. The changes in speed and acceleration leads to a higher fuel consumption.

The environmental damage and air pollution will be quantified with the use of research of CE Delft, INFRAS and Fraunhofer from 2011 (CE Delft, INFRAS & Fraunhofer ISI, 2011). Within this research models of NEEDS (New Energy Externalities Developments for Sustainability) and IMPACT (Internalization Measures and Policies for All external Cost of Transport) have been used. These models quantify the costs that are from emissions by a four determinants: health, damage to buildings and materials, loss of crops and the loss of biodiversity.

The costs in € per ton particles will be equal to the values presented in 2008. The external cost, presented by the research of CE Delft et al, are categorized by country and per particle. The estimated external cost of CO_2 for 2015 are equal to € 25 per ton, based on Anthoff (2007). Even though the current price of CO_2 didn't develop the way the models expected, the value of € 25 per ton will be used. Many researches are still based on the models of NEEDS and IMPACT which also use these values.

The external cost of the particles NO_x, PM_{10} and SO_2 will also be equal to the costs presented in CE Delft et al (2011) (table 6.5). For particulate matter (PM_{10}) a distinction is made based on the location of the emissions: Metropole area, urban area and non-urban area. The ferry services are spread out throughout the whole country which implies that a weighted average will be used. The weighted average is € 136.000 per ton, which is comparable to other studies of external costs (CE Delft, 2007; IMPACT, 2008).

Table 6.5: External cost of CO_2, NO_x, PM_{10} and SO_2 per ton

Particle	CO_2	NOx	PM_{10}	SO_2
External cost per ton	€ 25	€ 8.800	€ 136.000	€ 12.800

By multiplying the external cost per particle with the total emissions by ferry services the costs of air pollution and environmental damage is quantified. Table 6.6 will show the results per vessel model.

Table 6.6: External cost of air pollution and environmental damage

Emission / Vessel model	CO_2	NO_x	PM_{10}	SO_2	Total
Swing-, cable ferry	€ 70.214,80	€ 389.467,54	€ 481.523,50	€ 2.265,99	**€ 943,471,84**
Ferry large	€ 238.742,31	€ 1.324.256,10	€ 1.637.262,09	€ 7.704,76	**€ 3,207,965,26**
Ferry small	€ 24.881,50	€ 138.012.,73	€ 170.633,92	€ 802,98	**€ 334,331,14**
Ferry boat large	€ 4.088,65	€ 22.678,92	€ 28.039,39	€ 131,95	**€ 54,938,91**
Ferry boat small	€ 14.890,98	€ 82.597,28	€ 102.120,28	€ 480,57	**€ 200,089,10**
Catamaran, Swath vessel	€ 458.639,70	€ 2.543.983,20	€ 3.145.288,32	€ 14.801,36	**€ 6,162,712,58**
Total	**€ 811.457,93**	**€ 4.500.995,78**	**€ 5.564.867,51**	**€ 26.187,61**	**€ 10,903,508,83**

The cost of air pollution and environmental damage by the ferry services is € 10,9 million. More than € 6 million is caused by the public transport ferries, the 'normal' ferries are accountable for almost € 5 million. Despite the relatively high cost for the environment the total social benefits of ferry services outweigh the costs to society.

One of the assumptions in paragraph 6.1.2 is that all ferry services use diesel. A remark should be made that multiple ferry services already use a cleaner fuel which result in smaller emissions. The total external cost could be lower when this could be integrated in the calculations.

6.1.4 Sustainability initiatives in the ferry service sector

In the operators survey the owner/operator of ferry services is asked if they pay attention to sustainability. Within this paragraph a distinction will be made between the utilitarian and recreational ferry services, because of different sustainability initiatives and motives behind these initiatives.

Fourteen owners/operators of utilitarian ferry services will implement or already have implemented sustainability initiatives. These initiatives will be or have been turned into large investments to the ferry service. Twelve of the fourteen initiative involve the purchase of a new ferry. In all cases the new ferry will replace an old ferry service. The remaining initiatives are turned into investments to the infrastructure in the near vicinity of the ferry service, like a waiting area for pedestrians and cyclists on both shores. For four operators financing these investments will be difficult. The current operating result doesn't provide them sufficient resources to do these investments on their own. These owners/operators have to request for a loan or subsidy.

The owners/operators distinguish two different types of sustainability: financial and environmental. Financial sustainability will lead to cost cuts which is beneficial to the operating result. Some examples: economical use of fuel, filter placements which leads to fewer oil replenishments. Besides the cost sustainability more and more environmental initiatives are implemented, like the use of cleaner fuels as GTL and dual (diesel-electric) propulsion. Also the used materials are looked upon by using the more environmentally friendly antifouling and paint.
The recreational ferry services are also trying to be more sustainable. Twenty owners/operators are investing in sustainability. Three operators are even willing to turn their vessels to fully electric vessels, which will reduce the emissions significantly. Four other operators are looking at repowering

(replace the old engine) options. One operator would like to replace the whole ferry. The other operators are mostly looking at improving the infrastructure. For four operators it is uncertain whether or not they will be able to finance their investment.

6.1.5 Possibilities to improve environmental sustainability

For ferry services six real options exist which could improve the environmental sustainability. These options, which should lower the emissions of particulate matter, NO_x and CO_2, are described in a memo from CE Delft (Den Boer, 2016). The six options are:

- Repowering
- Exhaust after-treatment systems
- Hybridization of the propulsion
- Fully electric propulsion
- Contra rotating propellers
- Gas-to-Liquid (GTL)

When a ferry service would like to repower, replacement of the current engine, the new engine will at least meet the current emissions standard. At this moment, the engines have to meet the CCNR stage two standard. When ferry services would already look ahead they will install an engine which will meet the NRMM regulation. Engines which already meet the NRMM standard do also use exhaust after-treatment systems. Exhaust after-treatment systems use a combination of a particulate filters and selective catalytic reduction (SCR). Usage of exhaust after-treatment systems will lead to a significant reduction of the emissions of particulate matters and NO_x (Den Boer, 2016).

Hybridization of the propulsions has two different possibilities: diesel-electric or diesel-hydraulic. The advantage of this propulsion is that is can turn engines on and off without losing any thrust. All the propellers could still be used, but the number of running engines could be reduced. A fuel consumption reduction of 10% could be achieved.

Currently, a fully electric propulsion is only possible on a limited scale. The batteries on board should have sufficient time to load. Especially, for the utilitarian ferry services the turnaround time is very low which is insufficient for the batteries to charge. This limits the possibilities.

When using contra rotating propellers two screws are assembled on one tail piece, each on one side. By assembling two contra rotating propellers behind each other the vortices will be reduced. Another advantage of contra rotating propellers is that it is very quiet, so there is less noise pollution.

The last option is to use Gas-to-Liquid (GTL). GTL is a liquid diesel which is obtained from natural gas (Salland Olie, 2014). Compared to conventional diesel, GTL has a cleaner combustion which leads to the exhaustion of less particles. Per liter GTL is on average 10 cents more expensive, whereby the use of GTL is a deliberate sustainable choice.

6.2 Market development

Ferry services are largely dependent on the supply of travelers. Nevertheless, a ferry service owner has sufficient options to optimize their service. One may think of providing decent time tables, good facilities, customer friendly personnel and reliability. Any customer should be aware of these qualities, so that the ferry service could attract as much as possible customers. However, there are more ways to attract new customers. This paragraph will discuss some possibilities to attract new customers by ferry services

6.2.1 Ansoff matrix

The Ansoff matrix is a marketing tool where a growth strategy for an organization could be determined (Ansoff, 1958). This matrix gives four different growth strategies: market penetration, market development, product development and diversification.

Market penetration

This strategy implies trying to sell more products on the same market. Two different approaches could be distinguished here: try to attract the people, who are currently using the ferry service, to use it more often of try to attract new people at the current location. The provided services could become of decisive impact. Another way to attract new people is by providing discounts.

Market development

With this strategy one offers the existence service on a different market. The different market in this case could be defined as another location. A different location brings its own dynamics, however when the core product (the ferry service) is good it could be possible to go to a different location.

Product development

The third strategy implies selling a new, or an improved version of the current product at the same market. An improved version of the current product could be by improving the reliability and the presentation towards customers or by adding an option to the current product like a water taxi-service.

Diversification

The last strategy is to offer a new product on a new market. For ferry services owners this could be done by selling boat tours on a different location. This strategy is the riskiest of all.

6.2.2 Market development in practice

6.2.2.1 Utilitarian ferry services

More than half (55,7%) of the utilitarian ferry services does not engage in market development. The owners provided various reason not to engage in market development. Ferry services with a municipal ownership structure only have the objective to make an area accessible for commuters and students. There are also a couple of free ferries which don't have the necessity to transfer as much as possible people. These ferry services are not financially dependent on the total number of transfers. Other important reasons are the lack of financial resources, high dependency on the infrastructure and too many ferry services in the near vicinity of their ferry service which limits the options.

The 44% that does engage in market development mostly tries to attract new customers. They mostly try to attract people with a recreational travel motif. Various options to achieve this goal are presented: becoming part of a cycling route/hiking trail, building a good relationship with local bars and restaurant or by extending the time schedule during summer. Three operators investigate the option to set up a new ferry connection which could lead to synergy advantages. One operator attracts more people by providing a water taxi-service in combination with package deals with local business.

6.2.2.2 Recreational ferry services

In total 46% of the recreational ferry services engages in market development. The most used strategy by recreational ferry owners/operators is market penetration. These ferry services would like to attract new passengers by giving discount during pre- and end of season, becoming part of a cycling route/hiking trail or by extending the time schedule.

