Bachelor Thesis Erasmus School of Economics

The Economic Feasibility Study of the Transition Hub

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Abstract

The Transition Hub is a new concept from Van der Wijngaart's Engineering Services. This study discusses the economic feasibility of the Transition Hub by means of a comprehensive financial analysis, identifying and estimating both the essential cost and revenue components for this project. The results suggest that although the Payback Period might be somewhat controversial at 7.9 years, the positive Internal Rate of Return of 13% and the positive Net Present Value of €2,986,336.43 show that the Transition Hub qualifies as economically feasible, responsible and promising. Generating sufficient, steady revenues but also lower construction prices and a quick and cheap loan reimbursement are key success factors for implementing the Transition Hub successfully in Rotterdam.

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1. Introduction

Nowadays, the parking situation in most metropolitan cities is becoming a source of frustration for daily travellers by car. Especially during rush hours, one can experience a substantial part of the whole trip searching for a parking space in congested urban areas. One study claims that over half the cars driving downtown in cities with serious parking problems are cruising to find a parking space, thus resulting in unfavourable congestion (Arnott & Rowse, 2009). Despite the fact that such large and agglomerated cities have put certain effort in improving the efficiency of parking in their most traffic-crowded areas, new technological advances are yet to be placed (Van der Knaap & Van Wee, 2004). Evenmore, experts predict a stable increase in the population of densely populated urban cities (Centraal Bureau voor de Statistiek, 2013), which can be directly linked to the demand for transport and therefore the amount of cars.

These different problematic factors regarding the parking situation have led to the current study on increased efficiency of parkings.
This study tackles both the complication of inefficiency and inflexibility of current parkings simultaneously by offering a comprehensive and integrated plan. We build this research on the business ideas and product concepts of Van der Wijngaart's Engineering Services[1]. Van der Wijngaart's Engineering Services recognises the waste and pollution problem and aims to prevent these with innovation and change. The concepts of Van der Wijngaart's Engineering Services are based on a circular approach to product life cycles and the company uses creative processes to connect different industries. Van der Wijngaart's Engineering Services currently offers modular products in the farming industry and is lead by Mr. Aad van der Wijngaart.

The present thesis looks from a holistic angle at the mobility needs of the city of Rotterdam and introduces these business ideas and product concepts of Van der Wijngaart's Engineering Services. Van der Wijngaart's Engineering Services has designed a concept of Flex Parking, which we rephrase in a more sophisticated way to "Transition Hub", to solve Rotterdam's congestion and particulates problems and to create a new paradigm of mobility. This study aims to legitimate the use of the Transition Hub in the infrastructure of a city on an economic basis.

But is this new business idea truly the right way to solve this issue?

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[1] For more information on Van der Wijngaart's Engineering Services, please visit: http://www.wijngaart.nl/

The overall central question in this study, consisting of three separate but complementary theses, is: *"How will Transition Hubs function in Rotterdam?"*
Although all three theses are researched and formulated separately, they do consist of a general part which was jointly made. This common part consists merely of the introduction and the theoretic framework partially, specifically the pages 2 to 15.

The subcentral questions, indicating a clear distinction between the theses, to this central question are:

- *"Is the Transition Hub economically feasible for implementation in Rotterdam?"*
- *"What is the best entry strategy for the Transition Hub in Rotterdam?"*
- *"What other functions can be performed by the Transition Hub in Rotterdam?"*

In the present thesis, the emphasis will be placed upon the *economic feasibility* of the Transition Hub, the mobility components which are interconnected to this and the possibility to exploit other functions at the Transition Hub. Therefore, the central question in this study is:

"Is the Transition Hub economically feasible for implementation in Rotterdam?"

This Transition Hub will, besides parking, provide two different types of electronic means of dependent individual transportation, the OlegO and the Wheelie. This study legitimates the use of the Wheelie and the OlegO. These two means of transportation can increase efficiency for the traveler by reducing the time traveled between the Transition Hub and the final destination. In this way the total travelling time of an individual or group of individuals is shortened; a mobility advantage.

In this study, the main focus is placed upon the parking situation in the city of Rotterdam. Rotterdam, being commonly known as the 2nd largest city of the Netherlands, is very popular for its important core commercial activities, infrastructure, society and especially for its port. Whilst Rotterdam currently counts more than 25 'big' parkings (Rotterdam.nl, 2015), the congestion is seen as a serious problem, which could only get worse. Citizens of the neighborhood around Winkelcentrum Keizerswaard experience increased problems with parking and are becoming furious at the municipality for not solving these issues after repeatedly discussing the issue (Roubos, 2013).

What is even more problematic is the fact that the existing parking is not considered flexible when it comes to the efficiency of the traveler. Most journeys require the use of multiple means of transportation and therefore a flexible connection between these. Parking nowadays usually consists of a less comfortable walk of at least 10 minute from the parking to the destination.
The existence of efficiently-operating parkings causes less congestion and undoubtedly stimulates the clustered areas important for business environment, thus positively influencing the regional economic growth (Arnott, 2005). Two main reasons contribute to this disturbing issue, being unavailable properties and technological inefficiency. Every square metre in the downtown of Rotterdam is essential for the companies located nearby, leading to minimal optimally located parkings. Also, the current existing parkings are claimed to take up more space than they should. A clear distinction at this point should be made between individuals with a long-term parking contract and just the simple 'shopper', who has no parking spot assigned to him in advance. Because of such diversity in businesses in the downtown of Rotterdam, it is quite difficult to predict what proportion of the total users of parkings are shoppers.

Besides the restricted mobility businesses and people face, another problem is embedded in the logistical system of a city. Goods and services are not optimally allocated in every neighbourhood for businesses and people. Goods and services are usually provided in fixed locations in the city from where business and logistical operations are conducted. Goods and services are transported from that point to the residents, such as the delivery of packages or letters. This causes additional unwanted traffic in urban areas of commercial freight and services (Crainic et al, 2004).

Another problem regarding the logistical system of a city is that people have to commute from home to their work destination, while in most cases the work place will not or cannot provide parking for their employees, forcing employees to travel longer and use more means of transportation than the optimal number of means needed. Research has shown that if an employer provides parking for their employees, 63 percent commute by car to their work. Only 16 percent commutes by car if the employer does not provide parking, which forces commuters to use public transport instead of individual transport (Jansson, 2010)

In addition to the scarcity of parking spaces, the parkings are located in the centre of the city. As for Rotterdam, most of the parkings concentrate in the centre of the city. Residents, commuters and tourists travel to these parkings, thus congesting the centre of the city. Besides congestion in the inner city, the highway around Rotterdam is one of the most congested infrastructures in Europe. According to INRIX Traffic Scorecard Rotterdam is the sixth worst congested city of

Europe in 2011 (INRIX, 2012). Also the exits of the A15 near Rotterdam are considered to have the highest congestion costs in the Netherlands (TNO, 2008). Though the crisis and the stagnating economic growth has decreased the congestion in Rotterdam (INRIX, 2012), it is expected that congestion will rise again, since there is an expected rise in economic growth in 2015 (Centraal Bureau voor de Statistiek, 2015).

Rotterdam has relatively and absolutely the highest concentration of particulates in the air due to traffic and industrial and port activities. Rotterdam has tried to tackle this environmental problem, since particulates are the second most harmful factor for the lifespan of the average resident of Rotterdam (Burdorf, 2009). In 2008 several researchers published findings that particulates are even deadlier than previously thought, emphasizing the need of reducing particulates and particulate standards in the city (Ballester et al., 2008). The maximum allowed concentration, set by the European Union, of 25 milligram per cubic metre is often surpassed in the daily measurements of particulates in Rotterdam (Landelijk Meetnet Luchtkwaliteit, 2015).

To fight these particulates, the Transition Hub will also purposely function as a central hub for electric cars and other fully or semi-electric vehicles, which are being used more and more often (Adriaanse, 2013). The municipality of Rotterdam supports the use of electric vehicles by providing charging points on streets and offering a subsidy for an own charging point on privately-owned properties (Nederland Elektrisch, 2015). Also other subsidies are offered to incentify the use of 'cleaner' vehicles, resulting in improved environmental conditions through less CO2 emission and less noise. So whilst the Transition Hub appears attractive for the standard daily traveller, it also contributes to society's push for more sustainability for the long term (Forbes, 2010).

To provide an answer to the question whether the Transition Hub would be financially feasible in Rotterdam, this research has looked at the financial functioning. This financial functioning is the backbone of a well functioning, feasible Transition Hub seen through the eyes of the company.
The main findings of this thesis are as follows. Although the Payback Period might be somewhat controversial at 7.9 years, the positive Internal Rate of Return of 13% and the positive Net Present Value of €2,986,336.43 show that the Transition Hub qualifies as economically feasible, responsible and promising. It is thus economically feasible to implement the Transition Hub in Rotterdam, which consists of the Flex Parking, Wheelie and OlegO.
Different, worse scenarios do, however, show that the Internal Rate of Return can deviate a few percent up to tens of percents. Getting steady revenues but also low construction prices and a quick and cheap loan repayment are key success factors for implementing the Transition Hub

successfully in Rotterdam. Steady to increasing revenues can be generated when there is a larger proportion short-parkers. Cheap and quick loan repayment can be achieved by making additional reimbursements using a part of the yearly net profit or by looking for alternative financing methods.

The structure of this thesis is as follows. After an extensive introduction about the central problem in this thesis study, a theoretic framework follows. In this section, the main theories and concepts are discussed. Subsequently, the sources of the relevant data collection are discussed in the data and methodology section, along with the used calculation and assessment methods. In the following part, the results from the analyses are presented. In the final conclusion and recommendations part, the central question in this study is answered. Furthermore, various recommendations are presented concerning the feasibility of this project.

2. Theoretic framework

The theoretic framework covers several concepts as well as economic theories. The concepts are taken from literature and adjusted in such a way that they fit within this specific study.

2.1. Concepts

2.1.1. Mobility

Mobility is the concept of moving from one point in space to another point in space at a certain cost of moving. Costs of moving are time, energy, money or something else such as comfort. In this research the focus lies on maximizing mobility in relation to time and money since these two are easily linked to the economic domain. Mobility of an individual is optimal when the individual can travel from point A to point B and minimizes the time costs.
There are two categories and two levels to mobility which gives four dimensions of mobility. The two levels are: individual mobility and mass mobility. The two categories are: independent mobility and dependent mobility. An individual can choose to travel on an individual level or on a mass level and by independent means or dependent means.

We define four different dimensions of mobility:
Independent individual mobility is the dimension where an individual moves through space not having any positive externalities from other resources or other people; this is the basic situation. Examples of independent individual mobility is walking or running.
Independent mass mobility is the dimension where an individual moves through space (potentially) having positive externalities from other people but not having any positive externalities from other resources. Examples are walking etc. in a group thus reducing influence of wind. This dimension of mobility is left out in this research since it is not common and has no use therefore.
Dependent individual mobility is the dimension where an individual moves through space having positive externalities from other resources but not having any positive externalities from other people. Examples are a bicycle, a car or roller skates.
Dependent mass mobility is the dimension where an individual moves through space having positive externalities from other resources and other people. Examples are a metro, a bus or a train; these resources are also called public transport.

Do note that it is assumed here that without other people an individual can build or buy a bicycle but cannot build or buy a train.

2.1.1.1. Mobility market structure

From an economic perspective, on the mobility market it may take people longer to reach their destination because of regulation, market imperfections or market failure. In practice, this means it could take people longer to reach their destination because of for example traffic lights, walking from train to metro or a traffic jam.

The points of delay can be categorized according to their nature. There are congestion points and transition points. A congestion point occurs within one means of mobility, a transition point occurs between means of mobility. Both congestion points and transition points can be expected or unexpected. Besides, both congestion points and transition points cause costs.

There are therefore expected congestion points causing expected congestion costs (e.g. traffic lights), unexpected congestion points causing unexpected congestion costs (e.g. traffic jams or detours), expected transition points causing expected transition costs (e.g. transfer time) and unexpected transition points causing unexpected transition costs (e.g. delay of train connection).

The market is assumed to be perfect besides the points of delay mentioned before. This means that there are no other costs of moving in this market besides those. There are no costs other than time related to the points of delay; costs such as rescheduling an appointment or missing a business deal are assumed not to incur. A perfect market also means for example that everyone drives at the same average speed and that every car uses the same average liters gasoline per kilometre.

2.1.1.2. Travelling

Travelling by independent means is always necessary to reach a destination. However, the dependent individual dimension has an advantage in providing flexibility: the possibility to reach the destination in close proximity. The advantage of using dependent mass resources is the availability and shorter traveling time between two locations. These locations are however set. In practice there can be a lot of transition time changing from dependent mass resource to another dimension or dependent mass resource.

If a person wants to travel from A to B, that person has a decision to make regarding the mobility dimensions. This person can choose to travel independently individually, e.g. walking, but this action is not happening in the economic domain. For this research, this basic situation is taken as reference point. But people travel by more means than independent individual means.

An individual could use an individual means of transportation to reach his destination in close proximity, but it is likely that there are expected and unexpected congestion costs. Another option is to use public transport, which causes shorter traveling time between stations, but this option has transition costs and the possibility of high unexpected transition costs. The third option is combining both individual and mass transport.

An individual is usually confronted by fixed and variable traveling time when traveling. Since the market is perfect, it is assumed that an individual has no significant influence over the fixed traveling time. The variable traveling time is the expected congestion time and expected transition time incurred when traveling between point A and point B.

2.1.1.3. Coping with market conditions

It is of public interest that unexpected congestion costs and unexpected transition costs are minimized. Minimizing these costs might be in the interest of private parties too but this is mostly not the case. This leads to moral hazard problems and inferior lock-in in innovation. Solutions to these situations can be found in integral approaches. These can be enforced by governments or offered by companies if the market situation gives room for innovation.

Transition time is minimized when there is no time between the use of one mean of transportation and the other mean of transportation in order to reach the destination. For example, a transition between a train and a bus is minimized when both stations are at the same location and both the train and the bus arrive at the same time. An individual tries to minimize his or her traveling time costs by reducing his or her transition time cost.

