

2011
2012

BEDRIJFSECONOMISCHE WETENSCHAPPEN

*master in de verkeerskunde: mobiliteitsmanagement
(Interfacultaire opleiding)*

Masterproef

Cargobikes - the solution to urban congestion? Current usage, future potential and impacts of an alternative way of short distance transportation.

Promotor :
Prof. dr. Davy JANSSENS

Copromotor :
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Christian Weirich

*Masterproef voorgedragen tot het bekomen van de graad van master in de verkeerskunde ,
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Summary

For various reasons, our mobility behaviour is questionable. One chance to reduce the negative impacts is to use other modes of transport. Within cities, the ecomobility consisting of walking, cycling and public transport is promoted for passenger mobility. Still, for cargo transport, there is no ecomobility pattern, as cargo is usually transported by cars or light goods vehicles (LGV). The same accounts for children, that are mostly transported using a car, sometimes by public transport or using children seats on bicycles. A possibility to transport cargo and children within usual distances in city transport is a cargobike. The cargobike offers capacities that is sufficient for most of the daily transporting needs.

This paper will look into the possible potential that cargobikes can have in Germany, especially in cities. To achieve this, a definition of a cargobike for the purpose of this paper as well as the various possibilities of transporting cargo on a bicycle are developed, starting from a traditional bicycle and ending with four-wheeled cargobikes. Numbers and facts about the current cargobike usage and the attitude of authorities are used in connection with a survey carried out on users of cargobikes to create an overview of the current situation. It turns out that very few cargobikes are used in Germany, and that authorities are aware of cargobikes, but mostly do not account for them in any special way. The survey gives an insight in how cargobikes are used and what the users see as advantages and disadvantages. Contrary to this, a survey is carried out on people who do not use cargobikes at the moment to get an impression of the general awareness level and expectations of what could be done with a cargobike.

All information collected through the procedures described is then used to draw up the identified factors that will influence the cargobike usage in the future. Not surprisingly, numerous factors exist, with the most important ones probably being the dominance of the car making the cargobike superfluous, the weather dependency and sensitivity towards topology as well as the insufficient infrastructure for bicycles today. The potential for the private, commercial and public user groups is drawn up, with a future outlook illustrating the impacts that a massively increased use of cargobikes would have on our society.

Finally, conclusions are drawn and recommendations given, aiming at measures to increase the use of cargobikes to improve the overall city travel experience.

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Abbreviations

LGV	light goods vehicle
MiD	Mobilität in Deutschland (engl. Mobility in Germany)
PM	particulate matter
ADFC	Allgemeiner Deutscher Fahrrad Club (German Cycling Club)

1 Introduction

With increasing awareness of problems arising due to heavy city traffic, sensitivity towards environmental impacts of one's behaviour and resource use as well as rising oil prices, alternative transport modes may take an increasing share in the future. One of these modes, especially for short and medium distances, is the bicycle. One special form of a bicycle is the cargobike, which exists in various forms and is used for various purposes (see chapter 3). Apart from a few cities like Amsterdam and Copenhagen, the cargobike is only used marginally and has not been in focus as a potential means for a larger amount of users in Europe nowadays. Cargobikes are human-powered and can carry comparably large loads or several children. Whereas in Copenhagen, The Netherlands or Asia cargobikes are part of everyday life, they are still a niche product on the fringes of traffic in Germany. Nevertheless, there seems to be rising awareness of this possibility to transport cargo. Various magazines (e.g. Klama, 2012 and Zelter, 2012) have published articles about cargobikes in the recent past. This thesis is intended to look at this transport mode in a detailed qualitative way.

1.1 Research Questions

Derived from the statement above that cargobikes are negligible in Germany so far, the main question of this paper is: Can the cargobike take a significant share of the modal split for short distance transportation? Which factors will influence this future development?

From the general question, the following, more detailed questions were derived to get a sophisticated overview on the current situation. The insights gained from the information gathered then help to give an answer to the main research question. It turned out that there are certain fields that most aspects discussed in this paper have a relation to. First, the existing **infrastructure**, both public and private, is important. Second, the **cargobike technology**, configuration and design play a role. Third, any **public policy** has an influence, as well as **emotions**, feelings and attitudes. Fifth and last field are **externalities**, that cannot be influenced directly. Therefore, already the research questions in Table 1 are shown displaying their relation to these fields. These main fields will be referred to throughout the paper, but of course aspects may have a relation to more than one of the fields mentioned above.

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Sub question	Infra-structure	Cargobike technology	Public policy	Emotions	Externalities
What is the influence of the initial situation?	x	x	x	x	
What is a cargobike used for?		x		x	
What are Dis-/Advantages for the public?			x	x	
What will the impact on cities be?	x		x		
What are measures to increase cargobike usage?	x	x	x	x	
What influences people to use cargobikes?	x	x	x	x	x
Current and potential modal split?	x	x	x	x	x

Table 1: Important fields identified and detailed research questions

1.2 Methodology

In this section, the chosen approach to answer the research question is explained to give the reader an idea of the sources and methods used.

The mixture of information gathered through the various ways described below leads to a detailed picture of the current situation and highlight measures that exist or could be thought of in the future. The points of view from the most relevant stakeholders ensures that the measures are not solely influenced by a single stakeholders' point of view. The inclusion of the most relevant stakeholders also allows an educated guess to be made about the market potential. So in general, this report describes the cargobike, gathers information on the current usage and its users, describes the attitude of public authorities, asks non-users for their attitude and opinion and tries to draw a picture of the possible share in traffic and what will influence the development.

1 Introduction

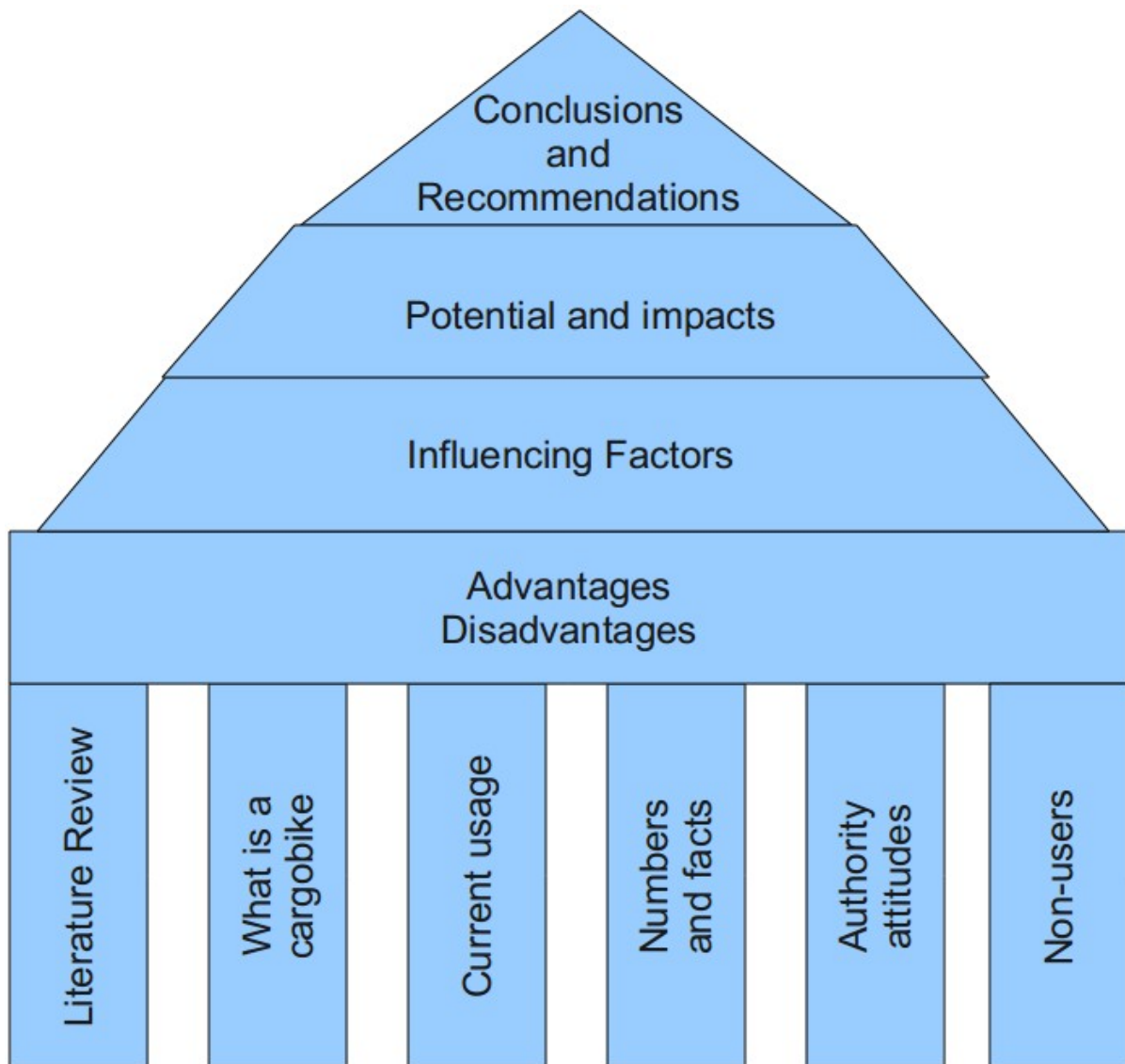


Illustration 1: Methodology

A **literature review** was carried out to gather information about cargobikes in general. The literature research also provided an overview on the cargobike itself (different kinds, technology etc.). To gather information about the current state, several sources have been queried for **numbers and facts on cargobikes**. It was tried to obtain statistical data from public authorities as well as information from dealers and manufacturers. These facts are a vital input to give a sound overview on the current usage. To obtain information about **current usage**, owners and current users are questioned. This approach gains insight in the reasons for the use of a cargobike, as well as known drawbacks and advantages. The results allow to draw a detailed picture of the current usage. Also of major importance is the **attitude**

1 Introduction

of authorities (e.g. police, traffic planning departments) towards this alternative mode of transportation. Therefore, several example city authorities have been contacted to discover if they have cargobikes on their mind, what they expect from this transportation mode, if they support it or not, and if they do, how they support it and so forth. The police is also a source of information, especially in relation to parking violations, security (stolen bikes) and safety 'on-board' (when transporting children or large goods). A further approach to obtain information is a **survey on non-users**. Through this survey, various people have been asked i.a. about their attitude towards cargobikes, if they could think about using one and what requirements need to be fulfilled to use it. Also important is what other traffic participants (especially car drivers) expect if more cargobikes are around, as the increasing use of bicycles already leads to more critical situations (Rotermund, 2012). The survey provides similar information as the current usage, thereby allowing to compare some of the facts queried. However, it also includes stakeholders of traffic that are currently not in contact with cargobikes (as opposed to the current usage). The pieces of information gathered up to this point are displayed, showing **advantages and disadvantages** in relation to the identified stakeholders. Derived from that are the **influencing factors** that are important for the future usage of the cargobike. All information gathered and developed shows the **potential and its impacts**. The paper is finished by general conclusions and recommendations aiming at an increased modal-share of cargobikes.

1.3 How to read this document

Chapter 2 '**Literature review**' is to find possible available information on cargobikes. As this is rare, also literature in relation to cycling in general is discussed. **What is a cargobike?** As the cargobike is not a very well known means of transport, chapter 3 gives information on what a cargobike actually is. This is meant to be a short overview on the variety and characteristics of cargobikes. Chapter 4 '**Current usage of cargobikes**' then gives information on how the cargobikes are used nowadays. Therefore, 4.1 '**Numbers and facts on cargobikes**' tries to answer e.g. how many cargobikes are around. In 4.2 and 4.3 'Private users' and 'Professional users' are presented. Chapter 4.4 '**Attitude of authorities**' is another aspect that mainly illustrates the current situation. So, chapters 3 and 4 give a sound picture of the current situation which is the basis for developing any statement on future

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development. Chapter 5, dealing with the '**Non-Users**', is the link between the current situation and the future as it can give explanations why people nowadays do not use cargobikes as well as which expectations and requirements people have if the cargobike should be seen as an option. Similar is chapter 6 '**Dis-/advantages**', highlighting and explaining the advantages and disadvantages of an increased use of cargobikes. It uses the information gathered in the previous chapters, taking into account various stakeholders. Chapter 7 then defines and explains the '**Influencing factors**' that will play a role when trying to estimate the '**Potential and impacts**', which is done in chapter 8. These two chapters are closely related and in a way sum up the insights gained throughout the study. These are probably the most important chapters when interested in what the future holds for cargobikes. The last chapter '**Conclusion and recommendations**' sums up the results, last but not least by giving hints at what has to be done if the aim is to increase the modal split of cargobikes.