The remaining 56% that does not engages in market development has various reasons to do so. The most important reasons are a lack of knowledge and financial resources. The operational cost could either just be covered or not covered at all. Adjacent, one ferry owner even states that for recreational ferries it would not help to do market development since they will be override by the bigger ferry services. The last reason not to engage in market development is the objective of the ferry services. The ferry service is there as a mean of outdoor recreation and not for other usage.

6.3 Conclusion

The environment is becoming increasingly important. Ferry services have to follow these developments, because of new laws and regulations but also to preserve the environment as it is now. The laws and regulations limit the permitted emissions of an engine. Currently, the maximum emissions of combustion engines has to meet the CCNR stage 2 standards. Per 2019 or 2020, depending on the motorial output in kilowatts, new shipping engines have to meet the new NRMM directive. The incorporation of these new engines will have large implications for the ferry services.

In this chapter the emissions of CO_2, NO_x, PM_{10} and SO_2 have been expressed in absolute numbers based on the fuel consumption. Subsequently the external costs of these emissions have been calculated. Per vessel model the average fuel consumption per operating hour of the engines has been outlined after which the total number of operating hours of the engines have been expressed. Jointly these figures led to the total emissions of the ferry services. The catamarans and swath vessels turn out to be the most pollutant compared to the other models. These vessel model achieve a higher speed than other ferries for which engines are needed with a higher motorial output. In addition, these ferries travel a longer distance which requires a higher fuel consumption. The total external cost of the emissions is € 10,9 million, of which € 6,1 is caused by the catamarans and swath vessels. These costs are based on the assumption that all ferries use conventional diesel, however there are ferry services that use the cleaner GTL fuel.

Besides GTL, five additional options have been presented to enhance the environmental sustainability. Most of these options are currently feasible. Only the all-electric propulsion still has a number of barriers. The turnaround time of ferry services, especially during rush hour, is too short to sufficiently charge the batteries.

The owners are aware of the fact that they have to improve the sustainability. On one hand because of future legislation, but on the other hand because of their own conscious. Fourteen owners indicate that they are willing to invest or have invested to improve the sustainability. Twelve owners would like to replace the ferry for a new one.

Three recreational ferry services investigate the possibility to operate the ferry fully electric, which will lead to minimal emissions of the researched particles. Four other owners would like to replace their engines which would also lead to a reduction of the emissions.

Financial sustainability could be obtained by looking to additional sources of income. Market development could provide these additional resources. Both for the utilitarian and recreational ferry services less than 50% of the owners engage in market development. Those who does mostly focus on attracting new customers. Reasons not to engage in market development mainly focus on the lack of knowledge and money.

7. Saltwater ferry services

7.1 Introduction saltwater ferry services

In chapter two about the ferry service sector the saltwater ferry services are already briefly discussed. The saltwater ferry services maintain the connection between the Dutch mainland and the Wadden Island and the Western Scheldt. Even though the ferry service between Vlissingen and Breskens crosses salt water this ferry service won't be discussed in this chapter since it is a public transport ferry service. The connection to the Wadden Islands are operated by three different companies: the Koninklijke N.V. Texels Eigen Stoomboot Onderneming (TESO), B.V. Rederij G. Doeksen en Zonen and Koninklijke Wagenborg Passagiersdiensten. TESO operates the connection between Den Helder and Texel. The connections from Harlingen to Vlieland and Terschelling is operated by Doeksen. The last two connections, from Holwerd to Ameland and from Lauwersoog to Schiermonnikoog are operated by Wagenborg.

The connections to Vlieland, Terschelling, Ameland and Schiermonnikoog are owned by the Dutch national government which let them be operated based on an open tender. Every 15 year these connection will be tendered. The current concessions have been awarded by the 18th April 2014 (Rijksoverheid, 2016).The connection to Texel is special since TESO is in the hands of the residents of the island. The islanders are shareholders of the company which implements that they could influence the policy of the company.

The ferry services are offered with car ferries. Additionally there are four express services and one water taxi service. The economic impact of these ferry services will be quantified. The social impact will only be qualified.

7.2 Economic impact

As like the previous mentioned ferry services the economic impact will be expressed by the total number of transferred people, turnover from ticket sales and employment. The presented figures are based on the regular ferry services, which are the five car ferries. Each connection is offered with at least two vessels. Not all ferry services provided the necessary (financial) information. Based on the transferred annual review and an average tariff per person the total turnover is estimated.

Table 7.1: Direct economic impact saltwater ferry services

	Number of ferry connections	Transferred people per year	Turnover (€)	FTE
Wadden ferries	5	5.950.000	61.637.000	309,2

Jointly the saltwater ferry services transfer almost six million people annually. The turnover of ticket sales is € 61,6 million. Compared to the other ferry services the turnover is very high. Adjacent, he exploitation cost are high as well. The saltwater ferry services are being maintained by very large vessels which have to travel longer distances. Subsequently these ferries can transfer a lot of cars, trucks, bicycles and passengers at the same time. As a result both the revenues and costs will increase. At the end of the year all three operators gain a profit. Jointly there is employment for 309,2 FTE.

7.3 Social impact

The ferry services between the mainland and the Wadden Islands are quite unique compared to the other ferry services, since they are (almost) the only connection to the islands. Texel and Ameland have airfields for small aviation, but it's not a common way of transport (Rijksoverheid, 1996).
In previous chapters the social impact of ferry services is expressed by the Willingness to Pay and the Willingness to Accept. However, for these ferry services it isn't possible to value them the same way

since there is no alternative. Therefore, the social impact will only be expressed by qualitative aspects derived from interviews with the operators.

Accessibility
The most important aspect is to keep the islands and the mainland accessible. For almost all islanders the ferry service is the only possible connection with the mainland. When the ferry service, for any reason, would be terminated it means that the islands would be enclosed from the mainland. The Wadden Islands are dependent on the mainland for their supplies of food and other important resources. The termination of the ferry service would highly impair the livelihood of the islanders. When the main land is no longer accessible for the island residents it will affect their personal development as well. Students and commuters find their jobs and school on the mainland. When this wouldn't be accessible the commuters no longer can do their job and lose their income. The students will not be able to attend classes which provide them valuable lessons. That will have an influence on their future income.
The hypothetical termination of the ferry service would also affect the people on the mainland. The Wadden Islands are nice touristic places. Tourist who would like to visit the Wadden Islands could be affected by a termination of the ferry service.

Sustainability
All three operators value environmental sustainability highly. Partly because of future laws and regulations, but when the boat has to be renewed the operators run far ahead of the current laws by their own initiatives. About every 25 year a ferry boat has to be renewed. The new ferry boats will all minimize the energy use and the newest techniques are used to minimize the emissions of harmful particles. The new ferry boat of TESO uses CNG, which is a cleaner fuel, 'green' shore power and solar energy. Doeksen currently builds a new ferry boat that will use LNG. LNG minimize the emissions of particulate matter and NO_x.

Express service/Wadden taxi-service
A regular crossing with the ferry to the island of Vlieland, Terschelling, Ameland and Schiermonnikoog will cost between the 45 minutes and two hours. In addition to the regular ferry service both Doeksen and Wagenborg offer an express service which reduces the travel time. The time reduction is between the 30 and 75 minutes. The reduction of time is an advantage to the users. We have seen in the previous chapters that time is money and people value time differently. Especially commuters and business people gain from the express- and taxi-service

Other aspects
There are more aspects that will benefit the island residents and society as a whole. The tariff structure is different for island resident. Residents get a fair discount compared to the prices that a tourist will have to pay. Resident will use the ferry service more often and the ferry services don't want to overcharge the island residents. The ferry service also provides crossings for wounded and very ill people who can't be treated on the island for free. At last the time schedule is adjusted to the wants of the residents.

7.4 Conclusions

The ferry services that connect the Wadden Islands with the Dutch mainland are operated by three different companies. TESO, the operator of the connection to Texel, is a company that is established by the residents of island. As stakeholder they still influence the policy of the company. The other connection are owned by the Dutch government which are outsourced based on a concession to the companies Doeksen and Wagenborg. Jointly, the saltwater ferry services transfer almost 6 million people per year. The turnover of ticket sale is € 61,6 million and they create employment for 309 FTE.

Table 7.2: Direct economic impact saltwater ferry services

	Number of ferry connections	Transferred people per year	Turnover (€)	FTE
Wadden ferries	5	5.950.000	61.637.000	309,2

The social impact of the saltwater ferry services is not quantified. Based on qualitative aspects the social impact is specified. The most important social aspect is accessibility, since the ferry services are the only logical mean of transport to the mainland. Other social aspects are: a sustainable vessel fleet, the express- and water taxi-service and the satisfy the wants of the islands resident.

8. Developments in the ferry service sector

8.1 Experience

For several years the experience economy is evolving. A glass of wine at the hairdressers, whole experience centers at which customers derive utility from experiencing a product instead of the pure purchase of a product or service. Customers increasingly derive utility from the value additions. The experience is one of those value additions to a product or service (Pine & Gilmore, 2011). The advantage of ferry services is that the experience is already internalized in the service. The ferry service is a moment of relaxation during a trip or a moment of social interaction with fellow users, the ferry man or other people via social media. Therefore customer friendly, enthusiastic personnel should be one of the main priorities of a ferry service. In general the users of ferry service value these aspects on board as sufficient, however there are still opportunities to improve the experience. A change of mindset from pure transporter of people to service provider could already improve the ferry service and its experience.