The inherent problem of the conventional means of transportation is that all means are limited in their flexibility in the city centre. In the city centre cars, motorcycles and bicycles need to be parked in designated areas, which are almost never directly connected with the destination or the transition location. Therefore, those designated areas pose an extra transition for the individual and causes the total traveling time cost to increase. For public transport a similar, but a more static problem arises. Most bus, metro, tram or train stations are located at the centre of their neighbourhood, but are not directly accessible for every individual, implying inefficient transition time.

The trade-off between time and money counts too when moving to the city centre which is reflected in the willingness to pay for mobility, in metre per second, given a certain location. This is the demand side of the mobility market.

The supply side of the mobility market is diverse in its approach to serving the market: parkings, car manufacturers, public transport etc. serve the market in their own way. Th nis study looks at an integral way of serving the mobility market.

In order to serve the mobility market, the best parts of independent and mass transport have to be taken and have to be reconsidered in an integral way.

2.1.2. Elements of the Transition Hub

The Transition Hub is an innovative, automated parking, providing coherent and complementary travelling services to pursue one's journey. This section describes the key elements that make the comprehensive Transition Hub a well-thought solution for the current mobility market.

2.1.2.1. Flex Parking

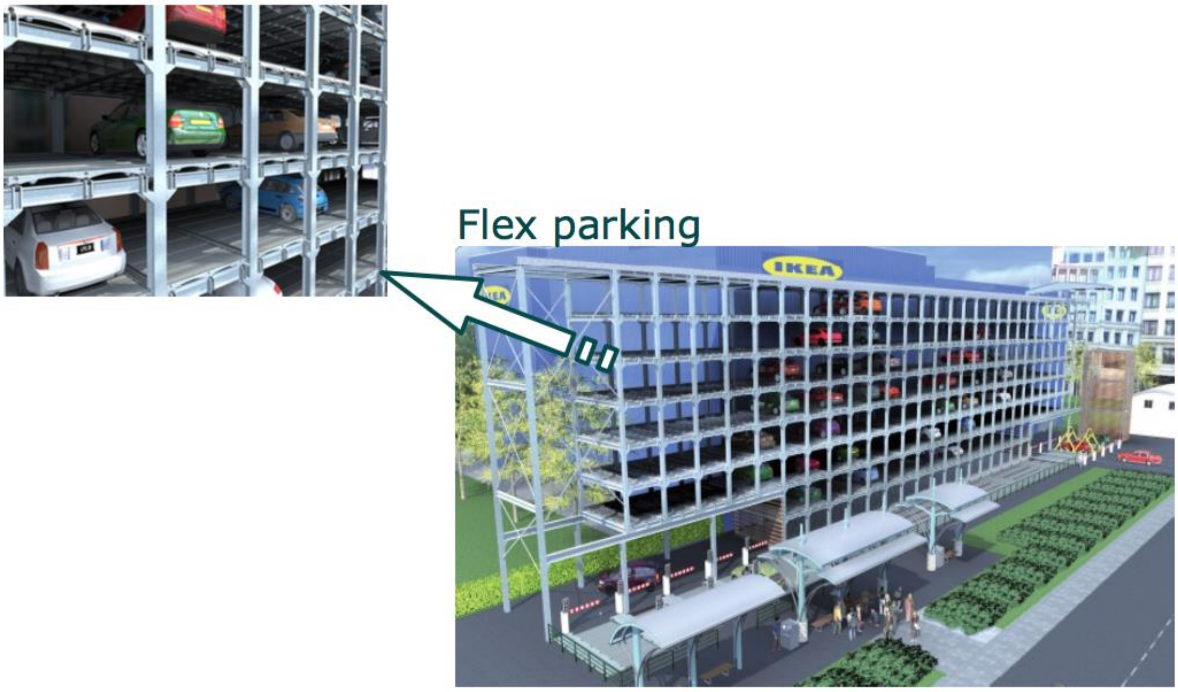


Figure 1: Flex Parking

Flex Parking can be explained as a sharply innovated version of existing parkings and can be viewed as beneficial for both the individual traveler as for the city as a whole. This idea basically requires less total size for the same amount of parking spaces, decreases total parking time and improves flexibility; these benefits will be briefly explained as follows.

Firstly, Flex Parking is able to provide at least the same amount of parking spaces of conventional parkings, by using significant less total space as a whole. This is possible because of the technologically advanced method of parking, which the Flex Parking adopts. Instead of the regular way of parking a car in a parking with multiple stories, the Flex Parking allows an automated, robotic crane to place the car in an empty parking space. This crane is highly technologically advanced and is comparable to the automated cranes used in the operations of the Haven of Rotterdam. Learning and adopting the way such advanced cranes are used and implementing this in a totally different industry, can be very beneficial and can deliver a direct boost to efficiency. The main idea behind adopting this technology is to save the individual a great deal of (valuable) time when travelling from point of departure to point of destination. One can simply drive up to this Flex Parking, place its car on the right spot and immediately pursue their journey. After the car is placed, the automated crane is supposed to finish the job of parking the car in a quick, safe method. This crane is designed and pre-programmed to purposely execute this order in an efficient way.

Also, making use of such an automated crane minimizes the probability of human errors/casualties. In the conventional way of parking, an individual uses its own driving skills, built through experience, to properly park a car in the for the car designated parking space. Also, it is safe to assume that not every car driver consists of the same level of skillfulness and focus. Because human behaviour is subject to human errors and other factors, the chances that an individual experiences a problem when parking is higher.

Another huge benefit of the Flex Parking is that it requires a considerable smaller total area for the same amount of parking spaces. In conventional parkings, an individual needs to be able to make turns, drive up to parking space, drive up to the different stories and be able to perform manoeuvres when necessary. A normal car requires at least a width of 6 meters to be able to make normal turns, which are usually necessary to make when parking the car. By making use of the Flex Parking and its services, all this 'wasted' space is removed and every single parking space is optimally utilized.

The Transition Hub combines all dimensions of mobility shaping an integrated mobility market. With regards to the competitors, taxi, train, bus, tram, metro, private car usage, carpooling, parkings, private bicycle usage, bicycle renting it is important to note that the Transition Hub aims to combine all of these in this integrated mobility market. The Transition Hub is a unique as well as a superior service when looking at all these competitors separately. As mentioned earlier, the market is shattered with high costs in time or money when going from one part of the supply chain to another.

2.1.2.2. Wheelie

Figure 2: The Wheelie

The Wheelie is a compact, light-weight (<10 kg), electric vehicle suited for one person to cover distances not greater than 10 kilometres per day. Its speed is maxed at 25 kilometres per hour and will be the equivalent of the scooter with a blue number plate in the Netherlands, which speeds is also capped at 25 kilometres per hour. It is designed to have a length of 0.8 meters, a width of 0.3 meters and a height of 1.2 meters in its normal situation. It is also designed for flexibility and manoeuvrability so that one can carry the Wheelie on either the back or by pulling it at the front. This mean of transportation can prove to be incredibly handy when moving from point to point within the inner-city, so called intra-city movements. This enables the traveler to quickly switch from a mean of transportation to a dependent individual mean. The Wheelie should be allowed in both traffic and public transport as it will increase the efficiency and reduce transition time cost for travelers. It will also be possible for both consumers and businesses to customize their Wheelies, as seen in figure 2, by adding logos or texts. Consumers may desire to personalize their wheelies, while businesses could benefit from brand exposure. As soon as the number of travellers making use of this new and flexible mean of transportation increases, others will undoubtedly be positively influenced and probably follow this hype. Possibly, the Wheelie can also be used for fun-riding.

2.1.2.3. OlegO

Figure 3: The OlegO

The OlegO is a modular, small, one-manned, electric vehicle which can be used for a variety of activities. It has a range of approximately 25 kilometres and can reach speeds up to 45 kilometres per hour. Though unsuitable for highways, the OlegO is a mobile and fast vehicle to transport one in a city and thus improves overall city mobility. It is especially transport from a centre to the edge of the city that is suitable for the OlegO; so called inter-city movements. The OlegO is a motorised quadricycle, which are allowed by law on bicycle lanes and do not require a driver's licence. Just as in the case of the Wheelie, It will also be possible to customize the appearance of the OlegO for businesses and customers for branding or personal purposes. Also, it is plausible that individuals will make use of the OlegO to do daily grocery shopping. By introducing this smaller and more flexible vehicle, the current stream of traffic can be spread.

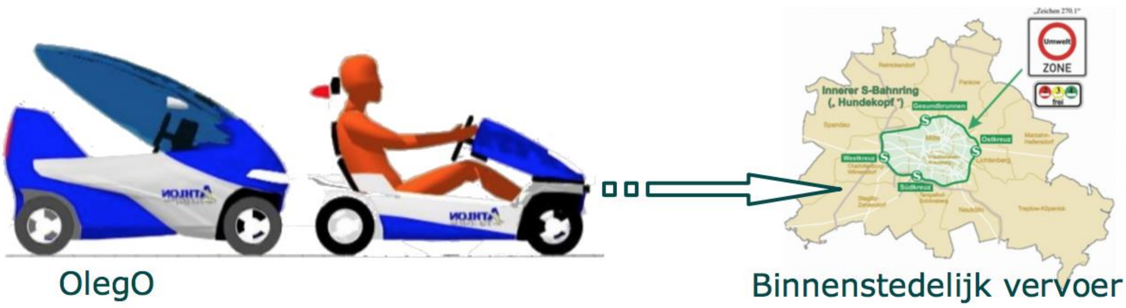


Figure 4: OlegO functionality in the inner city

2.1.3. The function of the Transition Hub

The Transition Hub allows travelers to quickly switch between means of transportation. As said above, a parking is almost never directly connected to the destination of the traveler, thus by parking, a traveler has to travel an additional distance from the parking to the destination. The Transition Hub minimizes the time needed to travel this additional distance by providing the Wheelie and the OlegO. This makes traveling via a car a flexible way of transportation. By lowering the barriers to travel without a car in a city, the Transition Hub provides a platform where environmental and congestion friendly vehicles are used in the city. Both health and pleasure of life will increase due to less environmentally hazardous fumes and less congestion.

2.1.3.1. Modular usage of the Transition Hub

Figure 5: A Flex Office

The Transition Hub is designed in a way that allows private or public parties to locate their operations in or next to the Transition Hub. The modular design enables parties to quickly build and insert an office, storage, logistical, living or other commercially used space (hence mentioned as a module) into the modular structure of the Transition Hub. The main advantage of the modules is the flexibility of properties. The module is easy to add and remove to and from the Transition Hub. The Transition Hub is therefore multifunctional and can be repurposed in a small amount of time to something entirely else. When there is a dire need of living quarters for students, the municipality or the university can add several living quarters in or next to the Transition Hub. If the need for extra living quarters for students is lower the next year, the modules can be easily removed to be replaced by either additional parking spaces or other modules. This multifunctionality will revolutionize the way cities think about the use of properties and land. Locating parking, goods and services in exactly the same places increases efficiency, reduces congestion and unnecessary emissions and adds value to the Transition Hub.

2.1.3.2. Environmental benefits of the Transition Hub

The Transition Hub enables travelers with electric and semi-electric vehicles to charge their vehicle whilst parked in the Flex Parking. The ground level of the Flex Parking is reserved for the charging electric and semi-electric vehicles, since charging requires the driver to insert the charging socket manually. With electric mobility is meant all vehicles for which an electric motor is the primary source of propulsion (Mckinsey, 2014). The Transition Hub could provide parking for electric and semi-electric vehicles for up to 20 percent of the total parking spaces, considering the growing trend of car-users. It has been shown that by increasing the supply of electric charging stations, the demand for electric cars increases profoundly (Sierzchula et al, 2015). The Transition Hub will function as the new centre for such environmentally neutral vehicles and will contribute to the stimulus that the Dutch government wishes to achieve. The Transition Hub gives the opportunity to solve the environmental challenges Rotterdam is facing regarding carbon dioxide and particulates.

Since it is possible to combine modules with parking, the amount of traffic in the city centre is restrained to the Transition Hub, which frees other, densely populated parts of the city of its congestion issues. Therefore the amount of emissions and sound generated by car traffic can be reduced to improve overall living quality. Because governments increasingly aim to keep their major cities cleaner and more peaceful, the costs this brings for society is growing. Realizing a reduction of these, which is the one of the objectives of the Transition Hub, would imply accomplishing various direct and indirect environmental benefits.

2.2. Financial Analysis

A comprehensive financial analysis comprises consideration of the financial costs and benefits regarding the project, thereby identifying and weighing its financial risks. In the business case of the Transition Hub, this mainly includes a Cash Flow Analysis containing an Investment, Profit & Loss, Scenario and Sensitivity Analysis. In order to make accurate predictions, this financial model will be applied to forecast in a practical, responsible way. To determine the economic feasibility of the parking, the outcome of the cash flow overview provides the eventual answers and recommendations.

2.2.1. General

For the Parking, the total costs can be split up into fixed (initial) investment costs, rent costs and operational costs. Benefits are derived from the revenues generated from rental of parking spots and complementary mobility services such as the Wheelie and the OlegO. Due to the technical nature of the Parking of Van der Wijngaart's Engineering Services, there are substantial differences in costs compared to standard, conventional parkings and there are considerable differences in mobility advantage for consumers either leading to a cost reduction or to a higher revenue. The cost advantage has a direct benefit for society; the mobility advantage has an indirect benefit for society. Compared to existing parkings in Rotterdam, these two fortunate factors alone, the cost and mobility advantage, highlight the necessity for implementation of the Transition Hub. However, these simple comparisons are not adequate to persuade society to make an immediate switch-over. The transition of making use of such a comprehensive Transition Hub instead of conventional parkings will require an entire paradigm shift regarding travelling at both inter- and intracity level. The ability to accurately predict whether the Transition Hub will have a decent financial workability lies in an in-depth financial research and analysis. On basis of this financial analysis, it will be decided whether the Transition Hub is economically feasible for implementation in Rotterdam.

To estimate whether the Flex Parking is feasible, the fixed product and operational costs of the Parking are calculated on the basis of the given product specifications of the Parking. This technical and economical data is provided by Van der Wijngaart's Engineering Services.