2 Literature Review

The literature review is intended to gather information on cargobikes or cycling in general. The focus will be on the influence that cycling has on mobility as well as aspects that may have an influence on the cargobike usage in general.

2.1 Mobility in Germany: patterns and behaviour

Mobilität in Deutschland (MiD, engl. 'mobility in Germany') by infas, DLR (2010) is the major research into mobility in Germany, researching the mobility of the German population and discussing and illustrating the results at length. The last report from 2008 shows some interesting points which may show a relation to cargobike usage:

General mobility behaviour and its impacts

- The overall main reasons for making a trip are shopping and leisure.
- Generally, a car is seen as necessary when there are children in a household.
- Living in a rural area produces about one quarter higher CO₂ emissions than living in a city, which is mainly due to the higher modal split of the car.
- Mothers with children younger than 6 years (a perfect age for being transported on a bicycle) make 29% of their trips for escorting. If the child is between 6 and 13, escorting still accounts for 18%.
- Shopping trips account for 22%, escorting trips for about 8% of all trips.
- Shopping is done at close quarters in 39% of all cases – shopping for daily needs even in 45%. In connection with that, the report also states that the locations for daily shopping usually can be reached with the bicycle.
- Generally, women do more escorting and shopping trips than men.
- The average trip length over all modes is 10km.

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Current trends

- Younger people tend to reduce their car use while at the same time fulfilling their mobility needs by using public transport, cycling or walking. This trend is encouraged by the fact that the rate of young people with a driving licence in cities decreases.

This trend was already mentioned within the review on transport research by Sandqvist and Kriström (2000), stating that especially younger people are willing to avoid using the car. They also state that people are generally more open to restrictions in car-usage than anticipated.

- The report confirms that bicycles do not only become more and more important in city centres, but also in densely populated and rural areas.

The role of bicycles

- The number of trips made with public transport or bicycle drastically decreases, if a car is available.
- The worse the weather (meaning low temperatures, rain or snow), the fewer people use a bicycle.
- Cyclists produce only about 1.4kg of CO₂-emissions each day, which is less than one quarter of the emissions that car users produce (6.4kg). The car users however only travel 46.9km each day, a cyclist travels almost half of that distance (22.7km).

2.1.1 “Mobility in Germany” with cargobikes?

The findings from MiD can be seen in connection with cargobikes as alternative cargo transportation on short distances.

Shopping and escorting trips account for a large share of overall trips. At the same time, especially shopping for daily needs is often done at close quarters within bicycle range. The share of escorting trips is higher with younger children. The younger the children, the easier it is to transport them in a cargobike. Thus, both shopping and escorting can be done using a cargobike, creating a great potential. However, it would be necessary to take a closer look at the distances of these trips, as the distance that can be ridden with a cargobike is limited.

2 Literature Review

Leisure trips may also show a potential for cargobikes, e.g. when driving to a sports club having to transport larger sports equipment.

Women do most of the shopping and escorting trips. This indicates that the design of cargobikes should take especially women into account, creating a vehicle with emotional and at the same time practical design. Also, the provision of electric assistance and easy handling need to be taken care of. As shown in chapter 5, many people are not aware of cargobikes. A better knowledge of cargobikes could reduce the fact that a car is seen as necessary as soon as there are children in the family.

The average trip length is stated as being 10km. That means that the average trip can be done with a bicycle in general, especially when electric assistance is available. Still, it has to be kept in mind that a car must still be available if a longer trip has to be made. But at this point, carsharing may come as an option.

Carsharing is also an aspect that is related to the decreased use of cars by young people that only want to use that mode of transport that suits their current needs best. A cargobike could further reduce the need to use a car at all. For people using public transport and a bicycle to get around, the cargobike could be the missing part that keeps them from buying or using a car at last. As stated in MiD, the availability of a car would then lead to the fact that a car is used for most trips.

2.2 Modal Choice

Dowling (1999) mentions that the increased use of cars by women was a significant trend in the past decade (i.e. the 1990's), as cars are used for managing family life including picking up of children, shopping, work and the like. It seems reasonable, that beside some drawbacks, cargobikes may be a substitution for a car, especially when distances are not too large.

Rodriguez and Joo (2004) show that there is a correlation between the modal split of bicycles and the physical layout of the environment (e.g. topography or presence of cycling paths). This indicates that the modal split of cycling can be increased by offering a good infrastructure for cyclists, or at least electric assistance to ease the use of a bicycle.

2 Literature Review

Lang et al. (2010) give several reasons for children being driven to school by a car, e.g. safety concerns when children walk on their own. At the same time they state that parents are frustrated by the parking situation, which may require them to walk quite a distance to the school anyway. Lang et al. (2010) also reveal that the need to drive children to school is a self fulfilling prophecy, as one reason to do so are the 'other parents' behaving dangerously while driving their children to school. The same may account for kindergartens. In opposite to school however, as kindergartens are usually closer the option to walk is available. The study indicates that walking to school will save time and cost – a cargobike could be even more time effective. They also suggest trial days to allow parents to experience the benefits of using other modes than the car.

Buys and Miller (2011) show that mode choice even in areas with a good public transportation system available depends on a lot of factors. Although cycling only plays a minor role in this report, it is clear that the factors found are relevant for every modal choice. They clearly mention that it is not the availability of alternative, more sustainable transport modes, but how these modes compare with the car. They also state that time-efficiency is a “key determinant of transport choices”, which requires good infrastructure and possibly electric assistance to use cargobikes at comparably high speeds.

Southworth (2001) argues that the behaviour of people will not change through simple policy measures, especially not when these measures are not connected to each other:

“To have significant impacts on total vehicle miles of travel through urban restructuring will require some deep rooted changes in the way people choose to live and do business, and in turn choose to move between locations within entire urban systems”.

This indicates that the cargobike cannot be a simple measure that will reshape our cities, nor will any single policy that tries to convince people to change their transport modes. Topp (2012) sums it up by highlighting that personal advantages for people are what makes people change their mobility behaviour.

Browne et al. (2010) look into the effects and impacts of the increased use of light goods vehicles in urban areas. Several ways to reduce the impacts are discussed, however the use of a completely different mode of transport is not mentioned. Cargobikes may take a share, at

2 Literature Review

least in very special situations and high-density areas. Transport for London (2009) shows that using a cargobike is a possible alternative. Research in this area is currently undertaken by an EU supported initiative called 'cyclelogistics' (n.d.).

2.3 Cycling and its impacts on society

Hinde and Dixon (2004) discussed the influences of a car-reliant society on general health and obesity in particular. Beckmann (2001), cited in Hinde and Dixon (2004), states that “the automobile turns into a structural prerequisite for the organisation of everyday life... by creating social, spatiotemporal, and technological conditions that restrict the genesis of any other mobility paradigms”, describing exactly the difficulty to break the superiority of the car. From the discussion in Hinde and Dixon (2004) it can be interpreted that the car produces a society that requires a car to be able to live in. The cargobike could be one mode to increase physical activity while at the same time reducing the negative external impacts of car use.

Markgraf and Wagner (2011) discussed the situation of public transport today and the challenges it faces in the future. One important aspect argued by the authors is that public transport needs high capital investments and takes much time to implement. Even though the paper focusses on passenger transport, it reveals one aspect: Investments in motorized transportation, may it be fossil fuelled or electrically driven, require high capital investment on both infrastructure and vehicles. This aspect has to be kept in mind when discussing cargobikes and their requirements on infrastructure, as the demands on infrastructure made by cargobikes are comparably low.

The general costs of mobility rise on a much higher level than the general costs of living. Allianz pro Schiene (2012) shows that the cost for train travel in Germany have risen by 22.2% from 2005 until 2011. The fuel costs for a car have even risen by 28.0%. The general cost of living only rose by 11.1% in the same time period. As no fuel is needed for pedalling a bicycle, one could argue that the bicycle (and walking, of course) has the lowest operational cost rise in this period.

Sandquist and Kriström (2000) found that the participation in social activities does not depend on the availability of a car. They studied the life of adolescents in the city of Stockholm, clearly showing that it made no difference if their parents owned a car or not. In

2 Literature Review

this respect, cargobikes may further improve the situation, especially with young children experiencing that there is no need for a car if parents can still escort them.

2.4 Results of literature review

Literature about bicycles in general and cargobikes in particular is rare as mentioned by Thiemann-Linden et al (2004) and Prediger (2012). They also mention that most publications deal with specific problems in certain regions, like the installation of a parking area or the impact of a new bicycle-rent-system. Their findings describe what still seems to valid today, even though some more specific attention has been paid to this subject in the recent past (see e.g. Leben (2012) or Transport for London (2009), also in connection with Barner (2011))

The increased use of cars by women to manage family life is often done using a car, where a cargobike could be an option. This can be facilitated by a sophisticated cycling infrastructure and cargobike technology. The connection of the need to escort children to schools and kindergartens in relation with the fact that every transport mode is compared with the car is interesting in relation to cargobikes. A cargobike can be reasonably alternative, as it offers exactly what is needed for these typical escorting trips. Cargobikes would deliver an economic advantage, which is seen as necessary for a modal shift. Children could learn from the beginning that there is no need to use a car for everything, favouring a more healthy lifestyle and long term change. The national economy would benefit from this as well as from the fact that the use of cargobikes requires relatively low investments in infrastructure. One could also expect that infrastructure provided for bicycles in a quality as offered for cars today will result in an eased use of cargobikes. As shown, the topography plays a major role in relation to bicycle usage, and infrastructure can help to improve the topography for bicycles by e.g. replacing level crossings by tunnels and removing cycle barriers.

The literature only shows minimal relation to cargobikes, but some of the aspects stated can be connected to cargobike usage. There seem to be generally positive implications of increased bicycle usage, of which the cargobike is a special kind. This special kind however is able to fulfil some special requirements where generally the car is seen as absolutely necessary. Cycling in general has very positive effects on society and its health, and the behaviour that children adapt from their parents plays a major role. If the bicycle or the

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cargobike, respectively, should gain a larger share of the modal-split, it is necessary to raise the awareness of the positive effects that cycling has for every private person or companies.

3 What is a cargobike?

3 What is a cargobike?

To be able to get an insight into the current usage of cargobikes as well as their possible future usage, it is important to know what a cargobike actually is. Starting with the bicycle, this chapter will develop a definition for cargobikes that is used in this paper.

What is nowadays usually identified as a bicycle in Germany is a two-wheel, single-lane vehicle that is able to carry one person and powered by this person using muscular strength through pedalling.



Illustration 2: Example of a typical bicycle

There are various types of bicycles available, including sports bicycles made for high speeds, city-bicycles for daily use, trekking-bicycles for longer distances and travelling, mountain-bicycles for cross-terrain driving and so forth. It is neither the purpose of this paper to give a complete overview on all types of bicycles, nor would it fit into the set frame. However, it is important to keep in mind that bicycles can fulfil various and very special needs.

3 What is a cargobike?

Cargo is any goods that is transported, usually connected with the larger quantities transported by ships, trains or trucks. For the purpose of this paper, it is rather difficult to give a clear definition of cargo, as this may range from a simple shopping bag up to furniture or several parcels. The cargobikes shown have various operational purposes. Within the scope of this paper, it does not make any sense to differentiate or restrict to one single type of cargo. As shown later, cargobikes are rare enough and are therefore treated in general, and so is the cargo which is transported.

3.1 Transporting cargo on a bicycle

This sub-chapter will give a short overview on the different ways of how to transport cargo on a normal bicycle using devices that may be removed. It is not exhaustive, as there are dozens of different ways available to carry cargo on a bicycle. The options mentioned here are the most common seen in (German) cities.