Contrary to other companies, ferry services don't need to invest in an experience, they already are an experience. Still not all customers and potential customers are aware of that. It is important for the sector to communicate this message.

8.2 (Multi) functionality ferry service

The main function of a ferry service is transporting person X from location A to location B. Some ferry services even fulfill more functions. For instance, the ferry service could be part of an emergency plan or it is used as a work spot for people with a distance to the labor market. Within the entire sector 18 ferry services are part of an emergency plan of which 15 are operated throughout the whole year. The remaining three ferry services connecting small islands which are only open to the public during a couple of months per year. During these opening hours the ferry vessels are part of the emergency plan. The saltwater ferry services are all part of an emergency plan, since they are the only connection with the mainland for most residents. The inclusion of a ferry service in an emergency plan is decreasing. Only 8,5% of all the ferry services is included. In the previous researches only the utilitarian ferry services have been researched. In the current research only 15% of the utilitarian ferry services is included in an emergency plan, in 2004 and 2010 respectively 37,2% and 22,4% were included in an emergency plan. Despite the fact that ferry service could play an important role the decline keeps continuing.

Besides being part of an emergency plan some ferry services offer work places to people with some distance to the labor market. Ferry services are locations with a lot of social interaction where these people could develop themselves in both the social and employment field. Through the learning-work courses these people could re-integrate in society.

8.3 Sustainability

As already described in chapter 6, ferry services are already developing to become a more environmentally sustainable sector. Compared with other forms of transport by water, ferry services are already very sustainable (Den Boer, 2016). Ferry vessels are already replaced by more sustainable vessels that implement the newest techniques. Some recreational ferry services already operate with free floating all-electric ferry vessels, which can be recharged using solar energy or through charging stations ashore. Two utilitarian car ferries are already electrically operated, but that are non-free floating cable ferries.

In Norway there already is a fully electric car ferry in service. This ferry uses three different batteries, two are charged ashore and one on board of the ferry. The batteries are recharged with electricity that is generated from the current of the water. At this moment it is not yet possible to use this

technique since the turnaround times are to short and the batteries can't be used throughout the whole day. For the future it inevitably will be an option which will lead to ferry services with zero emissions.

8.4 Provincial ferry funds

Sustainability is also an important theme for the government. Based on the current operations not all ferry services have the opportunity to renew or renovate the ferry service. The province South Holland established the "Revolverend Verenfonds" in 2016 to give ferry services an opportunity to invest in the ferry services. The 21 utilitarian ferry services can get a loan from the province to improve the ferry service as long as it benefits environmental sustainability (Provincie Zuid-Holland, 2016). Since it is a loan the ferry services are required to refund, which implies that the provincial fund can help all 21 ferry services. South Hollands' ferry fund is the second provincial ferry fund. In 1992, the province of Gelderland already established a ferry fund that could be obtained when ferry services face an operating deficit (Stichting Veren Gelderland, 1995). The ferry services are not required to refund the money they received from the province.

In addition to the establishment of the "Revolverend Verenfonds" in South Holland, the province of North Brabant is investigating the possibilities to create a provincial fund as well. For many years Gelderland has been the only province with a fund for ferry services. The current developments show that more provinces acknowledge the impact of ferry services.

8.5 Guideline small ferry services

Many of the recreational ferry services use small ferry vessels. Most of the small ferries are shorter than 15 meters and no more than 12 passengers are transferred per crossing. However, any legal obligations for the operation of these vessels don't apply (LVP, CBRB & VNG, 2013). After a collision of a small ferry with an inland ship in 2012, the 'Leidraad kleine veren' is compiled by the LVP, CBRB and VNG. The objective of the guideline is to equip the skipper for its task, optimize the construction, stability, equipment and conditions of the ferry and assure the safe execution of the service. The guideline poses recommendations for technical- , nautical, and crew requirements on board of a small ferry. Nowadays many municipalities use the recommendations as minimum requirements, while outsourcing the small ferries. Skippers are obliged to at least have a small boat license. When the ferry services is operated on waterways where the Regulations for Rhine navigation personnel apply the skipper should at least have a large boat license (Rijksoverheid, 2016) (This is not a recommendation, but a law).

8.6 Dependency on inland skippers

Ferry owners report that it's difficult to find sufficient, qualified, skippers for their ferry service. For ferry services where only a small boat license is required the problems are limited. Ferry services where a large boat license is mandatory have a real struggle acquiring sufficient skippers. Most skippers on these ferry services are former inland skippers. The 'big' utilitarian ferry services can offer these skippers an appropriate income, but for the small recreational ferry services it is complicated. Some of the recreational ferry services fully rely on volunteers. The skipper can only get a small refund of € 4,50 per hour and is limited in the amount of hours they are allowed to perform the job. The number of former inland skippers that want to sail a small ferry is getting smaller. Ultimately this will lead to a termination of these ferry services, since they can't afford to pay a regular salary from their current revenues.

8.7 Opportunities and chances for the ferry service sector

As described in chapter four, ferry services all play a very important role in the prevention of vehicle-kilometers and the accompanied consequences as additional noise pollution, traffic injuries and environmental damage. The image of sustainable mean of transport could be improved by continuously becoming more sustainable in which ultimately all ferry service will not be polluting. Chapter 6 discussed the real options to become more sustainable. In Norway there currently is a car ferry which is fully electric operated, which could also be an example for the Dutch ferries. An additional advantage of green transport could be that it attracts potentially new users of the ferry service.

Besides a durable propulsion ferry services could also look at a standardization/harmonization of the ferry vessels or the ferry slip. At the moment every ferry service is using a different ferry which meets the different needs of the individual ferry service. A standardization of some parts of the ferry could already drop the construction costs which will make it easier to renew the ferry. This could both benefit the financial and environmental sustainability.

A third opportunity is caused by the improving Dutch economy. More people have a job and travel by road to get there. The Dutch knowledge institute for mobility (KiM) predicts that road traffic and travel time losses will increasing the coming years (KiM, 2016). Nowadays, ferry services already reduce travel times for many people and the increase in road traffic could be beneficial for ferry services. The same study of the KiM states that the rise of the e-bike makes it more attractive for many people to travel by bike. With an e-bike people can travel longer distances and with a higher speed. Ferry services reduce the distance between two locations located near the river which makes it easier for people to go by bike. All ferry services could benefit from the rise of the e-bike, but people need to be aware of the existence of the ferry service. Therefore, the ferry owners and governmental organizations should promote the use of a ferry service. Despite these chances a couple of ferry owners doesn't try to develop their own market. In most cases there is a lack of resources and/or knowledge, but some owners assume that market development doesn't work. Market development and promotion, from both the ferry service and the government, could lead to a more stable finance base. In addition to a proactive attitude from the sector, there are also factors that ferry services only have limited influence on. A study by a student of the NHTV Breda shows that navigation systems avoid the use of a ferry service. The navigation system assigns an "aggravating factor" to ferry service whereby more travel time is calculated than necessary (Van Raamsdonk, 2015). When actual travel data could be included in navigation systems probably more people will travel by ferry.

The users of ferry services indicate that they would like to have the ability to pay with a debit card. In the Netherlands the use of a debit card is becoming very popular. Even small amounts are payed with a debit card. People assume that they can use a card everywhere (Nederlandse Vereniging van Banken, 2016). On ferry services is it still common to use cash. The possibilities to pay by card are limited, because a stable internet connection is required, which turns out to be a problem. In addition, cash payments are less time consuming compared to using a debit card. When the flaws could be overcome this could be an addition for ferry services, because it reduces the possibility of losing a potential clients who doesn't have cash.

In addition to the practical benefits, like reduction of travel time, ferry services offer an experience. A crossing with a ferry service provides possibilities off peace or social interaction. Even though the ferry travels the same route day in, day out no single crossing is the same. The experience is there for both the users as the ferry man and crew. Ferry services could emphasize the experience more. For the users it will result in additional financial resources, but it could be used to attract new skippers as well. Especially for ferry services that require a skipper with a large boat license. Another

possibility to attract new skippers is by creating a new license especially for ferry services. The current requirements to get a large boat license are very strict. If they could be loosened it could lead to more potential new skippers.

8.8 Conclusion

The ferry service sector represent a significant economic and social impact. This impact could even be bigger. The developments in the sector show that there still are a lot of opportunities and chances for the sector. Chapter six shows that ferry services already try to improve sustainability. Nevertheless, there are still opportunities to create a 'green' image. At the moment there still are some technical and financial gasps that prevent the sector to be fully sustainable. Support from local and provincial governments can ensures that the ferry services have sufficient financial resources to improve. Certainly with the predicted growth of road traffic, ferry services can provide a drastic reduction of travel time and travel expenses. Both the government and the owners should stimulate the use of the ferry services by actively communicating the possibilities of travelling over water.

The experience of a product becomes more important. Especially the recreational ferry services could gain from this development. When they could carry out this message it could both have financial and employment gains. Attracting new people who would like to experience a service will create a financial gain. The experience could also be used to attract new skippers. The sector is largely dependent on former inland skippers, but the pool with new skippers has almost dried. Another possibility to attract new skippers could be the creating of a ferry service license.

9. Conclusions and recommendations

9.1 Introduction

The researches: “Hoe ver is de overkant?” (Oostinjen, 2004) and “Verdiensten van veerdiensten” (Den Hartogh, 2010) show that ferry services have a substantial impact for the Netherlands, both economically and socially. The research of 2004 showed that ferry services have been suffering a significant operating deficit. The update of 2010 showed that the ferry services managed to improve their financial position. The social impact of the ferry services also increased. The aim of this research is to update the most important key figures. In addition to the previous researches the recreational and saltwater ferry services have been studied. The research question is:

"What is the current economic and social impact of the ferry services in the Netherlands, both seasonal as those ferry services who operate all year, and what policies could all the different actors within the sector carry out?"