2.2.2. Investment Analysis

In the investment analysis the main focus goes to the initial investments necessary for setting up the planned project (Wilkinson, 2013). Functioning as the heart of the Transition Hub, the Flex Parking serves a central position in the whole project. The most essential components of the Flex Parking in the investment scheme are thus: construction of Flex Parking, Wheelie facility, OlegO facility, main office and charging points.

2.2.3. Profit & Loss Analysis

In any legitimate feasibility study, the use of a profit and loss analysis is paramount. The analysis resolving the annual profits and losses of the Flex Parking project is mainly divided into two components: Revenues and Costs (ECORYS, 2007). A project life expectancy of 20 years is used in this Profit & Loss scheme, viewable in Annex 2.

2.2.3.1. Revenue

The main source of revenue, just as in the case of ordinary parkings, is generated from the rents of available parking spaces to car travellers. A parking space can usually be rented in two ways: by paying a specified hourly tariff or subscription per month. Hence, we can classify two types of travellers: short parkers and subscribers. Short parkers, usually individuals parking their car for a few hours per day on different parking locations, pay the average parking tariff per hour in contrary to the parkers who pay a monthly subscription fee according to a parking contract.

2.2.3.2. Costs

Operational costs

Just like the annual revenues, properly investigating and identifying the annual costs plays a crucial role in the economic pre-feasibility stage . In this analysis, the emphasis is placed upon the yearly operational costs of the Flex Parking and the complementary services of the Wheelie and the OlegO. Based on a Dutch research, the operational costs per parking space for parking garages with more than 400 parking places is estimated at an average of 840 euro per year (Gerritsen, 2009).

Land Rent costs

Setting up such a project requires making use of land area. This land area could be property of the municipality or private owner(s), implying a certain cost linked to its occupation. In cities such as Rotterdam, especially in the inner city, land is a known factor of scarcity and should be optimally utilized to the benefit of society. By physically and technically organizing the Flex Parking in relation to its surrounding additional mobility services, the land area that is rented can be efficiently allocated, consequently lowering the rent land costs.

Maintenance costs

The Transition Hub in its whole is a relative capital-intensive project, thus maximizing utilization of the operational assets implies inevitable deterioration. These maintenance costs are the costs that are made annually to preserve the quality and nature of the tangible assets providing the expected services to its customers. By using a reliable percentage of the purchase costs, an estimation can be made what this cost component will be on a yearly basis.

Other costs

Accurate estimations of other costs such as technical assistance, office costs and especially the financing costs are also necessary for running an efficient parking complex. We assume, because of an almost fully automated parking, that the labour costs will solely be to hire, at most, one

technically high-skilled employee. This employee should exclusively be highly-educated, well-trained, reliable and responsible. In order to attain the prescribed qualified employee, he/she should be paid according to market conform salaries and receive reasonable amenities.
Office costs are estimated at a fixed amount annually, including office equipment such as desks, computers, surveillance equipment but also the provision of electricity and communication equipment.
Last but not least, the financing costs are included in the cost-section of this analysis. These financing costs are based on the assumption that this project will be (fully) financed through external financial resources. Annually, a proportional pre-determined amount of the (bank) loan must be repaid including a calculated interest payment. The bank loan scheme, better known as the amortization table, can be viewed in annex 2.D.

Depreciation costs

Depreciation is a method of allocating the cost of a tangible asset over its useful life. Businesses depreciate long-term assets for both tax and accounting purposes (IRD, 2015). Depreciation costs are not directly part of the cash flow but can play a strong role when predicting annual (gross) profits for a project. Different depreciation methods have been developed over the years, but it is essential to choose a depreciation method that matches well with the rate of utilization of the assets. Thereby, a corresponding amount can be secluded for potential replacement investments.

2.2.4. Cash Flow Analysis

To elaborate further onto the already-mentioned investment and profit & loss analysis, a cash flow analysis will be done, which basically gives a clear overview of the revenue stream and the cost stream (the investment and operational costs). Subsequently, subtracting the total cost from the total revenue, results in the net cash-flow annually (Ecorys, 2007). The net cash-flow will be primarily used to assess the economic feasibility of this project. To measure the attractiveness in economic terms, three commonly used financial methods will be used: Net Present Value (NPV), Internal Rate of Return (IRR) and Payback Period (PBP). The project is, from a government's (or municipality's) perspective, economically feasible if the NPV of the project is positive. Hence, if the NPV is negative, the project is unattractive in economic terms and will probably give an unpromising return on investment. However, whether the project is socially feasible is only partly determined by the economic feasibility, which only takes the direct financial impacts affecting the project into account.

2.2.4.1. Net Present Value

This method of calculating the net result of exploiting the project is regularly used for parking projects by municipalities. The difference between the present value of cash inflows and the present value of cash outflows. NPV is used in capital budgeting to analyze the profitability of an investment or project (Ecorys, 2007). The following is the formula for calculating NPV:

$$NPV = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} - C_0$$

where:

C_t = net cash inflow during the period

C_0= initial investment

r = discount rate, and

T = number of time periods

2.2.4.2. Internal Rate of Return

A private party will usually demand a certain return on its investment. This return should compensate for the risks taken for setting up/constructing the project. The thumb rule is a required return of between 10 and 20 % for similar projects (Ecorys, 2007).

Basically using the same formula as mentioned above, the Internal Rate of Return (IRR) or also known as the Economic Rate of Return (ERR), is the discount rate often used in capital budgeting that makes the net present value of all cash flows from a particular project equal to zero. Generally speaking, the higher a project's IRR, the more desirable it is to undertake the project. As such, IRR can be used to rank several prospective projects a firm is considering. Assuming all other factors are equal among the various projects, the project with the highest IRR would probably be considered the best and undertaken first (Schultz, 2005).

2.2.4.3. Payback Period

The length of time required to recover the cost of an investment. The payback period of a given investment or project is an important determinant of whether to undertake the position or project, as longer payback periods are typically not desirable for investment positions (Investopedia, 2015).
Calculated as:

Payback Period = Cost of Project / Annual Cash Inflows

Advantages and Disadvantages

There are practical advantages and disadvantages with using the payback period (Schade, 2007).

Advantages of payback period are:

1. Payback period is very simple to calculate.

2. It can be a measure of risk inherent in a project. Since cash flows that occur later in a project's life are considered more uncertain, payback period provides an indication of how certain the project cash inflows are.
3. For companies facing liquidity problems, it provides a good ranking of projects that would return money early.

Disadvantages of payback period are:

1. Payback period does not take into account the time value of money which is a serious drawback since it can lead to wrong decisions. A variation of payback method that attempts to remove this drawback is called discounted payback period method.
2. It does not take into account, the cash flows that occur after the payback period.

The mobility market is known for its high initial investments and relatively long payback periods. The level of competition is severe at investment moments but tend to be lower afterwards. The market growth rate is low but dramatically disrupting this big market could lead to serious growth potential for innovative products and businesses (Nijkamp & Rienstra, 1993).

2.2.5. Scenario Analysis

In the previous analyses, the estimations and assumptions are made for a realistic, modelized base-situation of the project. To acknowledge and account for the awareness and possibility of fluctuations and volatility in the different financial parameters and to anticipate for these unwanted, unexpected deviations, different scenarios will made and analyzed in this Scenario Analysis (Postma & Liebl, 2005). In this analysis, three different unfavourable scenarios will be hypothesized and eventually critically assessed. In order to identify which scenario is the least favourable and thus the most alarming, we will use the same three measurement methods as before to assess the economic performance. Such an analysis is commonly done for such feasibility studies and shows the range of possibilities for outputs, but does not give any insight into what happens if the values of variables fall between the extremes (Björnsdóttir, 2010).

2.2.6. Sensitivity Analysis

Additional to the scenario analysis, a sensitivity analysis will also be done. Sensitivity analysis is a way to predict the outcome of a decision if a situation turns out to be different compared to the key prediction(s) (Postma & Liebl, 2005). Sensitivity analysis can be extremely useful when attempting to determine the impact a particular variable will have on the actual outcome if it differs from what was initially assumed. By creating a given set of scenarios, the analyst can determine how changes in one explanatory variable(s) will impact the target variable.

3. Data and Methodology

3.1. Investment Analysis

In the investment analysis, the main focus goes to the initial investments necessary for setting up the project. These investments are placed in a well-arranged 20-year investment scheme (annex 1), starting in year one. The most essential components of the Flex Parking in the investment scheme: construction of Flex Parking, Wheelie facility, OlegO facility, main office and charging points.

The calculations of the construction of Flex Parking are based upon a predetermined total amount of 500 parking spaces. Also, the construction cost per parking space is assumed to be € 10,000, which is far less than the initial costs per parking space of conventional parkings (Verkeersnet, 2009). By making use of the standard average measures of a car, length of 5 meters and width of 2 meters, the area per parking space is 10 square meters.

The Wheelie and Olego facility construction are very dependent on the organization of the way these services will be provided to customers. To organize these facilities, the wheelies will be stored by folding them up and placing them on top of each other (5 on one pile). Using the measurements of the Wheelie, the total area including an extra margin for flexible workability of the Wheelie facility can be determined. Henceforth, whenever estimating the initial construction costs of the Wheelie and OlegO facilities, the total area necessary for these facilities is used. The idea is to use the rented land for the parking as efficient as possible, by partially occupying it with facilities for the Wheelie and the OlegO in this complex. Thus, to calculate the investment costs of constructing these facilities, the estimated costs per parking space are used once again.

Building such a parking requires at least one main office to be present nearby; just like the Wheelie and OlegO facility, we assume that the main office is built also as part of the whole complex. A minimum space required for such an office is estimated in the investment scheme, plus other accompanying costs of initially setting up an operational office (office inventory, computers and such). The last construction component of the whole parking complex is the building costs of the charging points for electric vehicles (fully and semi). These emplacement costs are estimated on basis of given, existing commercial prices. Also, a proportion of 0.2 charging points per parking space is estimated when calculating the amount of charging points to suffice the Flex Parking.

Furthermore, an initial batch of Wheelies and OlegOs, which fulfill an additional and complementary role in this project, is purchased. A proportion of 0.2 for both the Wheelie and the OlegO is estimated per parking space. Using this ratio results, in our case of a parking of 500 spaces, in the idiosyncratic investment of both 100 Wheelies and 100 OlegOs. The purchase price per Wheelie and OlegO are a given in this investment scheme, respectively € 1,700 and € 4,700. At last, a contingency of 5 % is added, to account for possible deviation in the initial expected investments.

3.2. *Profit & Loss Analysis*

One of the major sections of the overall financial analysis, is the profit & loss analysis. The analysis resolving the profits and losses of the Flex Parking project is mainly divided into 2 components: Revenues and Costs. Again, a project life expectancy of 20 years is used in this Profit & Loss scheme (Annex 2).

3.2.1. Revenue

As categorized earlier, we can discern two types of travellers: short parkers and subscribers. Short parkers pay the average parking tariff per hour, whilst the contracted parkers pay a monthly subscription fee. In order to make predictions about the demand for parking in the foreseeable future, the current parking situation should be closely examined. To estimate the distribution of subscribers and short parkers, the actual numbers of current existing parkings is used to state a subscribers to short parkers ratio of at least 0,25 (Q-Park, 2013).

The other two sources of revenue are due to the incoming rents of the Wheelie and OlegO, which a part of the travellers will use for continuing their journey more efficiently. To estimate a reasonable tariff per hour to demand for renting these services out, a practical method of "willingness-to-pay" has been developed.

The minimum demand tariff for renting out a Wheelie per day, assuming an average daily distance of 10 kilometres per day, is calculated at € 1.36. Subsequently, the minimum demand tariff per kilometres is € 0.14 per kilometer to operate break-even. Using the newly developed method, the minimum amount a traveller is willing to pay is € 0.29. Thus, the actual tariff that is determined from travellers for renting the Wheelie for a day will be fixed at € 0.29 per kilometer; a considerable mark-up on top of the break-even of € 0.15.

The minimum demand tariff for renting out a OlegO per day, assuming an average daily distance of 25 kilometer per day, is calculated at € 4.22. Subsequently, the minimum demand tariff per kilometer is € 0.17 per kilometer to operate break-even. The OlegO can drive at a higher velocity and can thus be used for travelling larger distances, indicating that the tariff demanded for the OlegO can be slightly higher than the € 0.29 chosen for the Wheelie. A tariff per kilometer of € 0.35 is determined for the OlegO, reflecting its higher overall value for travellers.

Finally, the total revenues per year are calculated on basis of the above mentioned assumptions.

3.2.2. Costs

Operational costs

Based on a Dutch research, the operational costs per parking space for parking garages with more than 400 places is estimated at an average of 840 euro per year (Gerritsen, 2009).

To calculate the operational costs of the Wheelie, multiple other parameters have to be estimated and determined. An average daily distance of 10 kilometres is estimated, with a given energy cost per kilometer of € 0,02, results in the daily operational costs per Wheelie. To calculate the annual operational Wheelie costs, this outcome should be multiplied by the amount of Wheelies (100) and the amount of days a year (365).

The same calculation method used for the Wheelie is applicable when calculating the annual operational costs for the OlegO. An average daily distance of 25 kilometres is estimated, with a given energy cost per kilometer of € 0,04. After subsequently multiplying, the outcome shows the yearly operational OlegO costs.

Land Rent costs

The total land area, measured in square meters, required for the emplacement of the Flex Parking is estimated by taking the following factors into account: the standard measurements of a parking space (length, width and height), the amount of desired parking spaces (500), the desired amount of stories of the building (8), extra land area for other necessary operational activities. Subsequently, the land rent costs can be estimated as a product of the total required land area and the rent costs per square meter (Cheshire & Sheppard, 1995). The land rent costs within Rotterdam vary notably, especially when distinguishing the inner- and outer suburbs. Therefore, an average value of land rent costs is used for estimation purposes, which is € 100 per square meter.