3 What is a cargobike?

Using a bag or a backpack



Illustration 3: Cyclist transporting bags on the handlebar (Naj-Oleari, 2007)

The simplest way to transport cargo is to 'attach' the cargo to the cyclist by means of a bag or backpack. This way, the amount of cargo that can be transported is limited in size and weight to what a pedestrian can carry or even less. Especially when carrying bags, it may be a safety risk as the cyclist only has one hand left to control the bicycle and may easily become unbalanced. This way of transporting smaller amounts of cargo is seen very often, as it does not require any special equipment when using a bicycle.

Handlebar/carrier baskets

The easiest and possibly mostly used way to transport cargo on a bicycle is a basket that is placed on top of the luggage carrier. There are different types and sizes available, mostly a backpack or grocery bags fit in there. Similar baskets are available to be attached to the handlebar, where very often shopping bags with a special adapter can also be clipped on.

3 What is a cargobike?



Illustration 4: Example of a handlebar-bag. This picture also shows a possibility to transport children on a normal bicycle



Illustration 5: Example of a large carrier basket

3 What is a cargobike?

Using this way of carrying cargo on a bicycle does not severely affect the handling, however steering with a loaded handlebar bag is different and needs some familiarisation.

(Travel-) Panniers

Similar to the baskets attached to the luggage carrier, (travel-) panniers are larger and can carry heavier loads. Panniers are mostly used when travelling around on the bicycle, but can also be seen in cities on a daily basis. As panniers can become very heavy when fully loaded, they affect the handling of the bicycle. Panniers (may) have the advantage that they can be locked to protect the cargo while the bicycle is left unattended.



Illustration 6: Bicycle fitted with travel-panniers and a handlebar bag

A special form of travel-panniers are so-called lowriders, which are attached to the front wheel to further increase the capacity for travel.

3.2 Transporting cargo using specialized vehicles and bicycles

All options detailed in the last chapter can be mounted and dismounted easily using a normal bicycle. The options that are presented in this chapter allow to transport more cargo, but need special construction.

3 What is a cargobike?

Table 2 gives an idea about the sizes of typical (types of) vehicles and bicycles that are used to transport cargo. For comparison and to get a better idea of the sizes, a Smart microcar has also been added:

3 What is a cargobike?

Type of bicycle	Length of bike[m]	Width of bike[m]	length of loading area [cm]	Width of loading area [cm]	Weight [kg]	Weight capacity [kg]
Traditional, normal bicycle	1.6 – 1.9	0.75 (handlebar)	-	-	15-20 (Bleicher, 2012)	100 (including driver and bike) (Bleicher, 2012)
Child carriage (Croozer, n.d.)	1.13 (adding to bicycle)	0.9	58 (“legroom”)	70 (“maximum shoulder width”)	15.3	45
Cargo carriage (Croozer, n.d.)	0.89 (adding to bicycle)	0.69	77	50	11.4	30
Bakers bike (Uwe Jaekel GmbH, n.d.)	Similar to normal bicycle	0.75 (handlebar)	27-35	47	-	25 (front rack)
“Long John” type (Larry vs Harry, 2007)	2.45	0.75 (handlebar)	60	47	24	100 w/o driver
Two-wheeler cargobike (Bakfiets.nl, n.d. b)	2.55 (long) 2.25 (short)	0.75 (handlebar)	72 (long) 43 (short)	45	-	100 w/o driver
Three-wheeler cargobike (Christiania Bikes, n.d.)	2.08	0.85	88	62	35	100 w/o driver
Four-wheeler cargobike (Vrachtfiets, 2011a)	3.2	1.1	200	100	-	400 w/o driver
Smart Fortwo (Anderson, 2012)	2.70	1.60	50	100	-	270

Table 2: Comparison of bicycle, cargobikes and some other cargo-carrying vehicles.

3 What is a cargobike?

Again, this list is by far not exhaustive. This is due to two main reasons that are closely related to each other: First, the market for cargo-carrying bikes is rather small (cf. chapter 4.1) and developing. This leads to numerous variants that are tried and tested for the market. Second, as the market is quite small, many people build their own, specialized cargo-carrying bicycles tailor-made for their own purposes (cf. results of the survey in chapter 4.2). It is important to mention that the bicycles shown here are only examples, the precise make, style and detail differ from manufacturer to manufacturer. For example, the two three-wheeler cargobikes shown below differ 10cm in length and 5cm in width. This can already make an important difference when considering e.g. where to store the cargobike (see chapter 5). They also have a different concept: The kangaroo by Winther is designed for transporting children (offering two adjustable seats), whereas the ChristianiaBikes three-wheeler has a flat floor, facilitating cargo transport. The following sections describe the different options in more detail.

Carriage

A carriage is not a bicycle itself, but attached to a normal bicycle to allow the transportation of cargo or children. As they can be attached to almost every normal bicycle, they have a high flexibility, as the transporting ability is only added to the bicycle when needed. Illustration 7 shows a typical cargo-carrying carriage.



*Illustration 7: Cargo-carrying carriage
(Adapted from Croozer (2012))*

Bakers bike

This kind of bike is very similar to a traditional bicycle and Bleicher (2012) reports that they almost ride like a normal bicycle. The obvious difference is the fixed rack that is

3 What is a cargobike?

mounted above the front wheel, which allows to transport (folding) boxes (as often used for shopping) or anything else that fits into the rack. As the racks are built stable, the cargo can be fastened with tension belts. The bakers bike shown in Illustration 8 also has a rack above the rear wheel, further increasing the possibilities to transport cargo.



Illustration 8: Example of a bakers bike (Uwe Jaekel GmbH, n.d.)

- Advantages
 - Handling is similar to a normal bicycle, does not need special training
 - Similar size as a normal bicycle, can be parked everywhere
- Disadvantages
 - Carrying capacity is quite limited
 - Additional tension belts needed to secure the cargo
 - No possibility to transport children

3 What is a cargobike?

“Long John” type

The group of bicycles described here has a rack mounted between the rider and the front wheel. According to Bleicher (2012), this results in a very low gravity centre which eases riding the bicycle. The low rack also allows easy loading. The cargo has to be secured by some means as the rack with its low frame itself does not offer enough stability. Bleicher (2012) also reports a lower manoeuvrability (in comparison to normal bicycles) due to the length, which also results in changed steering dynamics. It is therefore obvious that this kind of bicycle needs some training before being able to safely ride it. Illustration 9 shows a classic (Bleicher, 2012) example of these bikes, the 'Long John'.



Illustration 9: A typical Long John bicycle (Long John bicycle, n.d.)

- Advantages:
 - Low position of rack allows easy loading
 - Handling comparable to a normal bicycle, with high speeds even in curves.
 - Carrying capacity of 100kg
- Disadvantages
 - Additional tension belts needed to secure the cargo
 - No possibility to transport children

3 What is a cargobike?

- Steering and handling requires some training
- Very long, requires special parking and keeping space

Two-wheeler cargobike

The two-wheeler cargobike is similar to the 'Long John' kind of bike, but offers a box instead of a rack. This allows to transport cargo without the need to secure it. The box, which can also have a seat bench mounted in it, allows to transport children. With a special adapter, it is also possible to place a baby car seat in it, theoretically allowing to transport a baby from a very young age. However, health professionals and manufacturers (e.g. Steco, n.d.) suggest a minimum age of at least 4 month. The facts mentioned on the manoeuvrability and steering dynamics of the Long-John type is valid for the two-wheeler cargobikes as well. Illustration 10 shows an example of a two-wheeler cargobike, showing the bench with the seat belts for children.



Illustration 10: Two-wheeler cargobike (Bakfiets.nl, n.d. a)

3 What is a cargobike?

- Advantages:
 - Can carry two children and even babies, together with some cargo
 - Handling comparable to a normal bicycle, with high speeds even in curves.
 - Width is defined by handlebar, can therefore pass narrow cycle-lanes.
 - Carrying capacity of 100kg
- Disadvantages
 - Steering and handling requires some training
 - Long, requires special parking and keeping space
 - Maybe hard to handle by weak persons when fully loaded
 - Needs a safe stand when loading and unloading / children boarding
 - Comparably narrow box, shape of box limits usability (e.g. for drink crates)

Three-wheeler cargobike

At first sight, the only difference between the two-wheeler and three-wheeler cargobike is the added third wheel. The box is still mounted in front of the driver, but between the two front wheels. This makes the three-wheeler wider than all other bikes mentioned before, but in return offers a larger loading capacity (cf. Table 2). The overall bicycle is shorter than the two-wheelers. For the steering, varying concepts exist. The three-wheeler shown in Illustration 11 is steered by moving the complete box, which is an 'unusual' (Bleicher, 2012) way of steering. Another concept is to steer only the wheels, which requires the box to have rounded corners and thereby reduces the space available within the box. The moved wheels however provide a easier and faster riding that is more similar to a normal bicycle, whereas the moved box, according to Bleicher (2012) requires some adjustment to riding a three-wheeler and also limits the speed that is reasonable.

3 What is a cargobike?



Illustration 11: Three-wheeler cargobike (ChristianiaBikes, n.d.)



Illustration 12: Three-wheeler cargobike, especially for transporting children (Winther, n.d.)

3 What is a cargobike?

- Advantages
 - Large loading box, can carry children, babies and heavy loads
 - Safe standing during loading and unloading
 - Can be used in all weather conditions (snow, ice) without the danger of tilting (except for the general danger, see disadvantages)
 - Comparably short, important on traffic refuges when crossing a street
- Disadvantages
 - Special steering and handling, needs some training
 - Danger of tilting over when going too fast in curves (Kassa, 2008), which requires further speed reduction, additional to the
 - Maximum reasonable speed is limited to about 15-20km/h
 - Comparably wide, it may not be possible to pass all cycle-paths
 - Comparably heavy and large, cannot be put into cellars for storage easily
 - Parking in normal bicycle parking areas may be difficult due to its size

Four-wheeler cargobike

For larger and heavier cargo to be transported, four-wheeler cargobikes are available. Vrachtfiets (2011a) shows the various possibilities that these bikes offer, ranging from a closed box as shown in Illustration 13, a pick-up style loading box to a seat group for up to 8 children. Due to the weight, these kind of bikes are also available with two driver seats that pedal the four-wheeler together; electric assistance is also offered. An interesting aspect that is important is the weather protection that is shown in the illustration.

3 What is a cargobike?



Illustration 13: Large cargo-carrying bicycle for delivery services (adapted from Vrachtfiets, 2011b)

- Advantages
 - Very large loading box / area; various configurations offer flexibility
 - Safe standing during loading and unloading
 - Can be used in all weather conditions (snow, ice) without the danger of tilting
- Disadvantages
 - Special steering and handling, needs some training
 - Maximum speed is limited
 - Very large for a bicycle, in some cases necessity to use car infrastructure
 - Needs large parking spaces due to its size

3 What is a cargobike?

Special vehicles

Apart from the types of bicycles presented here numerous variants and special products exists, which differ in technical details or the proposed use. Nutzrad.de (2012) lists 15 different types of cargobikes, which are only used for transporting cargo. Overall, it has 41 categories of types listed, with a total of more than 500 bicycles used for transporting things and persons. They differ in the number of wheels (two, three or four), if the 'cargobay' is mounted in front or rear of the rider and if the cargobay is mounted above the wheel or next to it. This collection displays the enormous variety that currently exists for cargobikes.

A special kind of cargobike that is offered by a manufacturer is the cargobike for children (De Fietsfabrik, 2012). Illustration 14 shows this special cargobike for children, allowing them to grow up with other modes of transport than the car.



Illustration 14: The 'Kinderbakfiets' (adapted from McMahon, 2012)

3 What is a cargobike?

3.3 Cargobike definition

The derivation of the bicycle from the normal bicycle to the four-wheeler shows that there is no clear definition for what a cargobike is and how it differs from normal bicycles. For this study, cargobikes have been defined as

any bicycle that is specifically produced (or rebuild) to transport large and heavy cargo and/or children and persons using fixed installations that cannot be removed.

It is important to point out that this study only considers legal, safe and practicable ways to transport cargo. Examples of what is not considered is shown in Illustration 15 and Illustration 16.