This chapter will outline the ferry service sector and come up with a vision for the sector for the short and long run.

9.2 The ferry service sector

The Dutch ferry service sector consists of 313 ferry services. This study made a distinction between utilitarian and recreational ferry services. The utilitarian ferry service is a ferry service that operates throughout the whole year and transfers people with all travel motives, but mainly commuters and students. The recreational ferry services only operate a couple of months per year. They focus mainly on people with a recreational/touristic travel motif, but they don’t exclude people with a different travel motif. This research also studied the saltwater ferry services, which are connecting the Wadden Islands with the mainland. In total there are ten different connections to the Wadden Islands over which almost six million people are transferred per year.

The Netherlands has 84 freshwater ‘normal’ ferry services which are operated throughout the whole year. On top of that, there are 10 ferry services which are defined as public transport ferry services. Jointly these 94 ferry services are the utilitarian ferry services. The number of recreational ferry services is set at 113. In addition to these services there are 88 self-service ferries, water taxi services and express services. Which will not be covered in this research.

9.3 Economic and social impact

9.3.1 Economic impact

Chapter four and five describe the impact of both the utilitarian and the recreational ferry services. The economic impact is displayed by the number of transferred people per year, turnover and employment in FTEs.

9.3.1.1 Utilitarian ferry services

The 94 utilitarian ferry services have a direct economic impact with a turnover of € 33,5 million with an employment of 591 FTEs. In total these ferry services transfer 46,2 million people annually. The total key figures have been acquired by using extrapolation. Not all ferry service owners returned the operators survey, which required an embankment. Just like the research of 2004 and 2010 only the direct economic impact is studied. When the indirect economic output of ferry services would be included the impact of the ferry services would, logically, be higher. The table below shows the economic impact of the current research and that of the researches of 2004 and 2010.

Table 9.1: Comparison economic impact utilitarian ferry services

			Population			Transferred people per year (in millions)			Turnover (x million euros)			FTE		
			2015	2009	2004	**2015**	2009	2004	**2015**	2009	2004	**2015**	2009	2004
Charged ferries														
	Normal ferries	Car ferries	50	50	50	22,9	18,7	20	23,2	20,7	16,4	293	311	352
		Bicycle-pedestrian	20	27	17	2,3	2,2	1,6	2,6	1,8	1,3	65	75	54
	PT ferries	Bicycle-pedestrian	10	7	5	2,6	2,9	2,8	7,7	4,9	3,7	121	142	151
Free ferries														
		Car ferries	3	3	3	1,5	1,5	0,9	0	0	0	25	16	16
		Bicycle-pedestrian	11	6	7	16,9	7,1	7,5	0	0	0	87	68	68
Total			**94**	93	82	**46,2**	32,4	32,8	**33,5**	27,4	21,5	**591**	612	641

The research of 2004 (Oostinjen, 2004) showed that a large amount of ferry services suffered an operating deficit. In total the operating deficit was more than € 18 million. The update of 2010 (Den Hartogh, 2010) concluded that the financial position of the ferry service, on average, had improved. The total operating deficit decreased to around € 6 million, of which € 5 million could be accounted for by the public transport ferries. This research showed that the current total operating deficit is equal to € 6,5 million. The PT-ferries are responsible for a deficit of € 4,9 million. The 'normal' ferries have a negative operational result of € 1,6 million, which are mainly caused by the municipal ferry services. Often the municipalities assign additional overhead costs to the ferry service. This creates a distorted picture.

The fact that with fewer FTEs, compared to the previous researches, more people have been transferred, creates a worrisome situation. Despite an improvement in the efficiency of the sector the total operating deficit has not been decreased. Since it is unclear which ferry services have been included in the research of 2010, it is not possible to state whether this deterioration of the situation has actually taken place. The financial position per category ferry service shows that on average all ferry services obtain a positive operational result.

9.3.1.2 Recreational ferry services

The 113 recreational ferry services have a have a turnover of almost € 4 million, after extrapolation. The recreational ferry services are operated by 101,2 FTEs and 842 volunteers. Annually, the ferry services transfer almost 2,2 million people. The recreational ferry service also have an indirect economic impact which will partly be expressed in the social impact.

The analysis on the financial position per ownership structure, transferrable mean of transport and employment, shows that only three categories on average have a positive operating result. Almost half of the ferry services require a subsidy to stay operational. In addition to a subsidy, more often ferry services receive a small contribution from local entrepreneurs. In return the sponsors obtain some advertisement space on board of the ferry.

9.3.2 Social impact

The social impact, outlined in chapter four and five, displays the direct and indirect impact.

9.3.2.1 Utilitarian ferry services

The social impact is obtained by using multiple different methods: Willingness to Accept, the quantification of social aspect and environmental aspects. The Willingness to Accepts outlines the direct social impact. WTA embodies the value that an individual has to be compensated with in order to not use a ferry service anymore. The value of the WTA is expressed by two determinants: additional travel costs and travel time. The indirect social impact is quantified by social- and environmental aspects. In case of a hypothetical termination of the ferry services this will lead to an increase of the total number of vehicle-kilometers since people, in most cases, have to make a detour to get to the same place. The 493,4 million additional vehicle-kilometers will have an impact on the road safety, nuisance and the environment. The addition of vehicle-kilometers will lead to additional traffic injuries, noise pollution and an increase of the emissions of harmful particles which will affect the environment. The social impact will be displayed in table 10.2.

Table 9.2: Social impact of utilitarian ferry services

	Total WTA	Additional traffic injuries	Costs extra traffic injuries (€)	Noise pollution	Environmental damage (€)
Normal ferry services	€ 364 million	153	€ 42.931.800	€ 1,4 million (€1.387.295)	€ 8,9 million (€ 8.921.774)
PT-ferries	€ 21 million	1	€ 280.600	€ 9.141	€ 39.017
Total	**€ 385 million**	**154**	**€ 43 million**	**€ 1,4 million**	**€ 9 million**

The utilitarian ferry services represent a social impact of € 438,6 million. This is an increase in the social impact compared to the previous researches (see table 10.3). The most important reasons of this increase are the increase in the total number of transferred people and an increase in the average additional vehicle-kilometers.

Table 9.3: Comparison social impact utilitarian ferry services

	Year	Total WTA	Additional traffic injuries	Costs extra traffic injuries (€)	Noise pollution	Environmental damage (€)
Normal ferry services	2015	€ 364 million	153	€ 42,9 million	€ 1,4 million	€ 8,9 million
	2009	€ 259 million	102	€ 25,4 million	€ 0,5 million	€ 5,1 million
	2004	€ 231 million	75	€ 18,7 million	€ 0,7 million	€ 3,0 million
PT-ferries	2015	€ 21 million	1	€ 280.600	€ 9.141	€ 39.017
	2009	€ 16,5 million	1	€ 249.482	€ 5729	€ 51.813
	2004	€ 12 million	1	€ 249.482	€ 11.936	€ 49.960
Total	2015	€ 385 million	154	€ 43,2 million	€ 1,4 million	€ 9 million
	2009	€ 275 million	103	€ 25,7 million	€ 0,5 million	€ 5,1 million
	2004	€ 243 million	76	€ 19 million	€ 0,7 million	€ 3,0 million

9.3.2.2 Recreational ferry services

The social value of the recreational ferry services is expressed by the Willingness to Pay, government spending in the form of subsidies and the expenditures of a user which could, partly, be assigned to the existence of the ferry service. The Willingness to pay describes the maximum amount of money a person is willing to spend in order to maintain the service. The social value is displayed by the customer surplus: the WTP reduced by the actual price of a crossing. Subsidy is also a form of social value, since the government is willing to attribute to maintain the service. It benefits a larger goal than just the transfer of recreational users. The added value is partly mapped by assigning a part of the expenditures during a trip to the ferry services.

Table 9.4: Social impact recreational ferry services

	Willingness to Pay (WTP)	Subsidy	Expenses due to ferry service
Recreational ferry services	€ 32,1 million	€ 569.757	€ 12,4 million

9.4 Sustainability

The existence of ferry services prevents a lot of detour kilometers for many people, which saves time and money but also a reduction of the emissions of road traffic. In order to prevent the emissions of road traffic vessels are used which also emits. Actual data on the total emissions of ferry services are not known. Therefore the total emissions of ferry services have been calculated based on the average fuel consumption per operating hour of the engine per vessel model. The average fuel consumption is multiplied with the total number of operating hours of the engines per vessel model. Multiplying the total fuel consumption with emission factors per liter fuel resulted in the total emissions. The external costs of the emissions is set at € 10,9 million. This analysis, however, is based on the assumption that all ferry services use diesel, but some ferry services already use cleaner fuels.

Sustainability is high on the political agenda. Per 2019 or 2020, depending on the motorial output, new shipping engines have to comply to new requirements which mainly reduce the emissions of particulate matter and NOx. To meet the new emission requirements ferry service have six real options: repowering, exhaust after treatment, hybridization, full electric propulsion, contra rotating propellers and GTL.

The preservation of the environment is not only looked at because of forthcoming legislation. Sustainability is also an issue for the ferry owners themselves. There is a distinction between economic and environmental sustainability. Both the utilitarian a recreational show initiatives to make the ferry more sustainable in an environmental way.