Maintenance costs

The annual maintenance costs per supplied service (parking, Wheelie, OlegO) will also be estimated by applying predetermined maintenance percentages commonly used for comparable projects. To estimate the maintenance costs per year for the Flex Parking, 2 % of the initial investment costs is calculated. In addition, 5 % of the initial acquisition costs of the OlegO and the Wheelie is used to calculate the annual maintenance costs.

Other costs

The assumption of merely hiring one employee leads to the following. The costs of this employee is estimated at salary costs of € 60,000 per year including a certain amenities package.
Office costs are estimated at a fixed amount of € 10,000 annually, which includes office equipment, electricity, communication equipment and so on.
At last, the financing costs are included in the cost-section of this analysis. These financing costs are based on the assumption that this project will be (fully) financed through external financial resources. Annually, a proportional predetermined amount of the (bank) loan must be repaid including a calculated interest payment. To calculate the amount that has to be repaid yearly, the following loan conditions are determined. The loan period is 20 year and repaid annually at an interest rate of 6 %. Also, according to this initial financing plan, no optional extra payments will be made. The bank loan scheme, better known as the amortization table, can be viewed in annex 2.D.

Depreciation costs

The use of the services provided by the Wheelie and the OlegO to travellers is assumed to be intensive, thus requiring a different depreciation method than the ordinary linear method. A decreasing depreciation rate is applied to the project since the value of the project diminishes more in the first years after initiation. For the depreciation scheme, viewable in annex 2.C., the inverse sum of the years digit method is used.

3.3. Cash Flow Analysis

To elaborate further onto the already-mentioned investment and profit & loss analysis, a cash flow analysis will be done, which basically gives an overview of the revenue and the cost stream (the investment costs and the operational costs). Subsequently, subtracting the total cost from the total revenue, results into the net cash-flow annually. The net cash-flow will be primarily used to assess the economic feasibility of this project. To measure the attractiveness in economic terms, three commonly used performance indicators will be used: Net Present Value, Internal Rate of Return and Payback Period.

3.3.1. Net Present Value

Making use of the NPV requires accurate forecasts of the incoming and outgoing cash flows, taking into account the project life expectancy. This financial performance indicator provides a better usability when determining the value of the project. To discount the future cash flows a market interest rate of 6 % will be used, which is a credible interest rate nowadays for valuation and discounting purposes.

3.3.2. Internal Rate of Return

In addition to the NPV, the Internal Rate of Return is also a popular financial indicator. The same cash flows derived from the cash flow analysis in annex 3 can be used to calculate which rate of return is required for the NPV to be zero. Hence, the IRR that will be found can be interpreted as the growth rate the project will generate, if the cash flows consistent with the expectations.

3.3.3. Payback Period

Finally, after calculating the NPV and IRR, it is traditionally desired (usually by managers) to estimate how long it will take to pay back the initially done investment. The initial total investment of year 1 and the predicted net cash-flows in the upcoming years are used to calculate the third and final financial indicator, measured in years.

3.4. Scenario Analysis

In this analysis, three different unfavourable scenarios will be hypothesized and eventually assessed. The first two scenarios place more focus upon the cost-side, while the last scenario engages the revenue predictions.

The first scenario is from the standpoint that actual investment costs can easily be underestimated in such projects. Hence, the first scenario assumes the actual investment costs are 10 % higher than initially anticipated. To predict the magnitude of this scenario of actual higher initial investment costs, a cash flow analysis is done based on the increase. At last, the first scenario is subject to the previously mentioned three financial indicators to view the financial results.

The second scenario assumes that the annual operational costs are underestimated. Possible explanations for this can be unexpected inflation rate increases, excessive maintenance costs and so on. In this scenario it is assumed that the actual annual operational costs surpass the original annual operational costs by 10 %. As done with scenario 1, the financial results require reassessment by making use of the financial indicators.

The last scenario takes a revenue-side view in contrast to the first two scenarios. Just like the costs can be easily miscalculated, the revenues also have a high likeliness and risk of being overvalued when forecasted. An explanation for this is the fact that individuals are usually more fixated on predicting revenues than on managing costs from the beginning. Furthermore, higher risk can be explained by the fact that revenues can relatively easily be affected by external developments in comparison to the costs. The key assumption in the third scenario is a 10 % decrease in revenues relative to the base-situation. Reiteratively, the result is assessed by making use of the three financial indicators.

3.5. Sensitivity Analysis

To determine whether a parameter has substantial impact on the net result, a new financial scheme will be made. In this sensitivity analysis, the first step lies in identifying the particular parameters, which have a substantial influence on the net result by taking a look at the composition of revenue and cost sources. Thus, the relevant parameter is allowed to take minimum and maximum values within a certain interval. Instead of depending solely on the base-situation (as done in the cash flow analysis), a plausible range for these parameters is determined and used to calculate the outcomes from an economical perspective.

4. Results

4.1. Investment

Construction

In annex 1 the investment scheme is arranged based on a project life expectancy of 20 years. The initial investment for constructing the Flex Parking is estimated at € 5,000,000. The construction costs for building the Wheelie Facility is estimated at € 20,000 and of the Olego Facility at € 130,000. The construction costs for building and setting up the main office is estimated at € 50.000. At last, the construction of the charging points within the Transition Hub is estimated at € 48.300.

Acquisition

The fixed acquisition costs of purchasing the initial batch of Wheelies, an amount of 100, is estimated at € 170.000. The investment costs for 100 OlegOs is estimated at a total of € 470.000.

This investment scheme indicates no expected recurring investments in the upcoming years, although the reappearing purchase of a new batch of Wheelies and OlegOs every 5 years is an exceptional case. Due to its expected intensive utilization, neither the Wheelie nor the OlegO is probable to extend its life expectancy.

The total yearly investment costs sum up to a subtotal of € 5,888,300. The contingency is calculated by adding up € 294,415 (equal to 5%) of the subtotal investment costs every year. The total investment costs in year 1 are thus € 6,182,715. The necessary recurrence of the Wheelie and Olego acquisition costs sum up to a subtotal of € 640,000. Being subject to the 5 % contingency, this leads to a total investment cost of € 672,000 in year 6, 11 and 16, as can be seen in figure 6. By eventually looking at the entire project, spread over 20 years, the project investment costs cumulate to a total of € 8,198,715. In figure 7 the proportions of each investment are shown.

Figure 6: Annual project investment costs

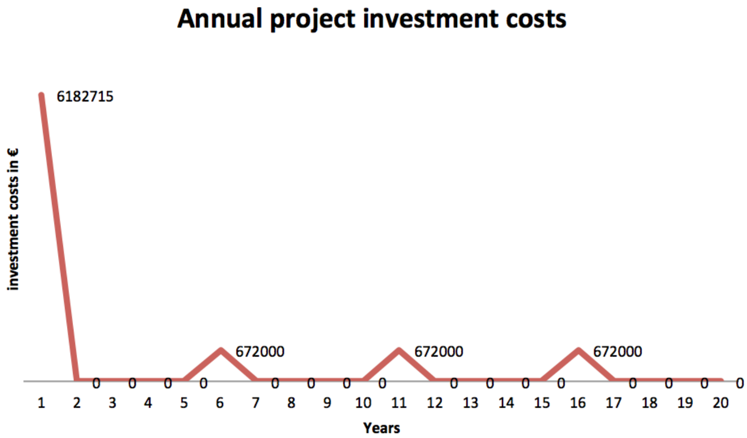
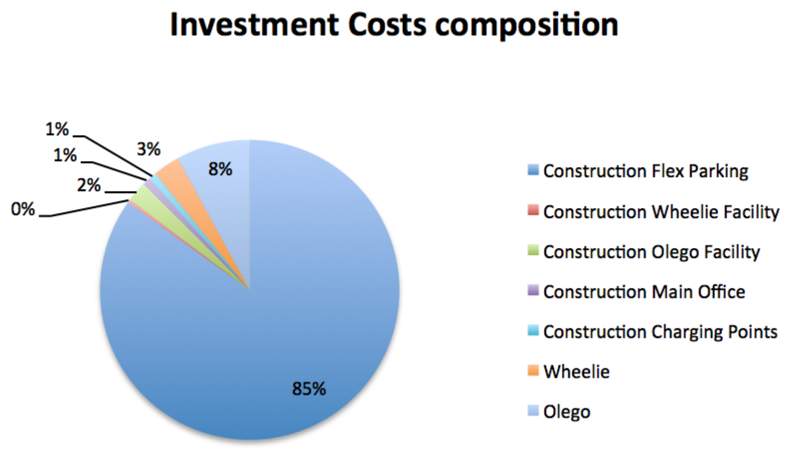


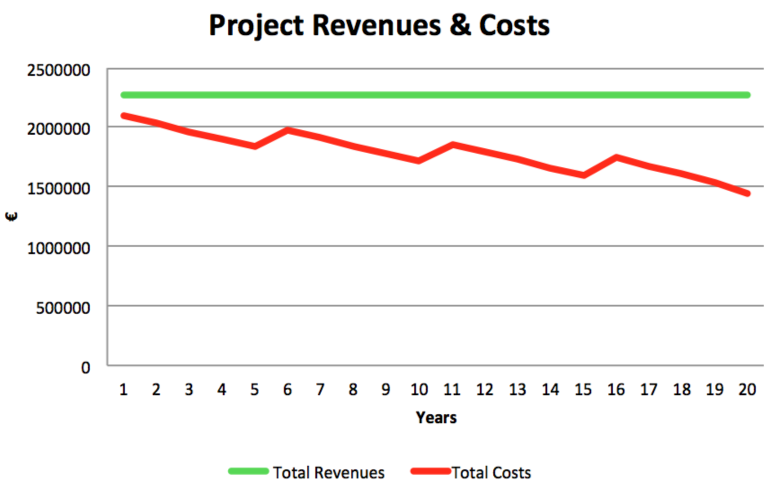
Figure 7: Investment costs composition



4.2. Profit & Loss

In annex 2 is a modelized overview of the estimated annual revenues and costs, based on a project life expectancy of 20 years and illustrated in figure 8 below.

Figure 8: Graph illustrating the predicted revenues and costs over time



4.2.1. Revenues

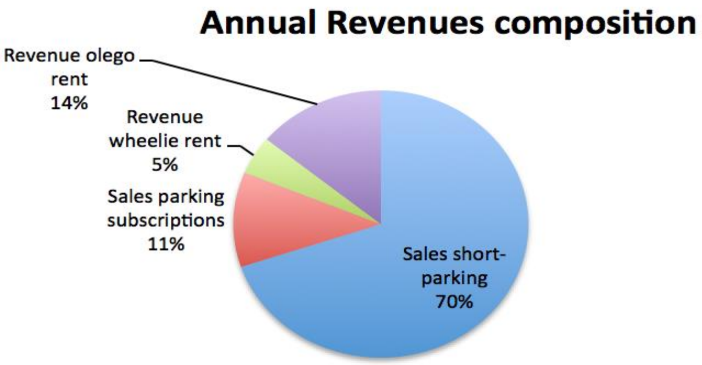
The expected annual revenue stream is divided into 4 key components in order to identify which source of revenue plays the most important role in the Transition Hub project. This part can be viewed in Annex 2.A.

The first two components consist of the revenues collected from providing the Flex Parking services. The sales revenues from short-parkings amount to € 1,586,655 and is considerably higher than the revenues collected from the parking subscriptions, estimated at € 260,820. The massive contribution of the short parkings to the revenues can be viewed in figure 9 below.

The other two revenue streams are divided over renting out the Wheelies and OlegOs as separate but complementary services of the Transition Hub. These revenues are estimated at an annual amount of € 105,850 for the Wheelies and € 319,375 for the OlegOs.

These multiple revenue streams can be summed up to reach a total revenue of € 2,272,700 annually, starting in year 1 up to year 20.

Figure 9: Graph illustrating the annual revenues composition



4.2.2. Costs

4.2.2.1. Operational Costs

The annual operational costs are divided into three main components, namely the operational costs of the Flex Parking, the Wheelies and the OlegOs. This can be viewed in Annex 2.B.

Based on various assumptions concerning the annual operational costs of the Flex parking, this is estimated at € 420,000. Based on given data, the operational cost estimation of the Wheelie is € 7,300 and of the Olego is € 36,500.

4.2.2.2. Land Rent Costs

The current spatial planning of the Transition Hub requires a certain area of land to be rented from the city's municipality. Based on a flexible parking providing 500 parking spaces, divided over an 8 story building including extra calculated land area for operational purposes, the estimated land area to be rented is 1,375 square meters. Using the rent costs of € 100 per square meter, results in total land rent costs of € 137,500.

4.2.2.3. Maintenance Costs

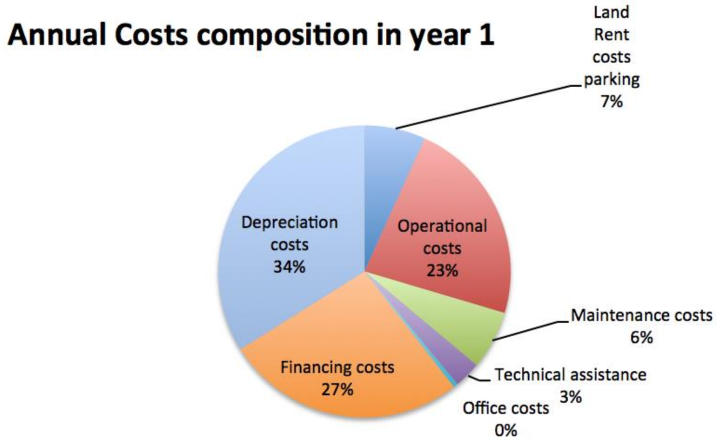
The annual maintenance that is necessary to maintain the operational services of the Transition Hub, is divided in three components: maintenance costs Flex Parking, maintenance costs Wheelies and maintenance costs OlegOs. By using a fixed percentage to estimate the diminishing value of these operational assets, the following maintenance costs are calculated. Maintenance costs Flex Parking are estimated at € 100,000. Using the same methodology, the maintenance costs of the Wheelies and OlegOs amount to respectively € 8,500 and € 23,500.