Illustration 15: “Cycle logistics in China” (Delorme, n.d.)

3 What is a cargobike?

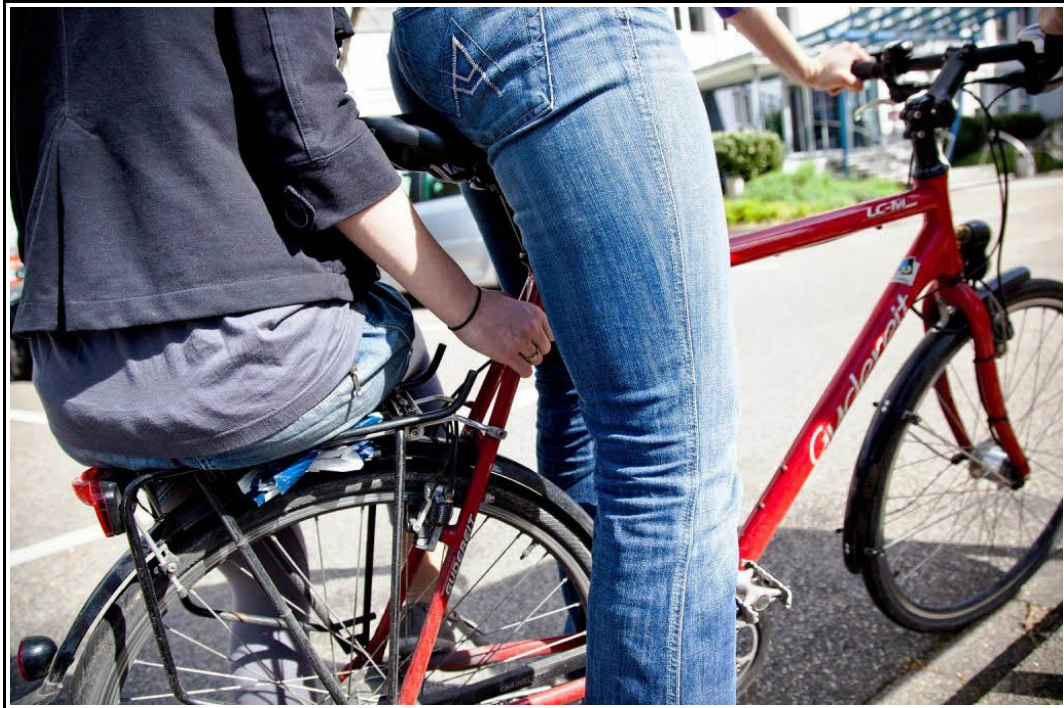


Illustration 16: Transporting persons on the luggage rack (Rock, 2011)

4 Current usage of cargobikes

A further aspect to improve the overall picture of the actual situation is a sound picture about the current usage of cargobikes. This chapter does not only state the reasons why users actually use a cargobike, but also gathers what the users see as positive as well as negative aspects about using a cargobike. Important for the influencing factors that will be developed later is the insight in what the users, both professional and private, would change to further improve the cargobike usage. The attitude of authorities is also discussed, but first the numbers and facts need to be sorted out.

4.1 Numbers and facts on cargobikes

The current situation of cargobike usage is the basis for future development. It is thus interesting to know how many cargobikes are around and what the economics are. This chapter details the approach and almost non-existing results.

Neither the association of European Two-Wheeler Parts' & Accessories Industry (COLIBI-COLIPED, 2011), nor the German Zweirad-Industrie-Verband (engl. Two-wheeler industry association) (Schreyer/ZIV, 2011) record data on cargobikes in any way. The ZIV (2011) published a list of the different types of bicycles, where twelve different types are mentioned. The cargobike belongs to the last group of 'special bikes', together with tandems, trikes, folding-bikes, recumbent bikes and others. This is another hint that there are no special statistics available.

The following well-known manufacturers have been contacted to obtain information about the number of cargobikes sold:

- ChristianiaBikes (Schütze, 2012)
- Bakfiets.nl (Stevens, 2011)
- Winther (Winther, 2012)
- Nihola (Teklay, 2011)
- Workcycles (Cutler, 2011)

4 Current usage of cargobikes

All the manufacturers replied in unison that information on sold bikes is classified as confidential, and that not even a rough order of magnitude is available. An exemption is a number mentioned in Hoff (2009), stating that the official importer of ChristianiaBikes in Germany sells about 120 cargobikes each year. However, this number dates from 2009 and may be different today. Still, this number is negligible in comparison to the numbers reported by COLIBI-COLIPED (2011): about 4 million bicycles and 200.000 Electric Power-Assisted Cycles were sold in Germany in 2010. The same accounts for dealers, who as well stated that giving information on the number of sold bicycles is confidential. However, one dealer from a major city who offered information said that the number of cargobikes sold in 2011 is 'a lower single digit number' [sic!].

The almost non-existing results from the statistics gathered so far led to the decision to choose cities with a good reputation in regards to cycling to have a better chance of getting some results. Therefore, the cities chosen for contact are the top-listed from the Allgemeiner Deutscher Fahrrad Club (ADFC, engl. German Cycling Association)-Fahrradklimatest (engl. "ADFC-Cycle-climate-check") (ADFC, 2012c):

- Cities with less than 100.000 inhabitants
 - Bocholt (Schliesing, 2012)
 - Wesel (Blaess, 2012)
 - Westerstede (Janssen, 2012)
 - Bünde/Westf. (Schuh, 2012)
 - Offenburg (Feigenbaum, 2012)
- Cities with more than 100.000, but less than 200.000 inhabitants
 - Erlangen (Grosch, 2012)
 - Oldenburg (Goroncy (2012)
 - Ingolstadt (Dobel, 2012)
 - Hamm (Winkelmann, 2012)

4 Current usage of cargobikes

- Ludwigshafen (Lappe, 2012)
- Cities with more than 200.000 inhabitants
 - Münster (Böhme, 2012)
 - Kiel (Redecker, 2012)
 - Oberhausen (Baum, 2012)
 - Hannover (Efkes, 2012)
 - Bremen (Just, 2011)

Additionally, the following cities have been contacted:

- Braunschweig (Heuvemann, 2011)
- Freiburg (Gutzmer, 2011)
- Berlin (Blümel, 2012)

The answers from the cities are the same in regard to numbers: There are no statistics on cargobikes available. The number of cargobikes is (subjectively) seen as very low, even though some respondents mentioned a (subjectively) growing number of cargobikes.

At the moment, it is not possible to gather extensive numbers about cargobikes in Germany. Fact is that cargobikes are not explicitly counted, as their number is too low. The few available numbers from dealers and manufacturers support this fact. Additionally, the survey on current users (see chapter 4.2) reveals that several users build cargobikes on their own, based on normal bicycles. These self-made cargobikes do of course not appear in any market statistic. Summing it up and taking an optimistic guess, it seems that there are no more than just a few thousand cargobikes around in Germany.

4.2 Private users

The survey carried out on the current users of cargobikes aimed at getting an insight why these people use cargobikes. An overall number of 41 persons answered the questionnaire, which can be found in chapter 11.1. The survey was carried out from January to March 2012.

4 Current usage of cargobikes

As cargobike users are very rare in Germany, contact to current users of cargobikes was quite difficult to establish. As a result and to get some respondents at all, the link to the internet-based survey was posted on an internet forum that deals with (cargo-)bikes. Therefore, the answers given are from users that do not only use their cargobike, but must be seen as quite enthusiastic and biased. This has been confirmed by the given answers. Still, the respondents are engaged in using their cargobike and therefore also have a good idea about the negative aspects. To get a complete picture, it would also be necessary to interview 'not-enthusiastic' users and, even more important, former users that stopped using their cargobike for some reason. The insights that would be gained from such a survey will definitely reveal even more about what has to be done not only to improve the situation for current users, but also for keeping unstable and insecure users. However, as mentioned before, it will be pretty difficult to get into contact especially with former users.

Survey results

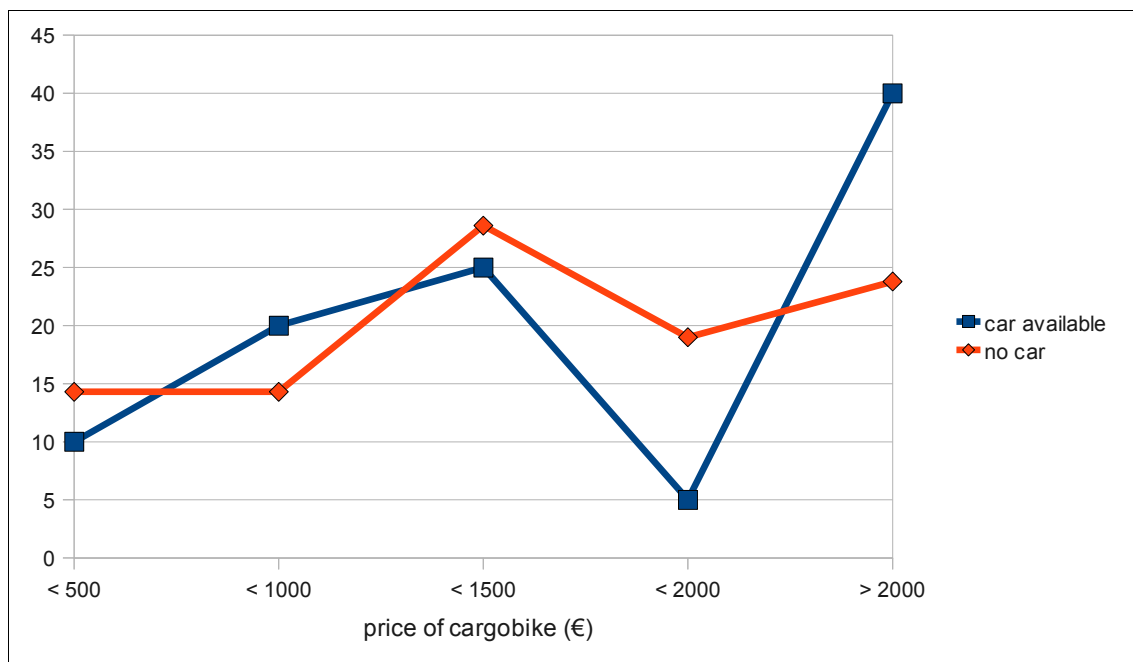


Illustration 17: Price of cargobike vs car availability

About half of the respondents (21) also have access to a car. Illustration 17 shows an interesting aspect, as the price paid for the cargobike does not show a clear dependency on the availability of a car. The fact that more cargobike-users with a car available pay a high price for the cargobike may hint at the use as replacement for a second car. In this case, a high

4 Current usage of cargobikes

price for a cargobike is still lower than a second car, and additionally parents may be willing to pay higher prices if they look for high quality to transport their children.

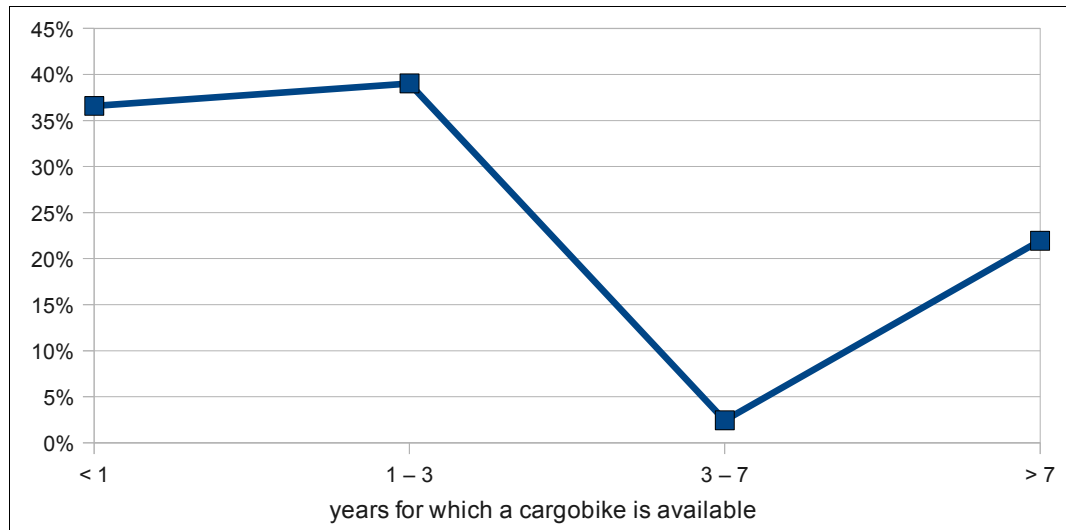


Illustration 18: Duration of cargobike availability

The duration of cargobike availability shown in Illustration 18 shows an interesting aspect. Either the cargobike is available for more than 7 years or access has been obtained in the recent years. A reasonable interpretation is that apart from those users using a cargobike for a long time, there is a trend in the recent years to buy and use cargobikes.