9.5 Saltwater ferry services

The ferry services that connect the Wadden Islands with the Dutch mainland are operated by three different companies. TESO, the operator of the connection to Texel, is a company that is established by the residents of island. As stakeholder they still influence the policy of the company. The other connections are owned by the Dutch government which are outsourced based on a concession to the companies Doeksen and Wagenborg. Jointly, the saltwater ferry services transfer almost 6 million people per year. The turnover of ticket sale is € 61,6 million and they create employment for 309 FTE.

Table 9.5: Direct economic impact saltwater ferry services

	Number of ferry connections	Transferred people per year	Turnover (€)	FTE
Wadden ferries	5	5.950.000	61.637.000	309,2

The social impact of the saltwater ferry services is not quantified. Based on qualitative aspects the social impact is specified. The most important social aspect is accessibility, since the ferry services are the only logical mean of transport to the mainland. Other social aspects are: a sustainable vessel fleet, the express- and water taxi-service and satisfying the wants of the islands residents.

9.6 Summary of economic and social impact

Table 9.6: Summary economic impact

Category		Population	Number of transferred people per year	Turnover (€)	FTE
Utilitarian ferry services		**94**	**46,2 million**	**€ 33,5 million**	**591**
•	*Normal ferry service*	*84*	*43,5 million*	*€ 25,8 million*	*470*
•	*PT-Ferry service*	*10*	*2,6 million*	*€ 7,7 million*	*121*
Recreational ferry services		**113**	**2,2 million**	**€ 4 million**	**101 FTE + 842 volunteers**
Saltwater ferries		**5**	**6 million**	**€ 61,6 million**	**309 FTE**

Table 9.7: Summary social importance

Social benefits of ferry services							
Category		**Total WTA**	**Additional traffic injuries**	**Costs extra traffic injuries (€)**	**Noise pollution**	**Environmental damage (€)**	**Total**
Utilitarian ferry services		**€ 385 million**	154	€ 43 million	€ 1,4 million	€ 9 million	**€ 438,6 million**
•	*Normal ferry services*	*€ 364 million*	*153*	*€ 42.931.800*	*€ 1,4 million (€1.387.295)*	*€ 8,9 million (€ 8.921.774)*	*€ 417,3 million*
•	*PT ferry services*	*€ 21 million*	*1*	*€ 280.600*	*€ 9.141*	*€ 39.017*	*€ 21,3 million*
		Willingness to Pay	**Subsidy**	**Expenses due to ferry service**			**Total**
Recreational ferry services		€ 32,1 million	€ 569.757	€ 12,4 million			**€ 45,1 million**
Social costs of ferry services							
Category		**Environmental damage (€)**					**Total**
Utilitarian ferry services		€ 10,9 million					**€ 10,9 million**

9.7 Sector recommendations

Large parts of this research have a common subject: sustainability. As is discussed in this research there are two kinds of sustainability: financial and environmental. The sector could capitalize on future laws and legislation and has a clear view on developments to reduce emissions. Investing in sustainable technologies could lead to an improved image of the sector. When the sector could profile themselves as durable, environmental transporter it could create gains for the economic and social impact.

The government could also pay more attention to durability on policy level. The financial situation of ferry services is still not very stable which creates problems with gaining loans. The province of South Holland already gave an example on how the government could help the sector to become more sustainable. The ferry services have a significant impact for the Netherlands, but only two provinces has a long term policy on ferry services. A durable policy, which can be used by all ferry services with a significant impact is advised.

In recent years the economic situation of the Netherlands has improved. More and more people have a job, which led to an increase of road traffic. As a result, many roads are congested during rush hours. Since ferry services can reduce travel time and travel cost it is advised that ferry owners should draw attention to potential users. In addition, ferry services offer an experience in which peace and social interaction could be major factor. The experience economy is becoming more important in society. Ferry services should find a way to capitalize the experience since the experience is already implemented in the service.

9.8 Recommendation for future research

Ferry services still have to deal with operating deficits. Since not all ferry services are included in the sample a complete picture is missing. It would be desirable in a next research to be able to assess the complete sector. In the research of Oostinjen there was a response of almost 100% which gave an overall overview without making assumptions. Therefor it could be desirable to focus on different categories individually which could improve the response of the researches. Despite that the response wasn't 100% in this research the statements made are reliable.
In the current research the social importance of the PT-ferries is based on the characteristics of the research of 2004. Although the characteristics of the current users didn't seem to have significant differences it would be advised to take a closer look at the public transport ferry services.
A third recommendation is to quantify the social impact of the saltwater ferry services. Since the objective is to qualify and quantify the impact of the whole sector it is advised to implement a method to quantify the saltwater ferries.

9.9 Reflection on research

The two previous researches already created a clear theoretical framework in which a major part of the research has taken place (Oostinjen, 2004; Den Hartogh, 2010). The current research however, has a deepening by accompanying the recreational ferry services. In contrast, the recreational ferries mostly have a touristic character, which needed a much different approach. It was the hard to find an accurate balance between the recreational and utilitarian ferry services within the theoretical framework, since some parts overlapped and others didn't really.

For the utilitarian ferry service the method was already there, for both the economic and social impact. Despite the fact that the methods were defined already attempts have been made to refine the method. The operators survey has been send via email and the ferry owners had the opportunity to fill out the

survey for more than one ferry service at the time. The adjustment was made to enhance the response, but in reality still not every owner wanted to participate and it created problems to process the acquired information. Additional correspondence with the ferry owner was required to get a decent overview of the supplied information which sometimes wasn't obtained. Even though it was nice to speak to so many actors in the sector I would have asked to fill out the survey on individual level, if I had the opportunity. The response of the user survey was less than hoped for. The survey was spread over social media and the ferry services was asked to promote the users to conduct the survey, this didn't result in huge amounts of respondent. Conducting a survey on board of a ferry was still very successful, but time consuming. In comparison to the previous researches other ferry services have been used to conduct surveys on. Because of a decent distribution over different types of ferry services throughout the whole country no flaws in the results are expected.

To the recreational ferry services the same operators survey has been send. The users with a recreational/touristic travel motive did get a slightly different survey than the other users. While processing the conducted surveys this sometimes led to problems, but these problems could easily be overcome.

The research contained the utilitarian, recreational and saltwater ferry services which is a wide spectrum of the whole sector. This led to confusion on some occasions. From the start there was a delay compared to the planning. At first there wasn't a good reaction to this situation but with the help of my supervisor at CBRB and the support group this problem has been tackled. The guidance led to a shortage of the delayed time. Another factor that led to a delay of the research is the timing. The project started during the summer break, which resulted in a longer response time of the operators. The operators were also necessary to request a visit at the ferry service to conduct the user survey. Both surveys are key in the whole research, because the main results are based on the outcomes of the surveys.

Obtaining the required number of surveys was the most time consuming activity. Processing the surveys was relatively easy but a precise work. This sometimes les to a miscalculation which also had effects on other calculations. These problems have easily been overcome.

The last point in this reflection will be the cooperation with a support group. The research is supervised at CBRB, but accompanied with a support group of two branch organization: LVP and VEEON. The advantage of a support group is that they could be used as a soundboard. Jointly these people have large amount of knowledge of the sector. The disadvantage of a support group is to communicate with a huge amount of people. At certain points during the research a meeting with the support group was necessary to discuss the process, but it is hard to organize a meeting with ten people. In addition sometimes information was needed from the support group, but these people all have a full time job which makes it hard to get a quick response. Nevertheless the support group were of great support during the research which also led to the research as it is now.

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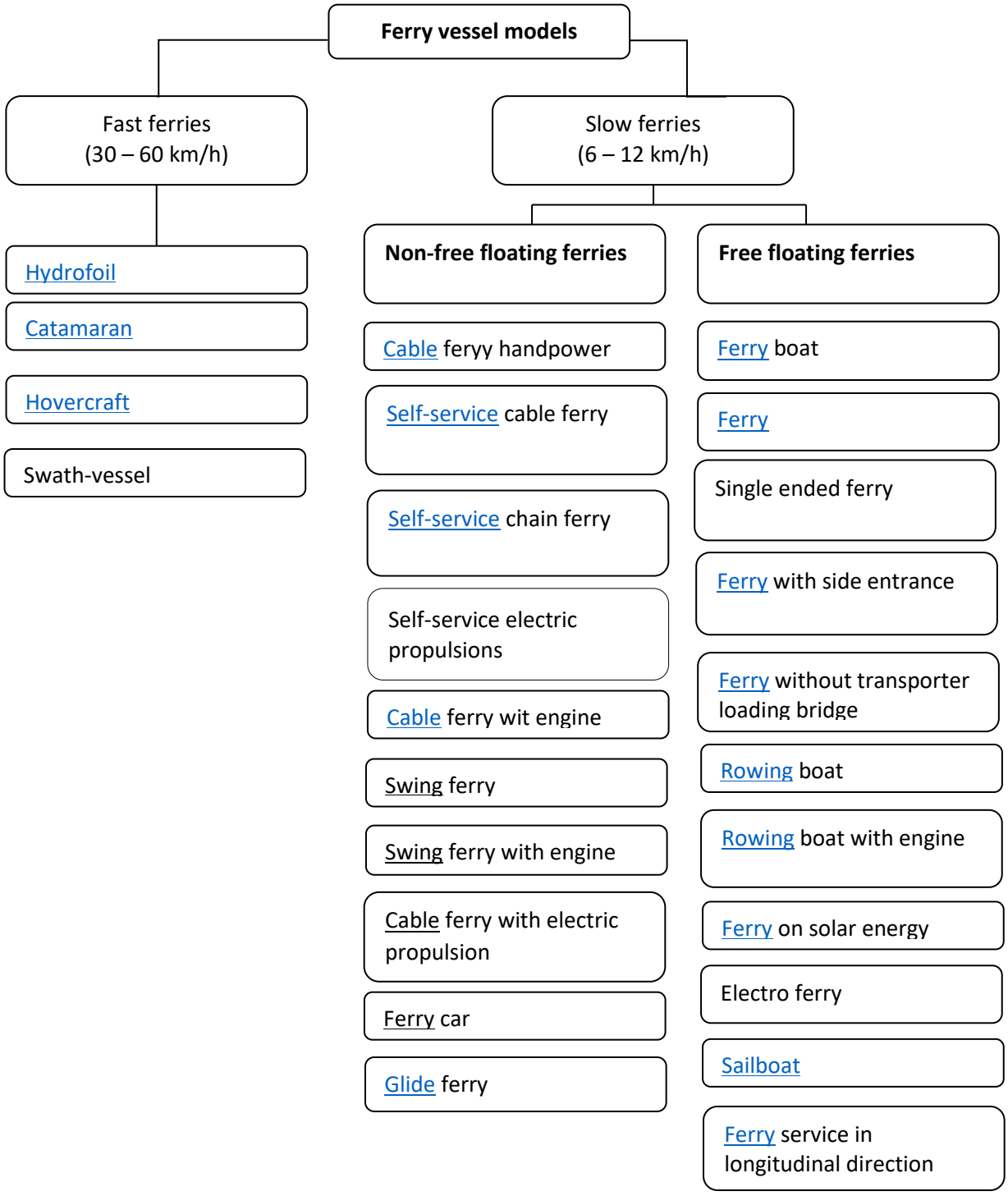
Annex 1: Overview vessel models