4.2.2.4. Other Costs

The cost estimation for hiring a full-time highly-skilled employee responsible for the technical assistance, is determined at € 60,000. The costs for operating the main office is estimated at € 10,000 per year. The financing costs (loan repayment plus interest payment), given a fixed interest rate of 6 %, loan period of 20 years and amount of payments annually, are calculated and amount to € 539,037. The Loan Amortization Schedule (annex 2.D.) shows a total cumulative interest of € 4,598,030.36, which is approximately 74% of the original loan amount. The following pie-chart, figure 10, indicates that these financing costs contribute substantially to the total annual costs per year.

Subsequently, after summing up to a subtotal, a contingency of 5% equivalent to € 67,117 is added. Finally, this results in a total operational cost of € 1,409,454.

Figure 10: Graph illustrating the annual costs composition in year 1

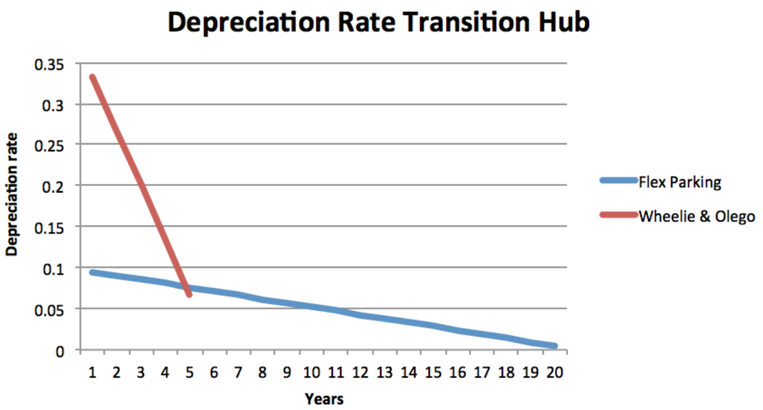


4.2.2.5. Depreciation Costs

By making use of the sum of the years digit method for estimating the systematic depreciation of the Transition Hub and its services, the following results are highlighted in figure 11. In year 1 the Flex Parking has its highest depreciation costs: € 476,190. In year 2 it amounts to € 452,381, in year 3 to € 428,571 and continues so on at a decreasing depreciation rate. In year 20 (last year) only € 23,810 is left to depreciate. The complete depreciation rate schedule of the Transition Hub can be found in Annex 2.C.

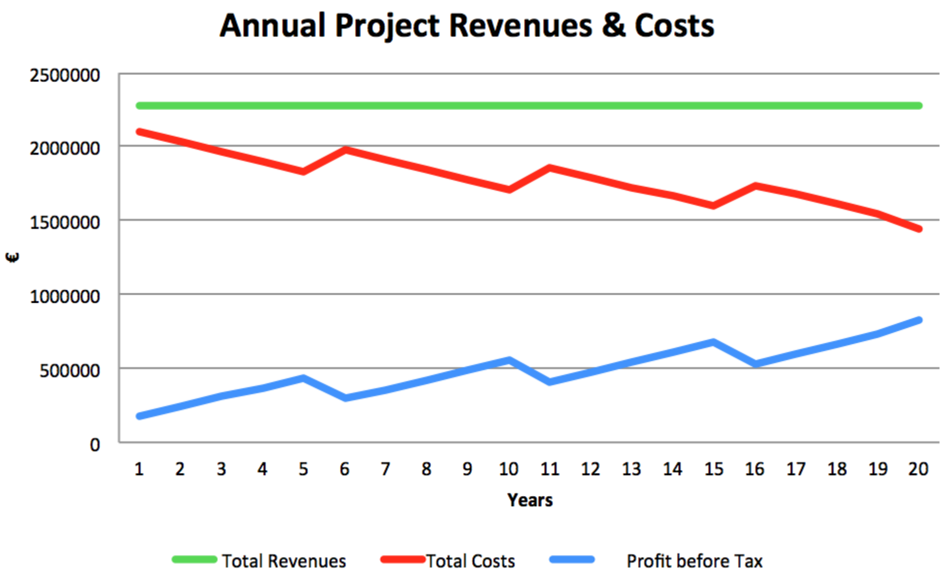
The same methodology is applied to the estimation of the depreciation costs of the Wheelies and the OlegOs, viewable in the profit & loss scheme in the annex 2.B. An important recognition is the fact that depreciation costs do not contribute to a cash outflow and thus are separated in the profit & loss scheme.

Figure 11: Graph illustrating the depreciation rate of the services



The last step in predicting whether the result seems fortunate, based on the estimated cash in- and outflows and depreciation costs, is subtracting the total annual operational costs plus the depreciation costs from the annual revenues. The result, better stated as the profit before tax, takes a value of € 173,722 in year 1. In year 2 the profit before tax increases to a value of € 240,198 and in year 3 a value of € 306,674. The profit before tax result follows this increasing trend, ending with a value of € 828,807 in year 20. This trend is illustrated beneath in figure 12.

Figure 12: Graph illustrating the annual project revenues, costs & profit before tax

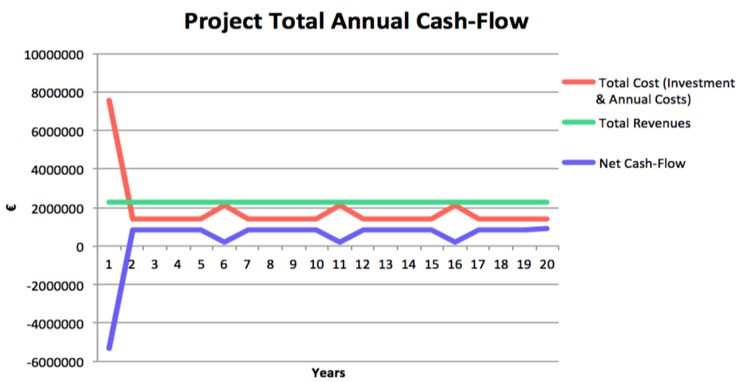


4.3. Cash Flow Analysis

To test whether the projected financial results, under the assumed conditions, appear attractive in economic terms, three standard financial indicators will be used for the assessment. In annex 3 and figure 13, the investment costs and operational costs are summed up and weighed against the revenues, which results in the net cash-flow. In year 1 the net cash-flow shows a negative value of € 5,319,469, which can be explained by the relatively large initial investment costs in that year. The following years a stable net cash-flow is expected of € 863,246 annually, except in year 6, 11, 16. In the latter years the net cash-flow is lower, as result of recurring investment costs of Wheelies and OlegOs every 5 years.

The final assessment of the net cash-flows is as follows. The Internal Rate of Return of the project is calculated at 13 %. The Net Present Value of the project, using a predetermined market interest rate of 6 %, is calculated at € 2,310,305.68. The PayBack Period is calculated at 7.9 years.

Figure 13: Graph illustrating the project total annual cash-flow



4.4. Scenario Analysis

In Annex 4 a scenario analysis can be viewed, where three different, rather pessimistic scenarios are projected. When financially assessing these hypothesized scenarios, the Ceteris Paribus condition is assumed.

Scenario 1: Investment costs + 10 %

The Internal Rate of Return of the project is calculated at 11 %. The Net Present Value of the project, repeatedly using a predetermined market interest rate of 6 %, is calculated at € 2,293,834.93. The PayBack Period is calculated at 8.7 years.

Scenario 2: Operational costs + 10 %

The Internal Rate of Return of the project is calculated at 9 %. The Net Present Value of the project, using the predetermined market interest rate of 6 %, is calculated at € 1,370,702.57. The PayBack Period is calculated at 9.5 years.

Scenario 3: Revenues - 10 %

The Internal Rate of Return of the project is calculated at 7 %. The Net Present Value of the project, using the predetermined market interest rate of 6 %, is calculated at € 379,567.43. The PayBack Period is calculated at 11.8 years.

4.5. Sensitivity Analysis

In addition to the previously done scenario analysis, a comprehensive sensitivity analysis has been done. The extent to which various parameters of the fixed investment, annual cost and annual revenue affect the estimated financial results, can be viewed in Annex 5.

A. Fixed initial investment

Starting with the explanatory parameters "construction costs per parking space" and "amount of parking spaces" in a two-way sensitivity analysis, the degree of influence on the initial construction costs of the Flex Parking is examined. The pie-chart (figure 7) illustrating the composition of the total investment costs, indicate that the construction of the Flex Parking is accountable for the largest share (85%) of the total investment costs. Thus, acknowledging the importance of the "construction costs per parking space" is varied with a plausible range with a minimum value of 25 % below the average value and the maximum of 25 % above the average value. Consequentially, the range for this parameter is between € 7,500 and € 12,500 per parking space.

The “amount of parking spaces” is varied between the possibility of constructing a parking with 250 (smaller version) and a larger one of 750 parking spaces. The outcome of this analysis results in a range of the construction costs of the Flex Parking between € 3,750,000 and € 6,250,000. Placing this in a cash flow scheme, the outcome is assessed by means of the accustomed financial indicators.

At a minimum value of € 3,750,000 of the initial construction costs of the Flex Parking, under stable circumstances, the IRR takes a value of 19% and the NPV a value of € 4,224,543,97. The PayBack Period is calculated at 6.4 years.

At the maximum value of € 6,250,000 of the initial construction costs of the Flex Parking, under stable circumstances, the IRR takes a value of 9 % and the NPV a value of € 1,748,128,88. The PayBack Period is calculated at 9.5 years.

B. Revenues

When looking at the pie-chart (figure 9) illustrating the composition of the revenues, the sales short parking will be responsible for 70 % of the total revenues annually. This fact emphasizes the need for further assessment of this dependent parameter, taking into account the influences of multiple explanatory input parameters.

Further elaborating on this, the explanatory parameters “average parking hours” and “parking tariff per hour” are the most influential, when considering the revenue driving factors from short parking customers. Varying the “average parking hours” between 3 and 7 hours per parking space and the “parking tariff per hour” between € 1.8 and € 3, results in the outcome values listed in Annex 5.B. To reflect the influence of this range in revenues from sales of short parking on the result, two additional schemes are placed in Annex 5.B, showing both the IRR and the NPV outcomes, using the same inputs.

Using the dependent parameter “sales short parkings” once again while holding the “amount of parking spaces” constant at 500, the sensitivity of this revenue outcome can be tested by varying the assumed proportion of parking subscriptions over a range of 0,1 to 0,4. Consequentially, the outcome is distributed over an interval range of € 1,269,324 to € 1,903,986. To further process these outcomes in revenues, two new cash-flow schemes are shown in Annex 5.B. The first shows the IRR, NPV and PBP when using the bottom value of the range to indicate its effect on the financial results. This consists of a IRR of 4 %, a NPV of € -653,425.14 and a PBP of 13.8 years. The second shows the IRR of 21 %, a NPV of € 6,626,098 and PBP of 5.6 years when using the top value of the mentioned range.

C. Costs

The last part of the sensitivity analysis consists of a deepened view of the impact of cost fluctuation on the financial results. In the pie-chart (figure 10) the cost composition is illustrated, evidently demonstrating that managing the “depreciation costs” and “financing costs” is of great importance.

Starting with the dependent parameter “financing costs”, principally predicted by the “interest rate” and the “loan amount”, a sensitivity scheme can be set up and viewed in Annex 5.C. The “interest rate” is varied over an interval ranging from 2 % up to 10 %, with the current market interest rate of 6 % being used in the base-situation. The “loan amount” is varied over values with a 10 % and 25 % diverging spread, using € 6,182,715 as initial loan amount as base-value. This interval outcome ranges between the yearly financing cost values: € 378,114.56 and € 726,219.38.

To further process these outcomes in revenues, two new cash-flow schemes are shown. The first shows the IRR, NPV and PBP when using the bottom value of the range, to indicate its effect on the financial results. This consists of a IRR of 17 %, a NPV of € 4,914,406.44 and a PBP of 6.6 years. The second shows the IRR of 8 %, a NPV of € 722,034.77 and PBP of 11.3 years when using the top value of the mentioned range.

5. Conclusion

This study started off with the situation description of metropolitan cities; parking is a growing source of frustration for daily travellers by car, especially during rush hours. Congestion is an enormous problem, that will likely increase in the future due to demographic trends and insufficient societal and infrastructural adaptation. Congestion could be solved for a great deal by improving currently existing parkings in terms of efficiency and by building new, innovative and thus better parkings.

This study is embedded within the latest trends using business idea and products of Van der Wijngaart's Engineering Services, which are applicable to the city of Rotterdam. To gain a better understanding of this comprehensive business problem, the research revolved around the question:

"Is the Transition Hub economically feasible for implementation in Rotterdam?"

This study has dealt with the financial layout of the Transition Hub, the OlegO and the Wheelie and their facilities, ultimately leading to a purposeful and credible economical feasibility approach and determination.

By closely examining the series of results in the previous chapter, we can conclude and discuss the following.

To determine whether this project is economically feasible, three different financial indicators have been used for assessment of the financial analysis. The rule of thumb for assessing positive economic feasibility for similar projects states that the IRR should be at least between 10% and 20% . This project generates an IRR of 13 % in the base-situation, suggesting that the Transition Hub qualifies as an economically feasible project.

The Net Present Value (NPV) indicates a positive financial result when it is greater than zero. The NPV of the Transition Hub in the base-situation is € 2,986,336.43, suggesting that this project is economically promising. Thus, based on the assumptions, has a positive outlook in terms of expected financial returns. Hence, the theory indicates that it would be financially responsible, advantageous and lucrative to exploit this project.

The PayBack Period (PBP) indicates the duration of time necessary for the initial investment costs to be earned back, which is in this specific case around 7,9 years. Whether this duration qualifies as a favourable or reasonable earning-back period can be controversial. A private investor might possibly consider this a somewhat unfortunate PayBack Period because it mainly strives for maximized profits, while the municipality might experience such a duration as reasonable because it is in less of a hurry to earn its investment back.

At last, the final conclusion and the ultimate answer can be given regarding the central question of this study: “Is the Transition Hub economically feasible for implementation in Rotterdam?”. The Flex Parking with its complementary, coherent components altogether forming the Transition Hub, qualifies as an economically feasible project.