Type of use	answers
private	39
job-related	9
club	5
Other uses (e.g. community)	6

Table 3: Usage environment of cargobikes. Other uses include e.g. a cargobike community in Vienna, which rents out cargobikes.

4 Current usage of cargobikes

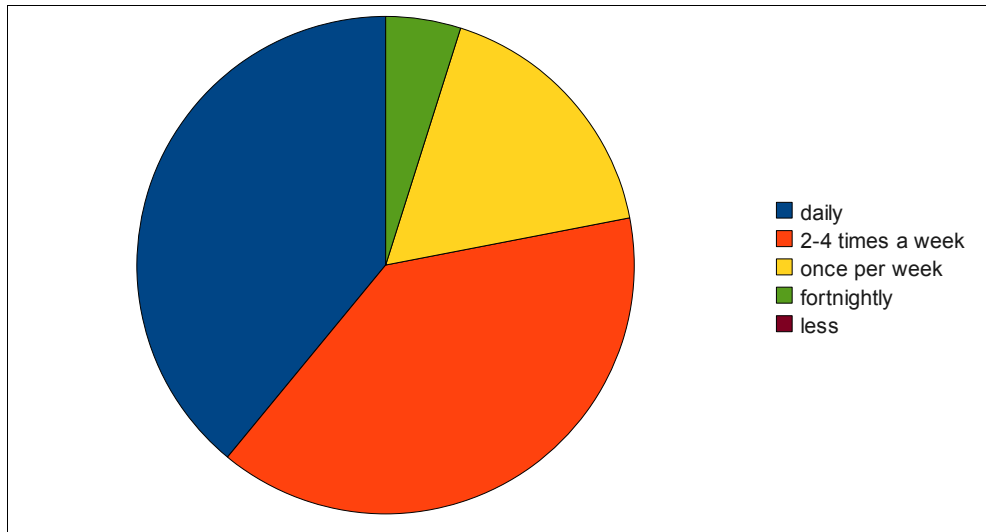


Illustration 19: Usage frequency of cargobikes

If a cargobike is available, it is used at least two times a week by more than 75% of all users (see Illustration 19). Whoever uses a cargobike, does so at least once in 14 days. These results are comparable to the results of the car-usage by the non-users (see chapter 5.1), showing that the cargobike is clearly part of the everyday mobility behaviour.

Activity	answers
Shopping	36
Large cargo	30
Babies aged 0-2	12
Children older than 2	16
Others	22

Table 4: Activities which the cargobike is used for.

The other uses mentioned in Table 4 include transporting music equipment, dogs, folding-bikes, used paper and glass, garden waste, Christmas trees, fitness equipment, smaller household moves, drink crates, parcels and other persons.

Those users who transport mainly children/babies and do shopping with their cargobike use it at least 2-4 times a week. If other uses dominate, the cargobikes are used less frequently – possibly due to renting a cargobike. If the cargobike however is used for the typical family management purposes shopping and escorting, it is used very often.

4 Current usage of cargobikes

Within the trip length' greater than 10km in Illustration 20, five respondents stated between 12 and 15km per trip. One respondent stated a comparably high distance of 32km. The maximum distance given is 80km, with the restriction that this was a one-time distance record.

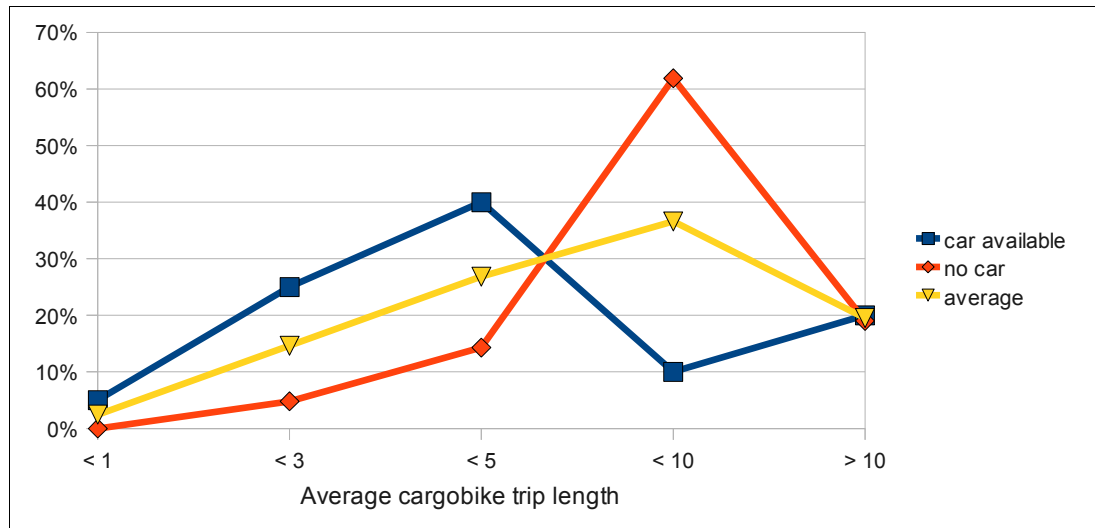


Illustration 20: Average cargobike trip length and its relation to car availability

The distances covered with the cargobike are on average longer if no car is available, as Illustration 20 shows. For a trip length greater than 5km, the car seems to be more convenient than the cargobike, so that users choose the car if one is available. This is in line with the findings from Mobility in Germany, that the use of ecomobility modes drastically decreases if a car is available. The cargobike is used for shorted distances, which relates to shopping and escorting trips which are usually done at close quarters.

Every respondent recommends the use of a cargobike. Two users however made restrictions: First, the cyclist should be able to handle it. Second, the cargobike should not have to 'stay outside overnight'.

4 Current usage of cargobikes

City population	Answers
< 10.000	2
10.001 – 30.000	3
30.001 – 50.000	2
50.001 – 100.000	4
100.001 – 250.000	7
> 250.000	21

Table 5: Population of city of residence

Distance [km]	answers
< 1	6
1 - 3	17
3 - 5	14
5 – 10	3
> 10	1

Table 6: Distance to city centre

Combining tables 5 and 6 shows that even though most cargobike-users live in large city, the distance to the city centre is quite small. This indicates that cargobike-users do not live in distant suburbs, but at close quarters to the city centre.

The reasons for using a cargobike can be summarized, at least for private persons, as “economical, ecological, healthy and practical”. The users without access to a car clearly mention the need for transport capacity for shopping bags, babies and children. Respondents state that being independent from parking spaces in the city is another advantage, as well as reducing the money spent for petrol.

Asked for positive as well as negative experiences from using cargobikes, the respondents gave various answers. All experiences are listed in Table 7, showing that several aspects are experienced both as positive as well as negative. Or, to put it differently, some of the answers given describe the same experience, but from a completely opposite point of view. When cargobike users write for example about the feedback on the street, there is on the one hand positive feedback, but on the other hand harsh criticism.

4 Current usage of cargobikes

	Positive	Negative
Infrastructure	Parking directly at the destination.	Difficult to find a space that is large enough to keep the cargobike at home. Bike racks may be too close together to allow locking a cargobike.
	Box in front allows to know ones own width (as opposed to carriage).	Cycle lanes are sometimes too narrow for a three-wheeler. Cargobikes too wide/long to pass everywhere (e.g. cycle barriers). Cargobikes need the complete width of a cycle lane and thus may block other cyclists. Bad surface (e.g. cobblestone) feels very uncomfortable.
Cargobike technology	Cost-efficient means of transport (independent from petrol price, no insurance, no taxes, no parking fees, low running costs).	Expensive to buy a cargobike. High maintenance cost when used extensively. Risk of theft (high price). No substitutions (as opposed to e-bikes).
		Sometimes low quality of parts or production. Risk of frozen brakes in winter. Slow riding speeds are critical in relation to conventional dynamos (not enough light).
	No need to couple (as with a carriage), less complicated to use. Cargobike is shorter than bicycle with carriage.	Box/cabin for children cannot be removed.
	Relaxing, flexible way to transport things.	High air resistance makes it exhausting to use a cargobike (on longer rides).
	Everyone can ride a cargobike. Fast and manoeuvrable even with cargo (accounts for two-wheeler).	Partly difficult to operate, especially for women (e.g. due to heavy weight). Rising slopes are seen as very negative.
	Better handling than with carriage. Safer than carriage or child-seat. Possibility to transport more children.	
	Possibility to transport almost everything (even more than with a small car trunk).	
	Roof protects groceries and children from weather (sun, rain, wind). Lockable seat provides safe kind of 'trunk'.	

4 Current usage of cargobikes

	Positive	Negative
Public policy	Makes a car superfluous, when living in a city.	
	Supports fitness and gives satisfaction.	
	Traffic education for children (showing alternative to cars).	
Emotions	Faster than a car.	Steep ramps at bridges prevent using cargobikes, require detours. Riding with a baby requires to ride very slowly.
	Car drivers overtake less closely (feels safer).	Impatient car drivers overtaking closely; Cargobikes are seen as obstacle by other traffic participants.
	Positive feedback from others on the street Extra respect when transporting children (as opposed to carriages).	People stare at cargobikes, which makes some users uncomfortable. Negative comments for not driving a car.
	Children may walk next to cargobike, if they want to. Flexibility to simply load child and bike into box when escorting child on its own bike.	
	No stress while participating in traffic and looking for parking space.	No chance to pass a traffic jam (as can be done with a normal bicycle).
	Direct contact to child, child (or dog) is in field of view, good communication to child. A lot of fun. Children prefer cargobikes over carriage, have more space and like to look at the way (instead of looking at the back of the cyclist). Keeps a wide space free when children learn cycling in front of a cargobike.	
Externalities	Great advertisement vehicle. Draws attention.	
	Independence from emissions.	

Table 7: Experiences made by cargobike users

4 Current usage of cargobikes

Asked for things that would further improve the experience of using a cargobike, the respondents gave the following replies:

Infrastructure

- Removal of tight curves
- Wider cycle lanes
- Adapting curbs to road level to avoid edges (“Drop curbs”)
- More cycle lanes, extension of cycle infrastructure
- Reduced steepness of slopes at bridges
- Improvement of cycle lane surfaces, reduced use of cobblestone streets. Reduce cycle-lanes with a sidewise slope (difficult and dangerous for three-wheelers)
- Removal of cycle barriers, or at least widening them to allow cargobikes to pass
- Special areas to park cargobikes (secured and weather-protected)

Cargobike technology

- 'Ban' hills. The users already mention that remedy would be electric assistance, which however would decrease the advantages and straightforward way of using the cargobike through the additional weight, necessary investment, battery charging and so forth.
- Technical aspects:
 - Possibility to easily adjust the height of the saddle for various cyclist heights.
 - Reduced weight
 - Possibility to fold the bike
 - Higher number of gears
 - General improvement of braking and shifting technology. The standard parts developed for standard bicycles do not fulfil the requirements for the higher weight
 - Larger loading area

4 Current usage of cargobikes

- Improved handling
- Improved seating for children
- Reduced price for cargobikes.
- 'Always bright weather'. This hints at means to protect the driver and the cargo from rain, sun, heat, cold and wind.