Short description of the ferry vessels

De beschrijvingen van de veerponten zijn afkomstig van de Vereniging van de Voetveren (Vrienden van de Voetveren, 2016)

Fast ferry:

Hydrofoil: Een draagvleugelboot is een snel varend aluminium vaartuig dat zich bij het bereiken van een bepaalde snelheid uit het water verheft en dan gedragen wordt door twee, onder het vaartuig aangebrachte, roestvrijstalen vleugels: een grotere aan de voorzijde en een kleinere aan de achterzijde. Dit type vaartuig kan een snelheid bereiken van 50 – 55 km/h, en wordt aangedreven door een krachtige dieselmotor. Dit model wordt momenteel in Nederland niet gebruikt.

Catamaran: Een catamaran is een snel vaartuig gebouwd op twee evenwijdige rompen met een dwarsverbinding waarop de passagiersaccommodatie en het stuurhuis zijn geplaatst. De krachtige motoren, die opgesteld staan in de rompen onder het vaartuig, zorgen ervoor dat de schepen een snelheid zou kunnen behalen van zo'n 60 km/h.

Swath-vessel: Een Swath-vaartuig, voluit Small Waterplane Area Twin Hull, is een speciaal snel vaartuig om groot water te bevaren zonder dat de passagiers last ondervinden van hinderlijke golfbewegingen en deining. Het vaartuig wordt computer gestuurd en stelt zichzelf in om onnodige bewegingen te voorkomen. Een swath-vaartuig is te vergelijken met een catamaran, echter verschillen de drijvers van elkaar. Onder water zijn de drijvers breder, maar bij het wateroppervlakte is de breedte teruggebracht tot een minimum waardoor golfslag slechts beperkt invloed heeft op het schip. Tijdens de overtocht wordt met ongeveer 30 km/h gevaren.

Hovercraft: Een hovercraft is een luchtkussenvoertuig waarbij lucht onder druk wordt geblazen in een ruimte die wordt afgesloten door rubber flappen. De luchtdruk zorgt voor een opwaartse druk waardoor het vaartuig omhoog geblazen wordt. Met behulp van propellers beweegt het vaartuig zich voort. Dit model wordt momenteel in Nederland niet gebruikt.

Slow non-free floating ferries:

Cable ferry with handpower: zie paragraaf 7.2

Self-service cable ferry: zie paragraaf 7.2

Self-service chain ferry: zie paragraaf 7.2

Self-service ferry with electric propulsion: zie paragraaf 7.2

Cableferry with engine: Dit model veerpont vaart tussen een geleiding van één of twee staalkabels die tussen twee oevers gespannen zijn. De aandrijving vindt plaats door middel van een verbrandingsmotor aan boord van de veerpont die een schroef aandrijft. Vanuit het stuurhuis vindt de bediening van de motor en de op- en afrijkleppen plaats.

Swing ferry: Een gierpont maakt gebruik van de stroming van een rivier. Stroomopwaarts ligt een anker met een staalkabel die verbonden is met de gierpont. Om de kabel vrij te houden van de bodem van de rivier wordt de kabel gedragen door een gierbootje. Door de kabel, die in een driehoeksverbinding aan de veerpont verbonden is, aan één zijde in te korten zal de pont zich 'vanzelf' naar de andere oever

brengen. Wanneer de pont naar de overzijde moet wordt de andere zijde ingekort. Dit model wordt momenteel in Nederland niet gebruikt.

Swing ferry with engine: Het principe van de gierpont met motor is gelijk aan die van de gierpont. Echter is dit type sneller aangezien de voorstuwing nu gedaan wordt door een verbrandingsmotor in plaats van de stroming. De gierpont wijkt niet van zijn route af aangezien de pont verbonden is aan kabels. De bediening van de motor en de op- en afrijkleppen vindt plaats vanuit het stuurhuis.

Chainferry with electric propulsion: De elektrisch aangedreven kabelveerpont wordt het merendeel van de tijd gebruikt op vaarwegen met weinig scheepvaartverkeer. Om de overtocht mogelijk te maken moet de, meestal doorlopende, kabel tussen de twee oever gespannen zijn. Het elektrische aandrijvingsmechanisme staat op één van de twee oevers opgesteld.

Ferry car: De veerwagen bestaat uit een platform boven water waarop passagiers, inclusief vervoersmiddel, vervoerd kunnen worden. Het platform staat op vier stalen poten die voorzien zijn van veerpont kopadingwielen met flensen die over een rails lopen. De voorstuwing vindt plaats met een verbrandingsmotor en kettingoverbrenging. Dit model wordt momenteel in Nederland niet gebruikt.

Glide ferry: De zweefveer is een platform, hangend aan stalen kabels onder een hoge brug, dat gebruikt werd door langzaam en zwaar landbouwverkeer. Op deze manier hoefde zij de hoge en vaak steile hellingen van een verkeersbrug niet te gebruiken. Dit model wordt momenteel in Nederland niet gebruikt.

Slow free floating ferries:
Ferry boat: De motorveerboot is een model schip dat uitsluitend gebruikt wordt als fiets-voetveer of voetveer. De motorveerboot wordt doorgaans aangedreven door een dieselmotor. Het in- en uitstappen gebeurt aan de stuur- of bakboordzijde.

Ferry: Een motorveerpont is een vrijvarend plat vaartuig dat voortbewogen wordt door één of meerdere verbrandingsmotoren. De aandrijving gebeurt door schroeven, Voith Schneider propellers of roerpropellers. De veerponten zijn voorzien van één of twee laadkleppen aan de voor- en/of achterzijde van het vaartuig, zodat voertuigen eenvoudig aan en van boord kunnen rijden. De bediening gebeurt vanuit een hoger geplaatst stuurhuis, ter hoogte van het midden van de pont.

Single ended ferry: Deze veelal kleinere veerpont wordt ingezet voor het overzetten van enkele voertuigen, passagiers, fietsers, scooters en brommers. Het laden en lossen vindt plaats aan de voorzijde van de pont. De besturing vindt plaats vanuit een verhoogd stuurhuis aan de achterzijde van de veerpont. Ten opzichte van de motorveerpont is deze pont wendbaarder. Immers moet het vaartuig steeds gedraaid worden om aan te kunnen leggen aan de andere oever.

Ferry with side entrance: In tegenstelling tot de motorveerpont en motorveerpont met koplading bevinden de op- en afrijvoorzieningen zich aan de stuur- of bakboordzijde. De bediening van de pont is vanuit een verhoogd stuurhuis aan de voor- of achterkant. Dit model wordt momenteel in Nederland niet gebruikt.

Ferry without transporter loading bridge: Deze veerponten zijn doorgaans zeer grote autoveren. In tegenstelling tot de andere ponten zijn de laadkleppen aanwezig aan de wal in plaats van aan boord. Aan wal bevinden zich lange beweegbare bruggen met kleppen om de tijverschillen op te vangen.

Rowing boat: Een houten of stalen roeiboot wordt door een veerman voortbewogen met behulp van twee roeiriemen. Dit model wordt momenteel in Nederland niet gebruikt.

Rowing boat with engine: Een meestal stalen roeiboot die uitgerust is met een verbrandings-buitenboordmotor om voetgangers en fietsers over te zetten.

Ferry on solar engery: Een veerpont die wordt voortbewogen door één of twee kleine elektromotoren die gevoed worden door zonnepanelen. Aan boord bevinden zich accu's waarin de energie tijdelijk opgeslagen kan worden, daarnaast kunnen de veren ook bijgeladen worden door aansluiting op het bestaande lichtnet.

Electro ferry: Een vaartuig dat is uitgerust met een grote hoeveelheid accu's die energie leveren voor de meestal twee aan boord geïnstalleerde elektromotoren.