However, it is important to take note of the fact that this seemingly promising financial outcome cannot automatically be considered a very strong signal of success. This point can be enforced by examining the rather ‘unfortunate’ outcomes of the scenario analysis. The results of this analysis show that, when comparing the financial outcomes of all three scenario’s, there is a considerable difference. To begin with the IRR, the scenario summary in annex 4.D provides a clear and easy view for comparison. Scenario 1 shows a drop in the IRR by 2% (from 13% to 11%), which is the relatively smallest deviation from the base-situation. The second and third scenario respectively show a relative drop of 4% and 6% in the IRR. This can be generally interpreted as follows: a scenario where the investment costs tend to diverge by a margin of 10% from the base case value affect the Internal Rate of Return less strongly compared to a scenario where the annual operational costs or the revenues diverge by the same margin. Examining the NPV and the PBP of all three scenario’s shows us a similar finding. To conclude, the financial result has the strongest dependence on the revenues, which emphasizes the importance of generating sufficient revenues to keep this project economically feasible.
We strongly advise the executor of the project to bear this important finding in mind, especially when making decisions regarding the establishment on strategical locations or marketing of the Transition Hub. By logical reasoning, the location and marketing of the Transition Hub will the most important factors affecting the revenues. By selecting the right location to set up the Transition Hub, the demand for the provided services can be optimized. By developing a sophisticated, strategic and long term marketing plan to introduce this new, innovative and more efficient way of parking, the probability of success can be increased. However, it is crucial to understand that although the revenues definitely deserve the most focus, it is of great importance to also manage the costs of constructing this project and the annual operational costs. Because of the project life expectancy, the progress can be steadily monitored and improved when and where necessary.

Also, the sensitivity analysis provides a good measurement of possible deviation from the base-situation. Starting with the first part, which solely places focus on the initial investment costs of the

Flex Parking, the findings indicate the possible outcomes. Using the interval of € 3,750,000 and € 6,250,000 for the initial construction costs of the Flex Parking, it can be concluded that the financial outcomes seem more favourable towards the lower bound of the interval. Hence, seeking for cheaper ways to construct the Flex parking or equivalently lowering the construction costs per parking space can prove to be extremely profitable. As a result of lower construction costs, a shorter period of time is necessary to earn back the investment costs.

The second part of the sensitivity analysis tests the sensitivity of the revenue driving parameters on the financial outcome. In a worst case situation where both parameters fall to an unexpectedly low level, the revenues fall to around € 800,000 annually, the IRR falls to around -15%, the NPV to around € -5 million. Consequentially, the revenues will not be able to cover the projected yearly expenses and earning back the investment will be impossible. In the best case situation where both parameters ascend to extremely favourable values, the revenues increase to almost double of the annual revenues in the base-situation, the IRR to around 40 % and the NPV to around € 16 million. This situation can be seen as utopian and would prove that this innovative business idea is a born-success and provides blooming prosperous expanding opportunities.

A similar reasoning can be given to the financial outcomes, when allowing the proportion of the parking subscribers to deviate from the predictions. A smaller proportion of subscribers implicate considerably higher profits and thus better financial results. However, this also implies less certainty in revenues, as subscribing parkers are committed to their contract.

The final part of the sensitivity analysis looked at the sensitivity of the costs on the financial results. The results indicate that the financing costs play a big role, as it is responsible for a huge part of the total annual costs. Thus, when attracting financial resources to exploit this project it is essential to thoroughly negotiate the loan terms with respect to the interest rate and the amount of payments annually. Another possible, smart way of mitigating the annual financial pressure from the existing liabilities is by using the yearly net profit to (partially) to make additional reimbursements. This is strongly recommended because the optional extra reimbursements will result in a much smaller period of repayment leading to substantial savings in interest payments. For example, assuming an additional reimbursements of € 200,000 annually would result into a repayment period of 12 years instead of 20 years. The cumulative interest would be € 2,659,054.27, which is a reduction of 42% in total interest payments, indicating the importance of serious consideration. Also, viewed from an overall perspective, managing the investment costs as a whole will result in less necessary financial capital to be borrowed, resulting in less pressure on the cost-side each year.

Finally, this thesis elaborated on the economic feasibility of the Transition Hub and suggests that implementation in the city of Rotterdam is strongly recommended, under the assumed circumstances. Follow-up research could estimate whether this financial feasibility model is useful and practical for other large, major cities and promote the paradigm shift that is gradually taking place with respect to city mobility.

6. Bibliography

Adriaanse, M. (2013, december 24). *Elektrische auto's in trek*. Retrieved from Elektrischeauto.nl: http://elektrischeauto.com/elektrische_auto_verkoop_2013/ (Accessed on 15 May 2015)

Arnott, R. (2005). *Spatial Competition between Parking Garages and Downtown Parking Policy.* Boston: Boston College.

Arnott, R., & Rowse, J. (2009). Downtown parking in auto city. *Regional Science and Urban Economics* Vol. 39, 1-14.

Ballester, F., Medina, S., Boldo, E., Goodman, P., Neuberger, M., Iniguez, C., & Künzli, N. (2008). Reducing ambient levels of fine particulates could substantially improve health: a mortality impact assessment for 26 European cities. *Journal of Epidemial Community Health, Vol. 62*, 98-105.

Björnsdóttir, A. R. (2010). Financial Feasibility Assessments. Reykjavik: Faculty of Industrial Engineering, Mechanical Engineering and Computer Science university of Iceland.

Burdorf, L. (2009). Ongezondste stad. *Monitor Erasmus MC, no. 5*, 15-18.

Centraal Bureau voor de Statistiek. (2013, January 4). *Bevolking vier grote steden groeit tot 2040 met 333 duizend inwoners*. Retrieved from Centraal Bureau voor de Statistiek: http://www.cbs.nl/nl-NL/menu/themas/bevolking/publicaties/bevolkingstrends/archief/2012/2013-bevolkingstrends-groei-grote-steden-art.htm?RefererType=RSSItem (Accessed on 15 May 2015)

Centraal Bureau voor de Statistiek. (2015). *CBS Statline*. Retrieved from CBS: http://www.cbs.nl/nl-NL/menu/themas/macro-economie/nieuws/default.htm (Accessed on 15 May 2015)

Cheshire, P., & Sheppard, S. (1995). On the Price of Land and the Value of Amenities. *Economica, Vol. 62*, 247-267.

Crainic, T. G., Ricciardi, N., & Storchi, G. (2004). Advanced freight transportation systems for congested urban areas. *Transportation Research part C: Emerging Technologies* Vol. 12, 119-137.

Ecorys. (2007). *Van parkeerbeheer naar mobiliteitsmanagement.* Ede: CROW.

Forbes. (2010, December 15). *Consumers Overwhelmingly Want CSR*. Retrieved from Forbes: http://www.forbes.com/sites/csr/2010/12/15/new-study-consumers-demand-companies-implement-csr-programs/ (Accessed on 16 May 2015)

Gerritsen, M. (2009). *Parkeren is Ris(man)keren.* Amsterdam: Amsterdam School of Estate.

INRIX. (2012). *Files dalen wereldwijd: INRIX Traffic Scorecard geeft een onthullende blik op de worstelende economieën in Europa.* Amsterdam: INRIX.

Investopedia. (2015). Payback Period. Retrieved from Investopedia: http://www.investopedia.com/terms/p/paybackperiod.asp (Accessed on 21 July 2015)

IRD. (2015, June 30). *Depreciation methods for fixed assets*. Retrieved from IRD: http://www.ird.govt.nz/business-income-tax/depreciation/bit-depreciation-methods.html Accessed on 20 May 2015)

Jansson, J. O. (2010). Road pricing and parking policy. *Research in Transportation Economics* Vol. 29, 346-353.

Knaap, R. v., & Wee, B. v. (2004). *Hoe te komen tot een transitie naar duurzame mobiliteit: een verkenning van theorieën.* Zeist: Colloquium Vervoersplanologisch Speurwerk.

Landelijk Meetnet Luchtkwaliteit. (2015). *Actuele luchtkwaliteit fijnstof*. Retrieved from Landelijk Meetnet Luchtkwaliteit Rijksinstituut voor Volksgezondheid en Milieu: http://www.lml.rivm.nl/index.php (Accessed on 29 May 2015)

McKinsey & Company. (2014). *Evolution. Electric Vehicles in Europe: gearing up for a new phase?* Amsterdam: Amsterdam Roundtable Foundation.

Nederland Elektrisch. (2015). *Subsidies*. Retrieved from Nederlandelektrisch.nl: http://www.nederlandelektrisch.nl/thema/bedrijf/regelingen-subsidies/ (Accessed on 29 May 2015)

Nijkamp, P., & Rienstra, S. (1993). Private Sector Involvement In Financing Transport Infrastructure: a Historical Sketch, Current Practice and Some Lessons. *Research Memorandum* Vol. 67.

Postma, T., & Liebl, F. (2005). How to improve scenario analysis as a strategic management tool? *Technological Forecasting & Social Change* Vol. 72, 161 – 173.

Q-Park NV. (2013). *Jaarverslag 2013 Q-Park.* Maastricht: Q-Park NV.

Rotterdam.nl. (2015). *overzicht openbare parkeergarages*. Retrieved from Rotterdam.nl: http://www.rotterdam.nl/overzichtopenbareparkeergarages (Accessed on 30 May 2015)

Roubos, L. (2013, March 7). *Steeds meer parkeerproblemen rond Keizerswaard*. Retrieved from Rijnmond: http://www.rijnmond.nl/nieuws/07-03-2013/steeds-meer-parkeerproblemen-rond-keizerswaard (Accessed on 15 May 2015)

Schade, J. (2007, January). *Life Cycle Cost Calculation Models for Buildings*. Retrieved from Researchgate: http://www.researchgate.net/profile/Jutta_Schade/publication/242404432_LIFE_CYCLE_COST_CALCULATION_MODELS_FOR_BUILDINGS/links/53f480250cf22be01c3ec750.pdf (Accessed on 20 May 2015)

Schultz, H. S. (2005). Internal Rate of Return. *Mathematics Teacher* Vol. 98, 531-533.

Sierzchula, W., Bakker, S., Maat, K., & van Wee, B. (2015). Worden door financiële prikkels meer elektrische auto's verkocht? *Tijdschrift Vervoerswetenschap* Vol. 51, 110-131.

TNO. (2008). *De kosten van de kwetsbaarheid van het wegennet in de Randstad in 2008 en 2030.* Delft: TNO.

Verkeersnet. (2009, July 22). *Ondergrondse parkeerplaats kost halve ton*. Retrieved from Verkeersnet.nl: http://www.verkeersnet.nl/1727/ondergrondse-parkeerplaats-kost-halve-ton/ (Accessed on 15 May 2015)

Wilkinson, J. (2013, July 24). *Investment Analysis*. Retrieved from Strategic CFO: http://strategiccfo.com/wikicfo/investment-analysis/

7. Annexes

ANNEX 1: INVESTMENT SCHEME TRANSITION HUB (€)

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Buildings																				
Construction Flex Parking	5000000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction Wheelie Facility	20000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction OlegO Facility	130000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction Main Office	50000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction Charging Points	48300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acquisition																				
Wheelie	170000	0	0	0	0	170000	0	0	0	0	170000	0	0	0	0	170000	0	0	0	0
Olego	470000	0	0	0	0	470000	0	0	0	0	470000	0	0	0	0	470000	0	0	0	0
																		0	0	0
Subtotal	5888300	0	0	0	0	640000	0	0	0	0	640000	0	0	0	0	640000	0	0	0	0
Contingency (5%)	294415	0	0	0	0	32000	0	0	0	0	32000	0	0	0	0	32000	0	0	0	0
Total (Euro)	**6182715**	**0**	**0**	**0**	**0**	**672000**	**0**	**0**	**0**	**0**	**672000**	**0**	**0**	**0**	**0**	**672000**	**0**	**0**	**0**	**0**
Total Project investment	**8198715**																			

ANNEX 2: PROFIT & LOSS TRANSITION HUB (€)

Year	1	2	3	4	5	6	7	8	9	10
A. REVENUES										
Sales parking short-parking	1586655	1586655	1586655	1586655	1586655	1586655	1586655	1586655	1586655	1586655
Sales parking subscriptions	260820	260820	260820	260820	260820	260820	260820	260820	260820	260820
Revenue Wheelie rent	105850	105850	105850	105850	105850	105850	105850	105850	105850	105850
Revenue Olego rent	319375	319375	319375	319375	319375	319375	319375	319375	319375	319375
Total Revenues	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**
B. COSTS										
Operational costs Parking	420000	420000	420000	420000	420000	420000	420000	420000	420000	420000
Operational costs Olego	36500	36500	36500	36500	36500	36500	36500	36500	36500	36500
Operational costs Wheelie	7300	7300	7300	7300	7300	7300	7300	7300	7300	7300
Land rent costs parking	137500	137500	137500	137500	137500	137500	137500	137500	137500	137500
Maintenance Parking	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000
Maintenance Olego	23500	23500	23500	23500	23500	23500	23500	23500	23500	23500
Maintenance Wheelie	8500	8500	8500	8500	8500	8500	8500	8500	8500	8500
Technical assistance	60000	60000	60000	60000	60000	60000	60000	60000	60000	60000
Office costs	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
Financing costs	539037	539037	539037	539037	539037	539037	539037	539037	539037	539037
Subtotal	1342337	1342337	1342337	1342337	1342337	1342337	1342337	1342337	1342337	1342337
Contingency (5%)	67117	67117	67117	67117	67117	67117	67117	67117	67117	67117
Total Operational Costs	**1409454**	**1409454**	**1409454**	**1409454**	**1409454**	**1409454**	**1409454**	**1409454**	**1409454**	**1409454**
Cash Flow	863246	863246	863246	863246	863246	863246	863246	863246	863246	863246
Depreciation Flex Parking	476190	452381	428571	404762	380952	357143	333333	309524	285714	261905
Depreciation Olego	156667	125333	94000	62667	31333	156667	125333	94000	62667	31333
Depreciation Wheelie	56667	45333	34000	22667	11333	56667	45333	34000	22667	11333
Profit before Tax	**173722**	**240198**	**306674**	**373151**	**439627**	**292770**	**359246**	**425722**	**492198**	**558674**