Public policy

- Generally more cycle-friendly politics, with the following special aspects pointed out:
 - Abolishment of obligation to use cycle lanes
 - Generally more space to park bicycles, which also allows to park cargobikes.
 - Car-free city centres
 - Reduce substitutions for cars; spent money for advancement of cycling.
- Possibility to take a cargobike on a train (e.g. space on trains, larger lifts)

Emotions

- More mutual respect with other traffic participants

Externalities

- Possibility to keep the cargobike at home in a (weather-) protected space, especially for those living in apartment blocks

4.3 Professional users

Apart from the professionals that took part in the survey (see chapter 4.2), two companies have been interviewed. Last but not least, the results found by Transport for London (2009) give a good summary on the aspects that are brought forward by professional cargobike users. These findings are supported by a short report by Klama (2012). In general and as expected, professionals use a cargobike if a business case exists, i.e. if a cargobike has advantages over other modes of transportation.

4 Current usage of cargobikes

Stiftung NeuErkerode

The Stiftung NeuErkerode (engl. charitable trust NeuErkerode) (Günter, 2012) uses cargobikes within their area to transport tools and materials for repairs. The cargobikes, mostly bakers bikes but also three three-wheeler cargobikes are mainly used by janitors and craftsmen to ride from the maintenance shop to a certain location of work. Walking would be too slow, whereas using a car would be too intricate. As the area is limited, there is no risk of having to drive a very long distance, which is seen as beneficial. The users of the cargobikes generally have a positive attitude towards the cargobikes. Another positive aspect seen is the low noise produced by cargobikes.

Bellis

Bellis (Rietzkow, 2012), a company that is responsible for the installation and maintenance of traffic lights, signs and similar as well as traffic control and guidance in the city of Braunschweig, uses cargobikes since 2010. The company is located near the city centre, resulting in short distances for a lot of maintenance work. As the workers have to stop frequently on their daily trips, the search for parking space using a small pickup truck was time consuming and the trucks blocked pavements. Using a cargobike, the workers now do not have any difficulties to find a space to park it. And the distances that have to be covered can easily be done using a cargobike. The ecological aspects also played a role, as well as the flexibility that cargobikes offered for inner-city operations. The cargobikes are only used during summer, namely from April-September, being an 'add-on' to the usual vehicles used.

The experiences made are mixed, especially during the initial phase. When the cargobikes were introduced, there was some resistance from the workers, fearing that they would have to abandon habits as well as the loss of using a status symbol (i.e. a car) during work. It also turned out that the workers that use the cargobike have to have some physical fitness to be able to use it. However, the users of the cargobike generally gave positive feedback, especially as the negative reactions that were feared from people did typically not occur. A major advantage of the cargobike is that they can be driven through parks and pedestrian precincts, cutting distances.

4 Current usage of cargobikes

Apart from the general improvements that are made for cyclists, Bellis did not mention specific improvements that are needed to ease the use of cargobikes. Wide cycle lanes, flat surfaces and other measures to improve the bicycle infrastructure are seen positive. An important aspect mentioned is the safety when riding a bicycle or a cargobike. The general thoughtfulness of all traffic participants needs to be increased to reduce dangerous situations for cyclists.

As workers are in danger of getting ill when entering an air-conditioned building after sweating while riding a cargobike, Bellis is aiming for electric assistance. This will reduce the physical activity required and thus allow workers to ride a cargobike without sweating extensively.

Bellis thinks of several other uses for cargobikes, e.g. cleaning trips, collection of waste or removal of weed. According to them, it requires some creativity to find possible uses and to adjust (the cargo bay of) the cargobike to the specific needs for each operation. It may also require adjustment of the parts that have to be transported, e.g. the use of foldable ladders to be able to place them in the cargobike.

Another important aspect mentioned is the image of a cargobike, especially with older workers, as they often remember some icecream-seller that used a cargobike 50 years ago. The process of enhancing the image of the cargobike is seen as not only necessary in a specific company, but also in society in general to reduce the resistance that companies may face when thinking about introducing cargobikes as an alternative way to transport.

Cycle Freight in London

Transport for London (2009) has carried out a study investigating the potential use of cargobikes by various companies in the London area. This study identified several aspects of cargobikes usage, which have also been mentioned by other professional users.

- The positive aspects are:
 - Low purchase cost of cargobikes
 - Low “Running cost – tax, insurance, storage and depreciation”

4 Current usage of cargobikes

- No parking costs. If, as is the case in London, there is a toll to enter the city, cargobikes do not incur this cost as well
- “Speed in congestion - [...] journey times are much less affected by variable traffic conditions.”
- Negative aspects seen in this study are:
 - Security concerns of bicycles or cargo being stolen. However, this threat proved to be negligible, “as there are almost no instances of theft of cycles or payload report” by actual users of cargobikes.
 - The payload that a cargobike can carry
 - The range that can be covered with a cargobike
 - Driver fatigue can become a problem when drivers are not fit enough
 - Seasonality

The last three facts are also mentioned by Rietzkow (2012).

4.4 Attitude of authorities

The attitude of authorities, especially local (city) authorities is important both for the current situation as well as the possible future development. This chapter describes if and how authorities deal with cargobikes. The results can be summarised as being almost not existent, as most authorities know about cargobikes, but do not explicitly take them into account in their planning. Some exemptions however exist.

The overall of 18 cities that have been contacted to get an impression of how German city authorities deal with cargobikes are the same as the ones contacted for numbers and facts (see chapter 4.1).

Generally, the infrastructure is not specifically built for cargobikes. Most respondents from the cities contacted (subjectively) state that cargobikes are known and exist in the cities, but are no more than just a few. One respondent even described cargobikes as 'exotic', indicating that: 1. The bikes are very rare and thus 2. cannot explicitly be taken into account. Cargobikes, even though a special type, are just accounted for as one type of bicycle. The

4 Current usage of cargobikes

improvements for cyclists that the general traffic planning and traffic policies aim at are seen as adequate for cargobikes as well.

The existing guidelines for the design of cycling infrastructure are considered sufficient by the city authorities. Additionally, other special types of bicycles that also need more space than a traditional bicycle are seen as a reason to adjust the infrastructure at certain points. These special types are, for example, bicycles with a carriage (e.g. necessary length on traffic refugees), three-wheelers and special bikes for e.g. disabled persons (necessary width on cycle lanes). Another important aspect are barriers that are in many cases constructed to allow the above mentioned bicycles to pass and thus also allow cargobikes to pass through.

A few examples exist where special care is taken in relation to cargobikes or where measures for other bicycles significantly improve the situation for cargobike users. Freiburg provides special parking facilities for tandems and bicycles with carriages, which can also be used for cargobikes (Illustration 21). In Bünde and Oberhausen, barriers are avoided and/or have already been replaced by bollards wherever possible. This allows long and/or wide bicycles to pass through, which would not be possible otherwise. However, this is also not explicitly done for cargobikes, but also for all other types of larger bicycles.

4 Current usage of cargobikes



Illustration 21: Special parking for longer and wider bicycles in Freiburg (taken from Best for Bike, 2010)

Police

The results from police queries show results similar to those of the cities (Buchheit, 2012; Lanfermann, 2012; Schulz-Töpken, 2012). Cargobikes are generally known by the police, but are reported to be rare. Experiences with users of cargobikes are unknown, it is likely that this is due to the low number of users. Cargobikes are also not explicitly accounted for in theft-statistics. It is therefore not possible to give any statement on the number of cargobikes that are stolen. Summing it up, the answers that were given show that cargobikes are not explicitly accounted for in any way by the police.

4.5 Type of use

This chapter will sum up not only the types of use mentioned in the survey, but also provide further examples on the type of use that is detailed simply by the type of cargobike that is available.

Commercial use

Heavy and stable cargobikes are used especially for transporting heavy goods. For example, Bellis (see chapter 4.3) uses three-wheeler cargobikes with tailor made boxes for maintenance of road signs and lighting. Four-wheeler cargobikes are offered (at least as a trial) by an IKEA store for rental to transport furniture home. Parcel and mail services use cargobikes for delivery services, often some kind of bakers bike (Klama, 2012), and craftsmen use it to transport their tools to their customers (ibid.). Similar to the craftsmen is one example from the survey, where sports equipment is transported for outdoor training. A further type of usage are promotional cargobikes. These kind of bikes use the space and carrying capacity a cargobike offers to built up a small promotional booth, where e.g. information is offered, or cargobikes that can be used to sell prepared food and supper. An example is the historic icecream-seller mentioned by Rietzkow (2012). All of these types are also found on Nutzrad.de (2012). The use of a bicycle instead of a car allows the user to place the booth in pedestrian areas without any need (to look) for parking space.

Private use

Many cargobikes are designed for the transportation of children, ranging from newborn (with the help of special carrying devices to mount a safety seat known from cars, e.g. MaxiCosi) up to youths. Cargobikes can also be used for transporting disabled persons, even with a wheelchair. Multi-purpose cargobikes try to mix the uses, offering a seat for children as well as enough space for transporting goods in a limited quantity (e.g. shopping bags, bottle cases) – either at the same time or in a convertible manner. There are also cargobikes that can be converted to a stroller. Uses mentioned in the survey show that cargobikes are used for a wide variety of cargo, which is similar to the things that are transported when using a car for local transport. Nutzrad.de (2012) lists various types of cargobikes for transporting cargo and children. Additionally, it lists wheelchair-transporting cargobikes and some more

4 Current usage of cargobikes

special bikes (see also chapter 3.2). As different as the types of bikes are the uses that the users mentioned. They transport virtually everything that fits in a cargobike, ranging from a newborn to household moves. Most answers include shopping bags, babies and children, dogs and simply 'larger cargo'.

4.6 Remarks on current usage

The information gathered in this chapter shows some interesting aspects. It can be seen that most private cargobike users own or have access to a cargobike either for more than seven years or less than three years. This may hint at a current trend, showing that there are many new users who have started using cargobikes recently. Cargobikes are also used very frequently, like car owners do (see survey on non-users in chapter 5.1). The cargobike users mostly live less than five kilometres away from the city centre, which relates to the average trip lengths given. This shows that living close to the city centre favours the use of cargobikes.

Asked for the aspects that would further improve cargobike usage, mostly infrastructural and technological improvements were mentioned. Many of the infrastructural aspects are closely related to policy measures. The improvements mentioned for the technology of the cargobikes are valuable hints for manufacturers. The same accounts for the extensive list of experiences made by the users, which can be a valuable input for any infrastructure development, technology improvement or policy measure. Even though the respondents have to be seen as biased, the positive experiences clearly outweigh the negative.

Regarding the professional users, there seem to be several business cases thinkable. But, comparably to the non-users shown later, there is too little awareness of cargobikes and what they can offer for companies. The numbers and facts as well as the attitude of city authorities shows that the cargobike is both very rare at the moment as well as not on the minds of traffic planning explicitly

5 Non-Users

To be able to assess any measure that is foreseen to increase cargobike usage, it is important to know why people don't use cargobikes, or what would be necessary to encourage them to use a cargobike.

5.1 Survey

To gather information on non-users of cargobikes, a non-representative online survey was carried out. It is documented in this chapter and reveals why the modal share of cargobikes in Germany is negligible. The questionnaire can be found in chapter 11.2 . In total, 178 persons took part in the online survey.

Car usage

Of the 178 respondents, 157 have access to a car. About 24% of all respondents with a car state that they use it for all purposes and do so daily. This is a clear indication that if a car is available, it is used for everything and everytime as already found by MiD. If a car is used for shopping and escorting, 70% of the respondents are women. This can be compared with the findings by Dowling (1999) that women use a car to manage family life.