Sailboat: Een zeilboot wordt voortbewogen door de wind. De kracht van de wind wordt opgevangen door het zeil van het schip waardoor hij wordt voortbewogen. Over het algemeen gezien is er een motor aanwezig om bij windstilte of tegenwind voortgestuwd te worden.

Ferry service in longitudinal direction: Een veerdienst in de lengterichting is een dienst die in tegenstelling tot de overige veren vaart in de lengterichting van een rivier of kanaal, waarbij vaak meerdere haltes aangedaan worden op basis van een vaste dienstregeling.

Annex 2: Operators' survey

Aanbiedersenquête

Algemene informatie

1) Wie vult deze enquête in:
   Contactpersoon:
   Organisatie/bedrijfsnaam:
   Functie:
   Emailadres:
   Telefoonnummer:
   Website:

2) Wie is de eigenaar van de veerdienst:

3) Wie is de exploitant van de veerdienst:

4) Hoeveel veerdiensten worden er onderhouden (M.a.w. hoeveel lijnen exploiteert u):
   - ☐ 1 veerdienst
   - ☐ t/m 4 veerdiensten
   - ☐ t/m 8 veerdiensten
   - ☐ t/m 12 veerdiensten

5) Waar vaart de veerdienst:
   Welke rivier, vaart, kanaal :

   Herkomst:

   Bestemming:

   Eventueel tussenstop:

6) Met wat voor type vaartuig(en) vaart u:
   - ☐ Motorveerboot
   - ☐ Motorveerpont (vrijvarend)
   - ☐ Motorveerpont met koplading
   - ☐ Kabelveerpont
   - ☐ Kabelveerpont met handkracht
   - ☐ Kabelveerpont met zelfbediening
   - ☐ Gierpont met motor
   - ☐ Roeiboot
   - ☐ Roeiboot met buitenboordmotor
   - ☐ Elektroveerboot
   - ☐ Zonneveerpont
   - ☐ Swath vaartuig
   - ☐ Catamaran
   - ☐ Anders:

7) Met hoeveel vaartuigen onderhoudt u de veerdienst:

8) Wat is het bouwjaar van uw vaartuigen:

9) Voldoet uw veerpont aan de huidige veiligheids- en milieueisen:
   - ☐ Ja
   - ☐ Nee

   Opmerkingen:

10) Onder welke categorie zou u uw veerdienst plaatsen:
   - ☐ Autoveer
   - ☐ Fiets-voetveer
   - ☐ Voetveer

Vaartijden en passagiers

11) Wat is de vaarperiode van uw veerdienst:
   - ☐ Het gehele jaar
   - ☐ Bijna het gehele jaar, uitzonderingen zijn de volgende dagen:

   - ☐ Aantal maanden per jaar, van/tot:

12) Wat zijn de vaartijden van uw veerdienst:

	Van (tijdstip)	Tot (tijdstip)
Maandag – vrijdag		
Zaterdag		
Zon- en feestdagen		

13) Wat is de afvaart frequentie van uw veerdienst (hoe vaak vaart u heen en weer):

   Aantal keer per uur:

   Aantal keer per uur tijdens de spits:

   Aantal keer per dag:

14) Hoeveel personen zet u, in totaal, per jaar over (indien u dit niet precies weet kunt u een schatting geven) :

15) Wat voor soort vervoersbewijzen verkoopt u:

- ☐ Enkele reis
- ☐ Retour
- ☐ Rittenkaart
- ☐ Abonnement
- ☐ Geen (gratis veerdienst)
- ☐ Anders:

16) Welke betaalmethoden kunnen passagiers gebruiken op uw veer:

- ☐ Contant
- ☐ Pin / creditcard
- ☐ OV-chipkaart
- ☐ Studenten-ov
- ☐ Betaal app
- ☐ 65+ / museumjaarkaart korting
- ☐ Abonnenment (automatisch opladen)
- ☐ Anders:

17) Kunt u een schatting geven van de verdeling van de reizigers over de vervoersmodaliteiten:

Personenauto / Personenbusje	%
Vrachtauto	%
Lijnbus (OV bus)	%
Motor	%
Brommer / scooter	%
Fiets	%
Te voet	%
Rolstoelgebruikers	%

18) Kunt u een schatting geven van de procentuele verdeling van het reismotief van de passagiers van uw veerdienst:

Woon-werk verkeer	%
Beroepsverkeer	%
Scholieren	%
Sociaal	%
Recreatief/toeristisch	%

19) Heeft de veerdienst nog een andere functie: (meerdere antwoorden mogelijk)

- ☐ Economische functie (andere bedrijven zijn afhankelijk van de veerdienst)
- ☐ Het veer is onderdeel van een calamiteitenplan
- ☐ Het veer heeft cultuur-historische waarde
- ☐ Het veer is onderdeel van een gevaarlijke stoffen route
- ☐ Anders:

Economische aspecten

20) Hoeveel personen zijn er in dienst bij de veerdienst (varend en kantoor personeel):
Aantal fte:

Aantal werkzame personen:

21) Zijn de exploitatiekosten (loonkosten, onderhoudskosten, afschrijvingskosten etc) van uw veerdienst hoger, gelijk of lager dan uw omzet:
- ☐ Hoger
- ☐ Gelijk
- ☐ Lager

22) Kunt u een schatting geven, in procenten, hoeveel uw exploitatiekosten hoger/lager zijn:
- ☐ 0 – 5 %
- ☐ 5 – 10 %
- ☐ 10 – 15 %
- ☐ 15 – 20 %
- ☐ 20 – 25 %
- ☐ 25 – 30 %
- ☐ Hoger dan 30 %
- ☐ Exact, namelijk %

23) Wat is de vervangingswaarde van uw vaartuig(en) en de veerstoep(en)
Vaartuig €
Toelichting:

Veerstoep €
Toelichting:

24) Wat is de omzet van de veerdienst per jaar:
Opbrengst kaartverkoop: €

Subsidie €

Overig (fondsen, donaties) €

Totaal €

25) Kunt u aangeven wat voor subsidie u ontvangt:
- ☐ Suppletie op basis van behaalde opbrengsten / aantal overgezette reizigers
- ☐ Afdekking van het exploitatietekort
- ☐ Vaste subsidiebijdrage op basis van aanbodcriteria
- ☐ Eenmalige investeringssubsidie

- ☐ Geen subsidie ontvangen
- ☐ Anders:

26) Op basis van welke wettelijke regeling ontvangt u subsidie:

27) Kunt u de samenstelling van de subsidie aangeven en aangeven vanuit welke overheidsorganen dit afkomstig is:

	Bedrag in €:	Ontvangen van:
Optie 1		
Optie 2		
Optie 3		
Optie 4		

28) Valt uw veerdienst onder een van de volgende wetten:

- ☐ Verenwet
- ☐ Wet Openbaar Vervoer
- ☐ Wet Personenvervoer
- ☐ Geen
- ☐ Anders, namelijk:

Duurzaamheid

29) Staan er grote investeringen op de planning:

- ☐ Ja
- ☐ Nee (ga door naar vraag 33)

30) Zo ja, welke?

31) Is er financiële ruimte voor het doen van deze investeringen:

- ☐ Ja (ga door naar vraag 33)
- ☐ Nee

32) Waarom is er geen ruimte voor het doen van de investering(en)?

33) In hoeverre houdt u zich bezig met de duurzaamheid van de veerdienst? (meerdere opties mogelijk)
   - ☐ In het geheel niet (ga door naar volgende sectie)
   - ☐ Ja, vanuit eigen beweging (ga door naar 34)
   - ☐ Ja, vanwege toekomstige wet- en regelgeving (ga door naar 35)
   - ☐ Anders, namelijk:

34) Welke initiatieven heeft u doorgevoerd/worden binnen korte tijd doorgevoerd m.b.t. duurzaamheid van de veerdienst? Kunt u aangeven wat uw drijfveren zijn voor deze initiatieven?

35) Heeft dit invloed op uw bedrijfsvoering:
   - ☐ Ja
   - ☐ Nee

36) Zo ja, kunt u aangeven in welke mate dit uw bedrijfsvoering beïnvloedt?