Year	11	12	13	14	15	16	17	18	19	20
A. REVENUES										
Sales parking short-parking	1586655	1586655	1586655	1586655	1586655	1586655	1586655	1586655	1586655	1586655
Sales parking subscriptions	260820	260820	260820	260820	260820	260820	260820	260820	260820	260820
Revenue Wheelie rent	105850	105850	105850	105850	105850	105850	105850	105850	105850	105850
Revenue Olego rent	319375	319375	319375	319375	319375	319375	319375	319375	319375	319375
Total Revenues	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**
B. COSTS										
Operational costs Parking	420000	420000	420000	420000	420000	420000	420000	420000	420000	420000
Operational costs Olego	36500	36500	36500	36500	36500	36500	36500	36500	36500	36500
Operational costs Wheelie	7300	7300	7300	7300	7300	7300	7300	7300	7300	7300
Land rent costs parking	137500	137500	137500	137500	137500	137500	137500	137500	137500	137500
Maintenance Parking	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000
Maintenance Olego	23500	23500	23500	23500	23500	23500	23500	23500	23500	23500
Maintenance Wheelie	8500	8500	8500	8500	8500	8500	8500	8500	8500	8500
Technical assistance	60000	60000	60000	60000	60000	60000	60000	60000	60000	60000
Office costs	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
Financing costs	539037	539037	539037	539037	539037	539037	539037	539037	539037	508526
Subtotal	1342337	1342337	1342337	1342337	1342337	1342337	1342337	1342337	1342337	1311826
Contingency (5%)	67117	67117	67117	67117	67117	67117	67117	67117	67117	65591
Total Operational Costs	**1409454**	**1409454**	**1409454**	**1409454**	**1409454**	**1409454**	**1409454**	**1409454**	**1409454**	**1377417**
Cash Flow	863246	863246	863246	863246	863246	863246	863246	863246	863246	895283
Depreciation Flex Parking	238095	214286	190476	166667	142857	119048	95238	71429	47619	23810
Depreciation Olego	156667	125333	94000	62667	31333	156667	125333	94000	62667	31333
Depreciation Wheelie	56667	45333	34000	22667	11333	56667	45333	34000	22667	11333
Profit before Tax	**411817**	**478293**	**544770**	**611246**	**677722**	**530865**	**597341**	**663817**	**730293**	**828807**

ANNEX 2.C.: Depreciation Schedule Transition Hub

Year	DEPRECIATION RATE OLEGO + WHEELIE	DEPRECIATION RATE FLEX PARKING
1	0,33	0,10
2	0,27	0,09
3	0,20	0,09
4	0,13	0,08
5	0,07	0,08
6		0,07
7		0,07
8		0,06
9		0,06
10		0,05
11		0,05
12		0,04
13		0,04
14		0,03
15		0,03
16		0,02
17		0,02
18		0,01
19		0,01
20		0,00

v.d. WIJNGAART'S
ENGINEERING SERVICES

ANNEX 2.D.: Loan Amortization Schedule (€)

Loan Amortization Schedule

Enter values	
Loan amount	€ 6.182.715,00
Annual interest rate	6,00 %
Loan period in years	20
Number of payments per year	1
Start date of loan	01/01/16
Optional extra payments	€ -

Loan summary	
Scheduled payment	€ 539.037,27
Scheduled number of payments	20
Actual number of payments	20
Total early payments	€ -
Total interest	€ 4.598.030,36

Lender name:

Project Name: TRANSITION HUB

Pmt No.	Payment Date	Beginning Balance	Scheduled Payment	Extra Payment	Total Payment	Principal	Interest	Ending Balance	Cumulative Interest
1	01/01/17	€ 6.182.715,00	€ 539.037,27	€ -	€ 539.037,27	€ 168.074,37	€ 370.962,90	€ 6.014.640,63	€ 370.962,90
2	01/01/18	€ 6.014.640,63	€ 539.037,27	€ -	€ 539.037,27	€ 178.158,83	€ 360.878,44	€ 5.836.481,80	€ 731.841,34
3	01/01/19	€ 5.836.481,80	€ 539.037,27	€ -	€ 539.037,27	€ 188.848,36	€ 350.188,91	€ 5.647.633,44	€ 1.082.030,25
4	01/01/20	€ 5.647.633,44	€ 539.037,27	€ -	€ 539.037,27	€ 200.179,26	€ 338.858,01	€ 5.447.454,18	€ 1.420.888,25
5	01/01/21	€ 5.447.454,18	€ 539.037,27	€ -	€ 539.037,27	€ 212.190,02	€ 326.847,25	€ 5.235.264,16	€ 1.747.735,50
6	01/01/22	€ 5.235.264,16	€ 539.037,27	€ -	€ 539.037,27	€ 224.921,42	€ 314.115,85	€ 5.010.342,74	€ 2.061.851,35
7	01/01/23	€ 5.010.342,74	€ 539.037,27	€ -	€ 539.037,27	€ 238.416,70	€ 300.620,56	€ 4.771.926,04	€ 2.362.471,92
8	01/01/24	€ 4.771.926,04	€ 539.037,27	€ -	€ 539.037,27	€ 252.721,71	€ 286.315,56	€ 4.519.204,33	€ 2.648.787,48
9	01/01/25	€ 4.519.204,33	€ 539.037,27	€ -	€ 539.037,27	€ 267.885,01	€ 271.152,26	€ 4.251.319,33	€ 2.919.939,74
10	01/01/26	€ 4.251.319,33	€ 539.037,27	€ -	€ 539.037,27	€ 283.958,11	€ 255.079,16	€ 3.967.361,22	€ 3.175.018,90
11	01/01/27	€ 3.967.361,22	€ 539.037,27	€ -	€ 539.037,27	€ 300.995,60	€ 238.041,67	€ 3.666.365,62	€ 3.413.060,57
12	01/01/28	€ 3.666.365,62	€ 539.037,27	€ -	€ 539.037,27	€ 319.055,33	€ 219.981,94	€ 3.347.310,29	€ 3.633.042,51
13	01/01/29	€ 3.347.310,29	€ 539.037,27	€ -	€ 539.037,27	€ 338.198,65	€ 200.838,62	€ 3.009.111,64	€ 3.833.881,13
14	01/01/30	€ 3.009.111,64	€ 539.037,27	€ -	€ 539.037,27	€ 358.490,57	€ 180.546,70	€ 2.650.621,07	€ 4.014.427,83
15	01/01/31	€ 2.650.621,07	€ 539.037,27	€ -	€ 539.037,27	€ 380.000,00	€ 159.037,26	€ 2.270.621,07	€ 4.173.465,09
16	01/01/32	€ 2.270.621,07	€ 539.037,27	€ -	€ 539.037,27	€ 402.800,00	€ 136.237,26	€ 1.867.821,06	€ 4.309.702,35
17	01/01/33	€ 1.867.821,06	€ 539.037,27	€ -	€ 539.037,27	€ 426.968,00	€ 112.069,26	€ 1.440.853,06	€ 4.421.771,62
18	01/01/34	€ 1.440.853,06	€ 539.037,27	€ -	€ 539.037,27	€ 452.586,08	€ 86.451,18	€ 988.266,97	€ 4.508.222,80
19	01/01/35	€ 988.266,97	€ 539.037,27	€ -	€ 539.037,27	€ 479.741,25	€ 59.296,02	€ 508.525,72	€ 4.567.518,82
20	01/01/36	€ 508.525,72	€ 539.037,27	€ -	€ 508.525,72	€ 478.014,18	€ 30.511,54	€ -	€ 4.598.030,36

ANNEX 3: CASH FLOW ANALYSIS/FINANCIAL RATE OF RETURN TRANSITION HUB (€)

Year	1	2	3	4	5	6	7	8	9	10
Cash Flow										
Investment	6182715	0	0	0	0	672000	0	0	0	0
Operational Costs	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454
Total Cost	**7592169**	**1409454**	**1409454**	**1409454**	**1409454**	**2081454**	**1409454**	**1409454**	**1409454**	**1409454**
Total Revenues	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**
Net Cash-Flow	**-5319469**	**863246**	**863246**	**863246**	**863246**	**191246**	**863246**	**863246**	**863246**	**863246**

Year	11	12	13	14	15	16	17	18	19	20
Cash Flow										
Investment	672000	0	0	0	0	672000	0	0	0	0
Operational Costs	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	137741
Total Cost	**2081454**	**1409454**	**1409454**	**1409454**	**1409454**	**2081454**	**1409454**	**1409454**	**1409454**	**137741**
Total Revenues	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**227270**
Net Cash-Flow	**191246**	**863246**	**863246**	**863246**	**863246**	**191246**	**863246**	**863246**	**863246**	**895283**

Internal Rate of Return	**13%**
Net Present Value (i=6%)	**€2.986.336,43**
PayBack Period	**7.9**

ANNEX 4: SCENARIO ANALYSIS TRANSITION HUB (€)

a: Cash Flow: Investment costs + 10% (€)

Year	1	2	3	4	5	6	7	8	9	10
Investment	6.800.987	0	0	0	0	739.200	0	0	0	0
Operational costs & Other	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454
Total Cost	8.210.441	1.409.454	1.409.454	1.409.454	1.409.454	2.148.654	1.409.454	1.409.454	1.409.454	1.409.454
Total Revenues	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700
Net Cash-flow	**-5.937.741**	**863.246**	**863.246**	**863.246**	**863.246**	**124.046**	**863.246**	**863.246**	**863.246**	**863.246**

Year	11	12	13	14	15	16	17	18	19	20
Investment	739.200	0	0	0	0	739.200	0	0	0	0
Operational costs & Other	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.377.417
Total Cost	2.148.654	1.409.454	1.409.454	1.409.454	1.409.454	2.148.654	1.409.454	1.409.454	1.409.454	1.377.417
Total Revenues	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700
Net Cash-flow	**124.046**	**863.246**	**863.246**	**863.246**	**863.246**	**124.046**	**863.246**	**863.246**	**863.246**	**895.283**

Internal Rate of Return	**11%**
Net Present Value (i=6%)	**€2.293.834,93**
Payback Period	**8.7**

v.d. WIJNGAART'S ENGINEERING SERVICES

b: Cash Flow: Operational costs + 10% (€)

Year	1	2	3	4	5	6	7	8	9	10
Investment	6.182.715	0	0	0	0	672.000	0	0	0	0
Operational costs & Other	1.550.400	1.550.400	1.550.400	1.550.400	1.550.400	1.550.400	1.550.400	1.550.400	1.550.400	1.550.400
Total Cost	7.733.115	1.550.400	1.550.400	1.550.400	1.550.400	2.222.400	1.550.400	1.550.400	1.550.400	1.550.400
Total Revenues	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700
Net Cash-flow	**-5.460.415**	**722.300**	**722.300**	**722.300**	**722.300**	**50.300**	**722.300**	**722.300**	**722.300**	**722.300**

Year	11	12	13	14	15	16	17	18	19	20
Investment	672.000	0	0	0	0	672.000	0	0	0	0
Operational costs & Other	1.550.400	1.550.400	1.550.400	1.550.400	1.550.400	1.550.400	1.550.400	1.550.400	1.550.400	1.515.159
Total Cost	2.222.400	1.550.400	1.550.400	1.550.400	1.550.400	2.222.400	1.550.400	1.550.400	1.550.400	1.515.159
Total Revenues	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700	2.272.700
Net Cash-flow	**50.300**	**722.300**	**722.300**	**722.300**	**722.300**	**50.300**	**722.300**	**722.300**	**722.300**	**757.541**

Internal Rate of Return	**9%**
Net Present Value (i=6%)	**€1.370.702,57**
Payback Period	**9.5**

c: Cash Flow: Revenues - 10% (€)

Year	1	2	3	4	5	6	7	8	9	10
Investment	6.182.715	0	0	0	0	672.000	0	0	0	0
Operational costs & Other	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454
Total Cost	7.592.169	1.409.454	1.409.454	1.409.454	1.409.454	2.081.454	1.409.454	1.409.454	1.409.454	1.409.454
Total Revenues	2.045.430	2.045.430	2.045.430	2.045.430	2.045.430	2.045.430	2.045.430	2.045.430	2.045.430	2.045.430
Net Cash-flow	**-5.546.739**	**635.976**	**635.976**	**635.976**	**635.976**	**-36.024**	**635.976**	**635.976**	**635.976**	**635.976**

Year	11	12	13	14	15	16	17	18	19	20
Investment	672.000	0	0	0	0	672.000	0	0	0	0
Operational costs & Other	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.409.454	1.377.417
Total Cost	2.081.454	1.409.454	1.409.454	1.409.454	1.409.454	2.081.454	1.409.454	1.409.454	1.409.454	1.377.417
Total Revenues	2.045.430	2.045.430	2.045.430	2.045.430	2.045.430	2.045.430	2.045.430	2.045.430	2.045.430	2.045.430
Net Cash-flow	**-36.024**	**635.976**	**635.976**	**635.976**	**635.976**	**-36.024**	**635.976**	**635.976**	**635.976**	**668.013**

Internal Rate of Return	**7%**
Net Present Value (i=6%)	**€379.567,43**
Payback Period	**11.8**

D. SCENARIO SUMMARY	Base Case	Scenario 1	Scenario 2	Scenario 3
IRR	13%	11%	9%	7%
NPV	€ 2.986.336,43	€ 2.293.834,93	€ 1.370.702,57	€ 379.567,43
PBP (years)	7,9	8,7	9,5	11,8

ANNEX 5: SENSITIVITY ANALYSIS TRANSITION HUB (€)

A. INITIAL INVESTMENT

		AMOUNT OF PARKING SPACES		
DEPENDENT: CONSTRUCTION FLEX PARKING	**5000000**	250	500	750
CONSTRUCTION COSTS PER PARKING SPACE	7500	1875000	3750000	5625000
	9000	2250000	4500000	6750000
	10000	2500000	**5000000**	7500000
	11000	2750000	5500000	8250000
	12500	3125000	6250000	9375000