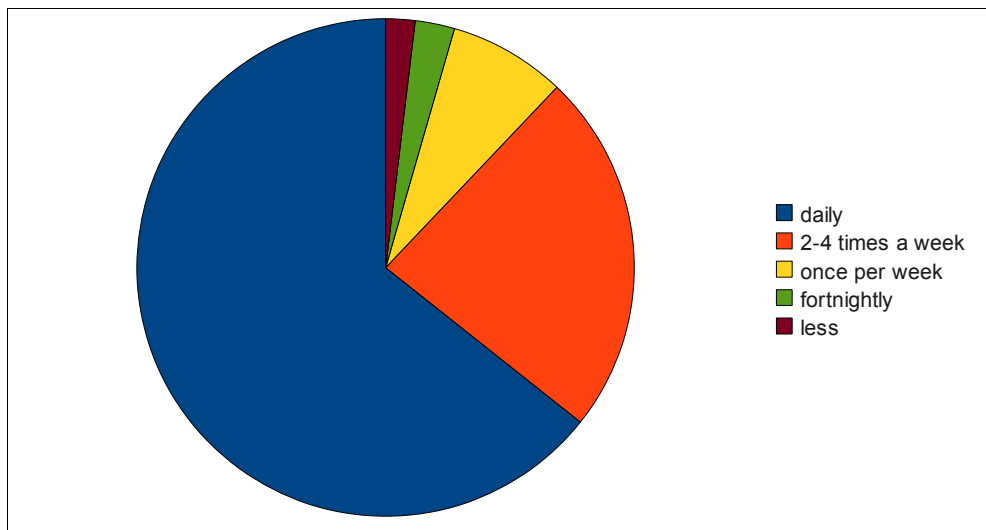


Illustration 22: Frequency of car usage (if car is available)

5 Non-Users

Activity	Answers
Commuting	105
Shopping	138
Larger cargo	89
Escorting	77
Other	40

Table 8: Activities cars are used for

The 'other' activities in Table 8 are cruising for fun, holidays, leisure trips and leisure organization, sport (clubs), visiting, cultural events, pulling a trailer, transport of people with reduced mobility, usage if distance and/or weather is unsuitable for bicycle or public transport.

Trip length	Answers
< 3km	1
< 5km	11
< 10km	30
< 15km	25
< 20km	28
< 50km	30
> 50km	30

Table 9: Average trip length when using a car

The average trip length shown in Table 9 shows that cars are driven for far greater distances than cargobikes or bicycles, respectively. On the one hand, a car enables the user to go greater distances, but on the other hand great distances (e.g. for commuting) require to use a car in the first place.

Public Transport

Of the 178 respondents, 40 have a monthly ticket for public transport. Of these 40 with a monthly ticket, 72.5% also have access to a car. Of those without a monthly ticket, 92.8% have access to a car.

5 Non-Users

Frequency	Answers
Daily	29
2-4x a week	5
1x per week	3
Fortnightly	2
Less than fortnightly	1

Table 10: Public transport usage frequency of respondents with a monthly ticket

It can be assumed that the daily users are mostly commuters and that the public transport is not necessarily also used on weekends.

Bicycle

Of the 178 respondents, 149 have access to an operational bicycle. The availability of a bicycle does not depend on the availability of a car or a monthly ticket for public transport.

Frequency	Answers
Daily	16
2-4x per week	39
1x per week	31
1x in two weeks	12
Less than fortnightly	50

Table 11: Bicycle usage frequency of respondents with an operational bicycle

Most users use their bicycle less than daily. When used once or twice a week, this is probably for shopping or going to a (sports) club. When used less than fortnightly, this is a clear hint at the bicycle being a transportation mode for leisure activities.

Activity	Answers
Commuting	41
Shopping	76
Escort	20
Leisure	71
Other	22

Table 12: Activities bicycles are used for

5 Non-Users

The other activities in Table 12 are sports, visiting, holiday, 'everything within short distance', cinema and concerts, and visiting the doctor.

Trip length	Answers
< 1km	0
< 3km	21
< 5km	34
< 10km	47
< 15km	28
> 15km	18

Table 13: Trip length for bicycle usage

The trip lengths of the bicycle are, as can be expected, much shorter than those of the car.

Cargobikes

Of the 178 respondents, 108 know cargobikes by sight. Of those who know a cargobike by sight, 65% would dare to ride a cargobike, whereas only 45% of those who don't know cargobikes by sight would dare to use it. As riding a cargobike is similar to normal bicycles, it can be assumed that the simple knowledge of cargobikes has an influence on the realistic assessment for riding a cargobike. This is a further hint that the awareness of cargobikes needs to be improved. A similar pattern can be seen when asked for a possible future usage.

Asked for the things that the respondents think can be transported with a cargobike, the following answers were given:

- Groceries, or bags in general
- Drink crates
- children and babies (with special fixtures)
- 'Everything that fits in', without risking safety
- Plants
- Dogs and other smaller animals
- Furniture

5 Non-Users

- Parcels and letters
- Other persons, especially 'drunkards' are mentioned
- Tools
- Sports equipment
- Bulk goods
- Garden waste, wood
- Pizza and other lightweight deliveries

Dare to ride a cargobike

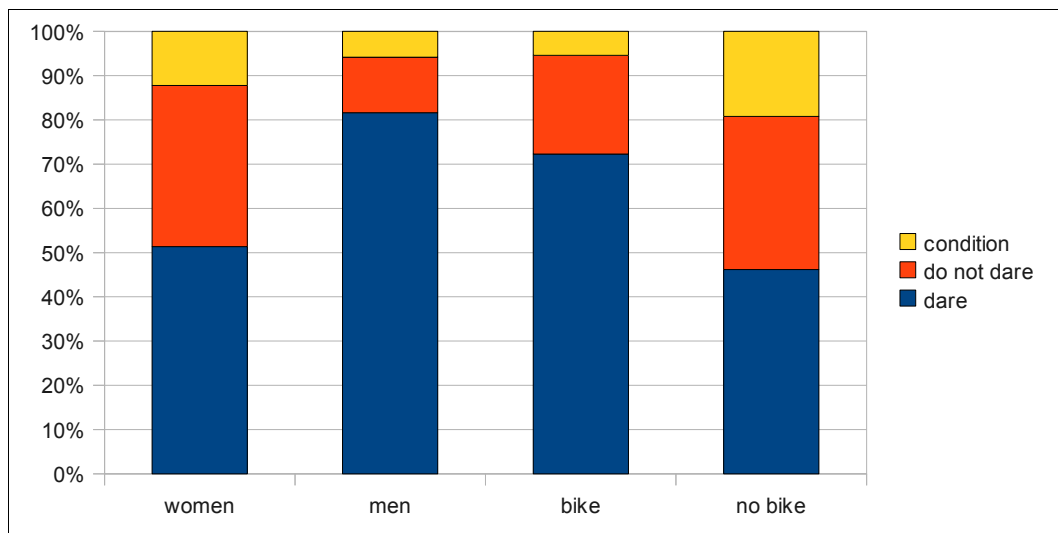


Illustration 23: Gender and bicycle availability dependence

122 of the 178 respondents would *dare to ride* a cargobike. The relations shown in Illustration 23 shows that a general availability of bicycles makes people dare to ride a cargobike more easily. More important, about 50% of women do not dare to ride a cargobike or mentions conditions. As the cargobike can be used for managing family life which is done mostly by women (cf. Dowling, 1999), remedy is needed to convince women that they are able to ride a cargobike. The conditions mentioned that have to be met before daring to ride a cargobike are:

- Briefing / instructions
- Possibility to test and try

5 Non-Users

- Easy handling, even with cargo
- Supporting electric assistance / no ascending slopes
- Comfort similar to a trekking bike
- Safety helmet available
- Normal cyclepaths can be used / no obligation to ride in normal road traffic
- No car or other means available / absolutely necessary

Use a cargobike

122 respondents cannot foresee to *use* a cargobike at all. 55 can foresee using one, and there is no difference between males and females. However the following requirements are mentioned:

- Infrastructure
 - (Weatherproof) keeping space available (especially in apartment blocks)
 - Safety
 - Trip time comparable with car or transporter
 - Usable in everyday life (short distances to and good accessibility of destinations, width and quality of cyclepaths)
- Cargobike technology
 - Good riding comfort and dynamics
 - Easy handling (getting on and off the bike, safe stand)
 - High reliability
 - Weight is not too great
 - Lockable transport box
 - Removable box
 - Electric assistance available (“no ascending slopes”)

5 Non-Users

- Reasonable price / good price-performance-ratio
- More practical than using a car
- If a carriage does not suit the needs
- Public Policy
 - Availability of cargobikes in Germany
 - Possibility to rent it at do-it-yourself stores to cycle cargo home
- Emotions
 - If using such cargobikes would be more popular
 - If it would be absolutely necessary
 - Better design
 - More time available
- Externalities
 - Good weather / summertime
 - Fuel prices continue to rise
 - No access to a car
 - If there is a need to use it (e.g. a family/children) – but the opposite is also mentioned: if a persons lives alone

The 55 respondents that could foresee using a cargobike stated the following activities that they could foresee using a cargobike for:

- Shopping
- Transporting children and dogs
- Escorting children
- Cargo, but only commercially

5 Non-Users

- Delivery services in cities / parcel services
- Holiday with children / camping
- Garden tools
- Garden waste, glass waste
- Music instruments
- Household move

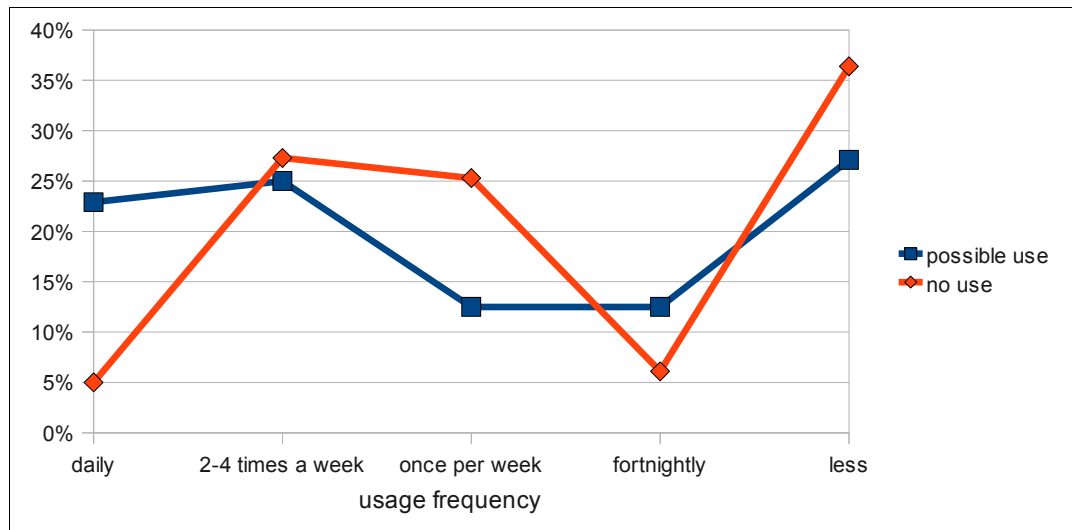


Illustration 24: Bicycle usage frequency vs. possible use of cargobike

The graph in Illustration 24 shows that those who already use their bicycle very frequently are more likely to use a cargobike in the future. When a bicycle is used daily, it probably already serves uses that can be done more easily when using a cargobike. If however the bicycle is used only once per week (e.g. for sports or recreation), there is no need for a cargobike.

5 Non-Users

Willingness to pay

Price	Answers
< 300€	8
< 500€	11
< 1000€	16
< 2000€	7
> 2000€	1
No statement	10

Table 14: Amount of money respondents would roughly be willing to pay for a cargobike

A comparison between the willingness to pay and the actual prices paid for cargobikes is done in chapter 5.2.

Reasons not to use a cargobike

The 115 respondents who cannot foresee using a cargobike at all provided the following reasons for not using a cargobike:

- Infrastructure
 - distances are too long
 - no (secure) space for storing the cargobike, especially in apartment blocks
 - doubts about the usability in relation to the given infrastructure
 - difficult to find a parking space in the city centre
- Cargobike technology
 - health reasons, high age
 - too exhausting, especially when fully loaded or going up hills
 - location of residence is too hilly
 - need to lock away things while on a trip
 - too slow, also compared to normal bicycles
 - not flexible (as opposed e.g. to a carriage)

5 Non-Users

- cargobikes are too heavy and impractical; too cumbersome (both in traffic and storing)
- more modern transport modes are available for cargo as alternative (e.g. cars)
- expensive for the narrow usage profile and weather dependency
- Public policy
 - expensive as an additional mode of transport, as the car is still needed
 - a gym is used for sports, no need to integrate sports in the everyday life
- Emotions
 - laziness
 - cargobike is too inconvenient (compared to a car)
 - anticipated difficult handling
 - safety concerns, especially in city traffic (reckless car drivers, difficult handling)
 - very narrow usage profile, cannot transport a wide variety of things
 - respondent estimates himself as an already uncertain cyclist
 - looks strange, odd design, unfamiliar
 - cargobikes are out of the ordinary, attract too much attention
 - make the rider feel ridiculous
- Externalities
 - weather dependence, additional weather protection is needed
 - car is available
 - simply no need to transport larger amounts of cargo – or a car is used for that
 - normal bicycle is considered sufficient for shopping (when living alone)
 - use of delivery services instead of own transportation

5 Non-Users

- trip-chains are used, would be too impractical to break the chain to change to a cargobike
- possibility to rent a LGV for cargo

5.2 Remarks and comparison to current usage

This chapter discusses the results of the survey on the non-users and some interesting aspects between users and non-users are compared.