Opmerkingen met betrekking tot de duurzaamheid van de veerdienst

Marktontwikkeling

37) Doet u aan marktontwikkeling
   - ☐ Ja (ga door naar 39)
   - ☐ Nee

38) Waarom niet? (ga door naar volgende sectie)

39) Op welke manier houdt u zich bezig met de ontwikkeling van de markt:
- ☐ Aantrekken nieuwe reizigersdoelgroepen
- ☐ Veerdiensten aanbieden op een nieuwe locatie
- ☐ Verkopen van nieuwe producten op de huidige veerverbindingen
- ☐ Verkopen van nieuwe producten in aanvulling op de huidige veerverbinding
- ☐ Nieuw product op een nieuwe markt

40) Licht uw antwoord eventueel toe:

Afsluiting

41) Heeft u naar aanleiding van deze enquête nog opmerkingen of vragen dan kut u deze hier kwijt:

Annex 3: User survey

Algemene gegevens

1) Locatie en tijd
   Veerdienst (tussen welke te plaatsen) :

   Datum :

   Weersomstandigheden :

   Leeftijd :

2) Wat is het vertrekpunt van uw reis: (waar bent u uw eigen reis begonnen)
   Locatie :

   Postcode :

3) Wat is de bestemming van uw reis:
   Locatie :

   Postcode :

4) Hoe vaak maakt u gebruik van deze veerverbinding:
   - ☐ Eén keer per dag
   - ☐ Meer dan één keer per dag
   - ☐ Een paar keer per week
   - ☐ Een paar keer per maand
   - ☐ Een paar keer per jaar
   - ☐ Dit is de eerste keer

5) Op welk(e) tijdstip(pen) maakt u meestal gebruik van deze veerverbinding?
   - ☐ 's Ochtends
   - ☐ 's Middags
   - ☐ Namiddag
   - ☐ 's Avonds

6) Wat is het reismotief van uw reis:
   - ☐ Woon-werk verkeer (ga door naar de sectie utilitair gebruik)
   - ☐ School (ga door naar de sectie utilitair gebruik)
   - ☐ Sociaal (ga door naar de sectie utilitair gebruik)
   - ☐ Beroepsverkeer (ga door naar de sectie utilitair gebruik)
   - ☐ Recreatief (ga door naar de sectie recreatief gebruik)
   - ☐ Toeristisch (ga door naar de sectie recreatief gebruik)

Utilitair gebruik

7) Van welke vervoersmodaliteit maakt u gebruik:

- ☐ Personenauto/ personenbusje
- ☐ Bestelauto
- ☐ Vrachtauto
- ☐ Lijnbus (OV bus)
- ☐ Motor
- ☐ Brommer / scooter
- ☐ Fiets
- ☐ Te voet
- ☐ Rolstoel
- ☐ Anders, nl:

8) Maakt u doorgaans gebruik van deze vervoerswijze:

- ☐ Ja (ga door naar vraag 10
- ☐ Nee

9) Van welke vervoersmodaliteit maakt u 'normaal gesproken' gebruik:

- ☐ Personenauto/ personenbusje
- ☐ Bestelauto
- ☐ Vrachtauto
- ☐ Lijnbus (OV bus)
- ☐ Motor
- ☐ Brommer / scooter
- ☐ Fiets
- ☐ Te voet
- ☐ Rolstoel
- ☐ Een andere veerverbinding
- ☐ Anders, nl:

10) Met hoeveel mensen maakt u de overtocht: (m.a.w. het aantal personen met wie u persoonlijk reist)

11) Hoe zou u de reis gemaakt hebben wanneer deze veerverbinding niet zou bestaan:

- ☐ Omrijden over de dichtstbijzijnde brug/tunnel met de fiets
- ☐ Omrijden over de dichtstbijzijnde brug/tunnel met de auto of ander gemotoriseerd vervoer
- ☐ Openbaar Vervoer
- ☐ Via een andere veerverbinding
- ☐ Ik zou de reis niet maken
- ☐ Anders, namelijk:

12) Hoeveel kilometer zou u om moeten rijden indien er geen veerdienst zou zijn:

- ☐ 0 – 5 km
- ☐ 5 – 10 km
- ☐ 10 – 20 km
- ☐ Meer dan 20 km
- ☐ Weet ik niet
- ☐ Exact, namelijk : km

13) Kunt u een schatting geven van de tijd die dit u extra zou kosten:

Ga door naar de sectie De Veerdienst

Recreatief gebruik

14) Van welke vervoersmodaliteit maakt u gebruik:

- ☐ Personenauto/ personenbusje
- ☐ Bestelauto
- ☐ Vrachtauto
- ☐ Lijnbus (OV bus)
- ☐ Motor
- ☐ Brommer / scooter
- ☐ Fiets
- ☐ Te voet
- ☐ Rolstoel
- ☐ Anders, nl:

15) Zou u de reis gemaakt hebben wanneer deze verbinding er niet zou zijn:

- ☐ Ja
- ☐ Nee

16) Hoeveel heeft u betaald om gebruik te maken van de veerdienst
€

17) Hoeveel bent u maximaal bereid te betalen om gebruik te maken van deze veerdienst:
€

18) Wat is voor u de belangrijkste reden om gebruik te maken van de veerdienst:

19) Hoeveel geld denkt u ongeveer te gaan besteden/ heeft u besteed tijdens uw trip (indien u dit niet weet kunt u een schatting geven) Dit bedrag is exclusief het gebruik van het veer, maar inclusief eventuele overnachting, drankjes op een terras, bestedingen tijdens winkelen etc.
€

20) Hoeveel invloed heeft de aanwezigheid van de veerdienst op uw keuze voor deze trip:

- ☐ Veel invloed
- ☐ Gemiddelde invloed
- ☐ Weinig invloed
- ☐ Geen invloed

De Veerdienst

21) Kunt u aangeven wat voor u de belangrijkste vorm van hinder zou kunnen zijn als de veerdienst er niet zou zijn geweest:

- ☐ Extra reistijd
- ☐ Extra reiskosten
- ☐ Toename van de verkeersonveiligheid
- ☐ Omzetverlies
- ☐ Ongemak
- ☐ Anders:

22) Op welke manier wist u af van de aanwezigheid van de veerdienst:

- ☐ Ik ben woonachting in de oevergemeente
- ☐ Bewegwijzering
- ☐ Internet
- ☐ Overzetveren app (mobiel)
- ☐ Folders
- ☐ Via kennissen en/of vrienden
- ☐ Via een reizigersorganisatie
- ☐ De VVV
- ☐ Anders:

23) Kunt u een oordeel geven over enkele aspecten van deze veerdienst:
1= Zeer positief, 2= Positief, 3= Niet positief, niet negatief, 4=Negatief, 5= Zeer negatief

	1	2	3	4	5
Het aantal afvaarten per uur van de veerverbinding	☐	☐	☐	☐	☐
Vaartijden van de veerverbinding	☐	☐	☐	☐	☐
Bereikbaarheid van het veer	☐	☐	☐	☐	☐
Informatievoorziening van het veer (bewegwijzering en vaartijden)	☐	☐	☐	☐	☐
Voorzieningen aan de wal (vb. wachtruimte)	☐	☐	☐	☐	☐
Voorzieningen aan boord (vb. zitplaatsen)	☐	☐	☐	☐	☐
Het aantal betaalmethode(n) aan boord van het veer	☐	☐	☐	☐	☐

24) Heeft u nog op- of aanmerkingen over deze veerdienst of veerdiensten in het algemeen:

Annex 4: Chi-square test

Bij de bepaling van het maatschappelijk belang van de veerdiensten is gebruik gemaakt van de gebruikersenquête. In het onderzoek is getracht de enquêtes zo eerlijk mogelijk te verdelen tussen werkdagen en weekenddagen. Dit vloeit voort uit de aanname dat een gelijke spreiding van het aantal afgenomen enquêtes over de week plaatsvind. Daar wordt mee bedoeld dat van iedere zeven enquêtes die zijn afgenomen er twee in het weekend afgenomen zijn. Om te toetsen of dit daadwerkelijk het geval is, is gebruik gemaakt van de Pearson Chi-square toets.

De Pearson Chi-square toets is een onafhankelijkheidstoets waarbij gekeken wordt of de steekproef en de waarnemingen onafhankelijk hebben plaatsgevonden. Aan de hand van twee hypotheses, H0 en H1, wordt getoetst of er al dan niet samenhang is tussen de werkelijke en de verwachte uitkomsten in de steekproef. De nulhypothese (H0) stelt dat de samenhang tussen de gemeten en de verwachte waarden ontbreekt, terwijl de twee hypothese (H1) stelt dat deze samenhang weldegelijk aanwezig is. Om de kans op een foute conclusie zo klein mogelijke te houden wordt gebruik gemaakt van een significantieniveau. Dit significantieniveau (α) is vastgesteld op 5%. Wanneer de waarde, p-value, van de van de Chi-square toets lager is dan het significantieniveau dan zal de nulhypothese worden verworpen. Dit geeft aan dat sprake is van samenhang tussen de gemeten en de verwachte uitkomsten. Wanneer dit het geval is zal een wegingsfactor toegepast dienen te worden. Wanneer de p-value hoger is dan het significantieniveau dan is er geen samenhang tussen het uitkomsten en wordt de nulhypothese aangenomen. Een opsomming van het significantieniveau en de hypotheses weergegeven.

$\alpha = 0{,}05$
H_0 = De waardes zijn onafhankelijk. De geobserveerde en verwachte uitkomsten zijn gelijk
H_1 = De waardes zijn afhankelijk. De geobserveerde en verwachte uitkomsten zijn niet gelijk

De verwachte waarde van het aantal enquêtes dat is afgenomen op een doordeweekse dag is gelijk aan 71,43% van het totaal (5/7). Dat betekent automatisch dat de verwachte waarde van de afgenomen enquêtes in het weekend gelijk moet zijn aan 28,57% van het totaal (2/5). De output van de Chi-square toets zijn opgenomen in onderstaande tabel, waarbij ook de geobserveerde en verwachte waardes zijn opgenomen.

	Observed	Expected
Doordeweeks	875	832,1429
Weekend	290	332,8571
Chi-square	7.725	
Degrees of freedom	1	
P-value	0,005445	

Uit de toets blijkt dat de *p-value* lager is dan het significantieniveau van 0,05. De nulhypothese wordt verworpen wat betekent dat een significant verschil aanwezig is tussen de geobserveerde en verwachte waarde. De enquêtes die doordeweeks zijn afgenomen zijn over gerepresenteerd in de steekproef wat leidt tot een wegingsfactor voor deze enquêtes gelijk aan 0,83[1].

[1] ((290/2)*5)/875

Annex 5: Results user survey

De onderstaande resultaten hebben betrekking op de **gehele** steekproef

Reismotief inclusief procentuele spreiding over de week