CONSTRUCTION COSTS FLEX PARKING RANGE IN € [3750000,6250000]

INPUT LOWER BOUND: € 3,750,000

Year	1	2	3	4	5	6	7	8	9	10
Cash Flow										
Investment	4870215	0	0	0	0	672000	0	0	0	0
Operational Costs	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454
Total Cost	**6279669**	**1409454**	**1409454**	**1409454**	**1409454**	**2081454**	**1409454**	**1409454**	**1409454**	**1409454**
Total Revenues	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**
Net Cash-flow	**-4006969**	**863246**	**863246**	**863246**	**863246**	**191246**	**863246**	**863246**	**863246**	**863246**

Year	11	12	13	14	15	16	17	18	19	20
Cash Flow										
Investment	672000	0	0	0	0	672000	0	0	0	0
Operational Costs	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1377417
Total Cost	**2081454**	**1409454**	**1409454**	**1409454**	**1409454**	**2081454**	**1409454**	**1409454**	**1409454**	**1377417**
Total Revenues	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**
Net Cash-flow	**191246**	**863246**	**863246**	**863246**	**863246**	**191246**	**863246**	**863246**	**863246**	**895283**

Internal Rate of Return	**19%**
Net Present Value (i=6%)	**€4.224.543,97**
Payback Period	**6.4**

INPUT UPPER BOUND: € 6,250,000

Year	1	2	3	4	5	6	7	8	9	10
Cash Flow										
Investment	7495215	0	0	0	0	672000	0	0	0	0
Operational Costs	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454
Total Cost	**8904669**	**1409454**	**1409454**	**1409454**	**1409454**	**2081454**	**1409454**	**1409454**	**1409454**	**1409454**
Total Revenues	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**
Net Cash-flow	**-6631969**	**863246**	**863246**	**863246**	**863246**	**191246**	**863246**	**863246**	**863246**	**863246**

Year	11	12	13	14	15	16	17	18	19	20
Cash Flow										
Investment	672000	0	0	0	0	672000	0	0	0	0
Operational Costs	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1377417
Total Cost	**2081454**	**1409454**	**1409454**	**1409454**	**1409454**	**2081454**	**1409454**	**1409454**	**1409454**	**1377417**
Total Revenues	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**
Net Cash-flow	**191246**	**863246**	**863246**	**863246**	**863246**	**191246**	**863246**	**863246**	**863246**	**895283**

Internal Rate of Return	**9%**
Net Present Value (i=6%)	**€1.748.128,88**
Payback Period	**9.5**

B. REVENUES

		PARKING TARIFF PER HOUR				
DEPENDENT: SALES SHORT PARKING	**€1.586.655,00**	**1,8**	**2,16**	**2,4**	**2,64**	**3**
AVERAGE PARKING HOURS	**3**	€713.994,75	€856.793,70	€951.993,00	€1.047.192,30	€1.189.991,25
	4	€951.993,00	€1.142.391,60	€1.269.324,00	€1.396.256,40	€1.586.655,00
	5	€1.189.991,25	€1.427.989,50	**€1.586.655,00**	€1.745.320,50	€1.983.318,75
	6	€1.427.989,50	€1.713.587,40	€1.903.986,00	€2.094.384,60	€2.379.982,50
	7	€1.665.987,75	€1.999.185,30	€2.221.317,00	€2.443.448,70	€2.776.646,25

		PARKING TARIFF PER HOUR				
DEPENDENT: IRR	**13%**	**1,8**	**2,16**	**2,4**	**2,64**	**3**
AVERAGE PARKING HOURS	**3**	< -15%	-15%	-8%	-3%	2%
	4	-8%	0%	4%	8%	13%
	5	2%	9%	**13%**	17%	23%
	6	9%	16%	21%	27%	35%
	7	15%	24%	30%	37%	48%

		PARKING TARIFF PER HOUR				
DEPENDENT: NPV	**€2.986.336,43**	**1,8**	**2,16**	**2,4**	**2,64**	**3**
AVERAGE PARKING HOURS	**3**	€ 7.023.007,89-	€ 5.385.115,19-	€ 4.293.186,71-	€ 3.201.258,24-	€ 1.563.365,54-
	4	€ 4.293.186,71-	€ 2.109.329,77-	€ 653.425,14-	€ 802.479,48	€ 2.986.336,43
	5	€ 1.563.365,54-	€ 1.166.455,64	**€ 2.986.336,43**	€ 4.806.217,21	€ 7.536.038,39
	6	€ 1.166.455,64	€ 4.442.241,05	€ 6.626.098,00	€ 8.809.954,94	€ 12.085.740,35
	7	€ 3.896.276,82	€ 7.718.026,47	€ 10.265.859,57	€ 12.813.692,67	€ 16.635.442,31

		AMOUNT OF PARKING SPACES
DEPENDENT: SALES SHORT PARKINGS	€1.586.655,00	500
PROPORTION SUBSCRIPTIONS	0,1	€1.903.986,00
	0,2	€1.692.432,00
	0,25	€1.586.655,00
	0,3	€1.480.878,00
	0,4	€1.269.324,00

SALES SHORT PARKINGS RANGE [1269324,1903986]

INPUT LOWER BOUND: € 1,269,324

Year	1	2	3	4	5	6	7	8	9	10
Cash Flow										
Investment	6182715	0	0	0	0	672000	0	0	0	0
Operational Costs	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454
Total Cost	**7592169**	**1409454**	**1409454**	**1409454**	**1409454**	**2081454**	**1409454**	**1409454**	**1409454**	**1409454**
Total Revenues	**1955369**	**1955369**	**1955369**	**1955369**	**1955369**	**1955369**	**1955369**	**1955369**	**1955369**	**1955369**
Net Cash-flow	**-5636800**	**545915**	**545915**	**545915**	**545915**	**-126085**	**545915**	**545915**	**545915**	**545915**

Year	11	12	13	14	15	16	17	18	19	20
Cash Flow										
Investment	672000	0	0	0	0	672000	0	0	0	0
Operational Costs	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1377417
Total Cost	**2081454**	**1409454**	**1409454**	**1409454**	**1409454**	**2081454**	**1409454**	**1409454**	**1409454**	**1377417**
Total Revenues	**1955369**	**1955369**	**1955369**	**1955369**	**1955369**	**1955369**	**1955369**	**1955369**	**1955369**	**1955369**
Net Cash-flow	**-126085**	**545915**	**545915**	**545915**	**545915**	**-126085**	**545915**	**545915**	**545915**	**577952**

Internal Rate of Return	**4%**
Net Present Value (i=6%)	**€653.425,14-**
Payback Period	**13.8**

INPUT UPPER BOUND: € 1,903,968

Year	1	2	3	4	5	6	7	8	9	10
Cash Flow										
Investment	6182715	0	0	0	0	672000	0	0	0	0
Operational Costs	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454
Total Cost	**7592169**	**1409454**	**1409454**	**1409454**	**1409454**	**2081454**	**1409454**	**1409454**	**1409454**	**1409454**
Total Revenues	**2590031**	**2590031**	**2590031**	**2590031**	**2590031**	**2590031**	**2590031**	**2590031**	**2590031**	**2590031**
Net Cash-flow	**-5002138**	**1180577**	**1180577**	**1180577**	**1180577**	**508577**	**1180577**	**1180577**	**1180577**	**1180577**

Year	11	12	13	14	15	16	17	18	19	20
Cash Flow										
Investment	672000	0	0	0	0	672000	0	0	0	0
Operational Costs	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1409454	1377417
Total Cost	**2081454**	**1409454**	**1409454**	**1409454**	**1409454**	**2081454**	**1409454**	**1409454**	**1409454**	**1377417**
Total Revenues	**2590031**	**2590031**	**2590031**	**2590031**	**2590031**	**2590031**	**2590031**	**2590031**	**2590031**	**2590031**
Net Cash-flow	**508577**	**1180577**	**1180577**	**1180577**	**1180577**	**508577**	**1180577**	**1180577**	**1180577**	**1212614**

Internal Rate of Return		**21%**
Net Present Value (i=6%)		**€6.626.098,00**
Payback Period		**5.6**

C. COSTS

		LOAN AMOUNT				
DEPENDENT: FINANCING COSTS	**€6.182.715,00**	€4.637.036,25	€5.564.443,50	€6.182.715,00	€6.800.986,50	€7.728.393,75
INTEREST RATE	**2%**	€283.585,92	€340.303,10	€378.114,56	€415.926,01	€472.643,20
	4%	€341.201,24	€409.441,49	€454.934,99	€500.428,49	€568.668,74
	6%	€404.277,95	€485.133,54	€539.037,27	€592.941,00	€673.796,59
	8%	€472.292,38	€566.750,86	€629.723,18	€692.695,50	€787.153,97
	10%	€544.664,54	€653.597,45	€726.219,38	€798.841,32	€907.774,23

FINANCING COSTS RANGE [378,114.56,726,219.38]

INPUT LOWER BOUND: € 378,114.56

Year	1	2	3	4	5	6	7	8	9	10
Cash Flow										
Investment	6182715	0	0	0	0	672000	0	0	0	0
Operational Costs	1240485	1240485	1240485	1240485	1240485	1240485	1240485	1240485	1240485	1240485
Total Cost	**7423200**	**1240485**	**1240485**	**1240485**	**1240485**	**1912485**	**1240485**	**1240485**	**1240485**	**1240485**
Total Revenues	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**
Net Cash-flow	**-5150500**	**1032215**	**1032215**	**1032215**	**1032215**	**360215**	**1032215**	**1032215**	**1032215**	**1032215**

Year	11	12	13	14	15	16	17	18	19	20
Cash Flow										
Investment	672000	0	0	0	0	672000	0	0	0	0
Operational Costs	1240485	1240485	1240485	1240485	1240485	1240485	1240485	1240485	1240485	1240485
Total Cost	**1912485**	**1240485**	**1240485**	**1240485**	**1240485**	**1912485**	**1240485**	**1240485**	**1240485**	**1240485**
Total Revenues	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**
Net Cash-flow	**360215**	**1032215**	**1032215**	**1032215**	**1032215**	**360215**	**1032215**	**1032215**	**1032215**	**1032215**

Internal Rate of Return	**17%**
Net Present Value (i=6%)	**€4.914.406,44**
Payback Period	**6.6**

INPUT UPPER BOUND: € 726,219.38

Year	1	2	3	4	5	6	7	8	9	10
Cash Flow										
Investment	6182715	0	0	0	0	672000	0	0	0	0
Operational Costs	1605995	1605995	1605995	1605995	1605995	1605995	1605995	1605995	1605995	1605995
Total Cost	**7788710**	**1605995**	**1605995**	**1605995**	**1605995**	**2277995**	**1605995**	**1605995**	**1605995**	**1605995**
Total Revenues	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**
Net Cash-flow	**-5516010**	**666705**	**666705**	**666705**	**666705**	**-5295**	**666705**	**666705**	**666705**	**666705**

Year	11	12	13	14	15	16	17	18	19	20
Cash Flow										
Investment	672000	0	0	0	0	672000	0	0	0	0
Operational Costs	1605995	1605995	1605995	1605995	1605995	1605995	1605995	1605995	1605995	1605995
Total Cost	**2277995**	**1605995**	**1605995**	**1605995**	**1605995**	**2277995**	**1605995**	**1605995**	**1605995**	**1605995**
Total Revenues	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**	**2272700**
Net Cash-flow	**-5295**	**666705**	**666705**	**666705**	**666705**	**-5295**	**666705**	**666705**	**666705**	**666705**

Internal Rate of Return	**8%**
Net Present Value (i=6%)	**€722.034,77**
Payback Period	**11.3**

ANNEX 6: GENERAL INFO & ASSUMPTIONS

FLEX PARKING

TOTAL PARKING SPACES	500
AREA PER PARKING SPACE IN SQUARE METER	10
TOTAL AREA IN SQUARE METER	5000
TOTAL PARKING SPACES PER LEVEL	62.5
AMOUNT OF LEVELS	8
TOTAL AREA RENT INCLUDING EXTRA AREA IN SQ. METER	1375

1 Olego/Wheelie per 5 parking spaces:

AMOUNT OF OLEGO	100
AMOUNT OF WHEELIE	100

Description WHEELIE	**Unit**	**Operational info**	**Folded up**	**Wheelie Unit (piling up)**
Radius	km	25		
Speed	km/h	20		
Battery	km	25		
Length	m	0.8	0.8	1
Width	m	0.3	0.3	0.5
Height	m	1.2	0.3	
Production Costs	Euro	1700		
Usage per km	Euro	0.02		
Depreciation term	years	4		
Residual Value	percentage	0		
Maintenance Costs	percentage	5		
Tax	percentage	0		

Land Area storage Wheelie (5x = 1 pile)	0.5	M^2
Land Area storage Wheelie (20x = 4 piles) for 100 parking spaces	2	M^2
Land Area storage 100x for 500 parking spaces	10	M^2
Extra area	10	M^2
Total area	**20**	M^2

Total parking spaces Wheelie Facility **2**

Description OLEGO	**Unit**	**Operational info**
Radius	km	50

Speed	km/h	45
Battery	km	50
Length	m	1.4
Width	m	0.75
Height	m	1.2
Production Costs	Euro	4700
Usage per km	Euro	0
Depreciation term	years	4
Residual Value	percentage	0
Maintenance Costs	percentage	5
Tax	percentage	0

Land Area 1 OlegO	1.05	M^2
Land Area (20x)	21	M^2
Land Area (100x)	105	M^2
Extra Area space	25	M^2
Total Area space	**130**	M^2
Total parking spaces OlegO Facility	**13**	

TOTAL PARKING SPACES NECESSARY WHEELIE + OLEGO	**15**
TOTAL NECESSARY SPACES FOR OFFICE	2
TOTAL SPACES UNAVAILABLE FOR PARKING	**17**

STANDARD MEASURES PARKING SPACE (2007)

Average width vehicle	2	M
Average height vehicle	2	M
Average length vehicle	5	M
Volume vehicle	20	M^3
Area per parking space	10	M^2