The majority of the respondents has access to a car. The usage frequency of the car is in line with the findings from Mobility in Germany, showing that if a car is available, it is used very often. At the same time, bicycles are mostly not used daily. The quite large share of 2-4x a week hints at activities like shopping or sports, and the majority uses the bicycle less than fortnightly. This clearly indicates that the bicycle is not used as a means of transport in everyday life. No respondent uses a bicycle when going less than one kilometre. Even though one respondent (that lives alone) mentioned that a normal bicycle is sufficient for shopping, shopping is one of the main uses for a normal bicycle. This can be a good starting point for promoting the cargobike, as an existing mobility behaviour (shopping) can be replaced with a cargobike. Where people (especially families) need the car at the moment for doing the 'weekly shopping trip', the cargobike can be an alternative. Roughly 40% of the respondents have no idea about cargobikes, which makes it impossible for them to see it as an alternative transport mode. The non-users have mentioned various reasons why using a cargobike is not an option for them. These insights are valuable if trying to promote cargobike-usage.

5 Non-Users

Comparison to users

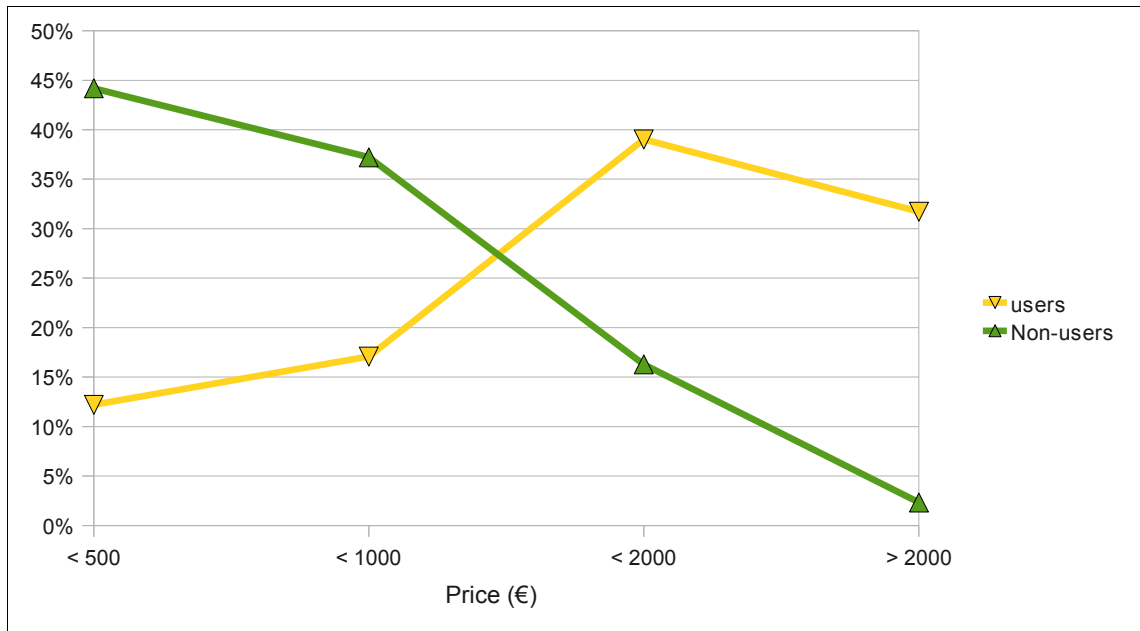


Illustration 25: Actual price vs. willingness to pay

Illustration 25 shows a clear discrepancy between the prices actually paid by users of cargobikes and what non-users would be willing to pay with their level of information available. This can have several reasons. First, a cargobike may simply become more expensive with additional options improving the basic bike, comparable to cars. Second, if the cargobike is seen as an additional mode of transport instead of completely replacing the car, additional money has to be invested and can therefore be expected to be quite low. Third, users that use cargobikes as a means to manage their family live or as a replacement for the car are likely to be willing to invest more in a high-quality cargobike.

5 Non-Users

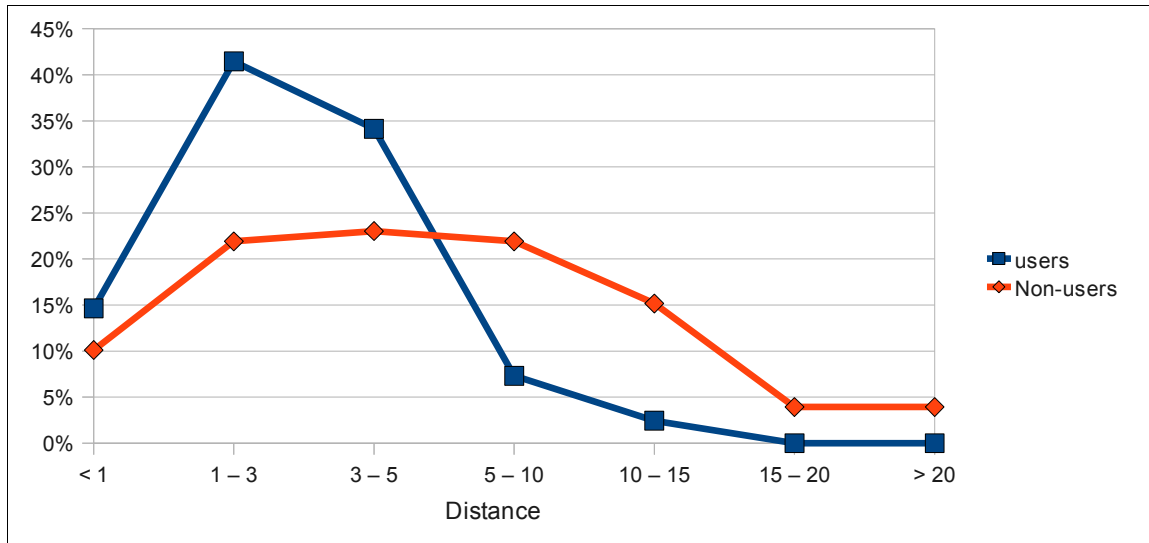


Illustration 26: Distance to city centre

The distance that can be covered plays an important role for the mode choice. The results displayed in Illustration 26 show that the cargobike-users live closer to the city centre, which makes the use of a cargobike feasible in the first place. Even though improvements like electric assistance and cycling-highways can stretch the operational radius of cargobikes, it can be doubted if those who live more than 15km away from the city centre will ever use a cargobike on a daily basis. Still, it can also be seen that the majority of the non-users lives within 10km radius from the city centre, thereby being potential users of cargobikes.

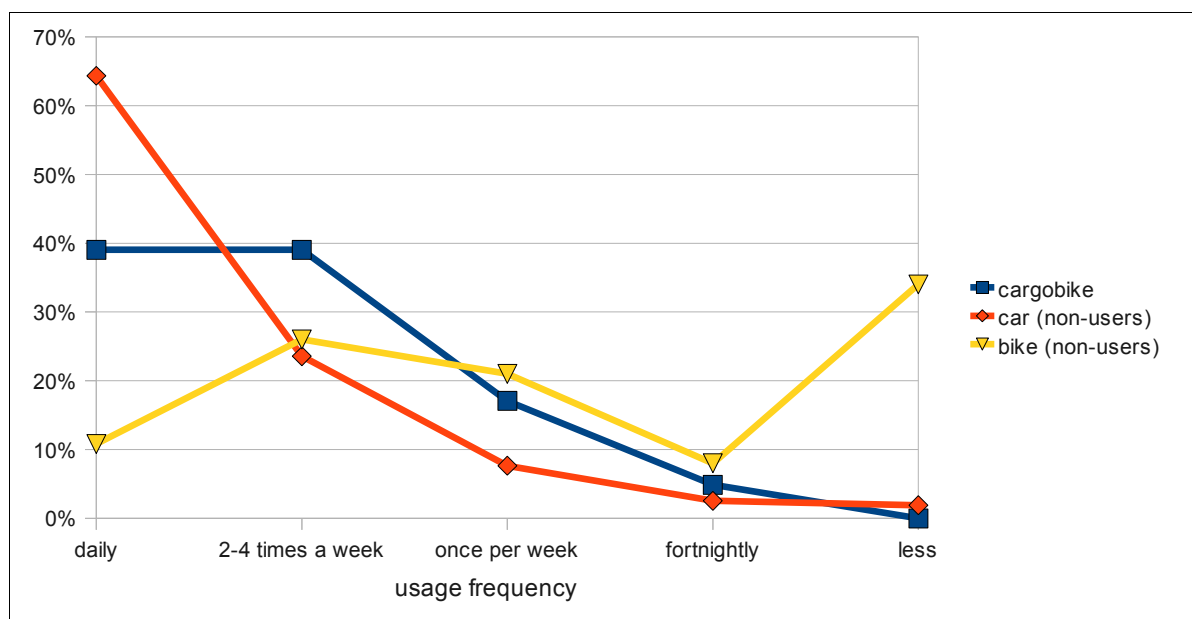


Illustration 27: Usage frequency of cargobike, bicycle and car

5 Non-Users

If a car is available, it is mostly used daily. This may be due to the simply need to use it (e.g. commuting over a long distance) or be another proof that if a car is available it is used for almost all mobility needs. Another striking aspect from Illustration 27 is that a small amount of people use their car less than fortnightly. It can be questioned if this is economical, especially in comparison with car-sharing. Cargobikes are used frequently as well, but a lower percentage uses them daily. This is supposedly due to either a more thoughtful mobility behaviour in which every trip is questioned in regard to its necessity. Another explanation could be that the cargobike is just one mode in a mixture where each mode is used according to the actual needs. Similar accounts for the normal bicycle, which is mostly used for special occasions ('less than fortnightly') or doing shopping or going to sports club during the week, which is mostly done 1-3 times a week.

6 Dis-/advantages

Considering the cargobike as an alternative transportation mode for short distance goods transportation, various stakeholders may see various advantages and/or disadvantages of cargobike usage. Table 15 gives an overview on various aspects of an increased modal share of cargobikes and the influence of these aspects on the listed stakeholders; further aspects and stakeholders may exist. The table also shows that, like most transportation modes, many stakeholders exist and a large variety of aspects has to be taken into account.

Both the aspects and the stakeholders are described below the table. The information processed here arose during the course of information collection in the previous chapters and it will be helpful to sum up some of the findings at this point. This will help to understand the next chapters dealing with the influencing factors and possible impacts.

6 Dis-/advantages

		Public Authorities	Car industry and dealers	Bicycle industry / dealers	Car rental companies	City residents	Firms	Car drivers	Kindergartens	Shopping malls	Health insurance	Petroleum industry	Fitness centres	Environment
Infrastructure	Cycle Infrastructure expenses	x				x				x				x
	Car infrastructure expense	x				x		x						x
	Provision of electricity	x	x	x	x					x		x		x
	Cycle parking space	x		x		x		x	x	x				x
	Car parking space	x	x		x	x		x		x				x
Cargobike technology	Cost efficiency			x			x	x						
Public Policy	VAT	x					x	x						
	Petroleum tax	x					x	x						
	Parking fees	x			x	x	x	x						
	Health aspects	x				x					x		x	
	Urban sprawl	x				x			x	x				x
	Traffic education	x	x	x	x	x			x		x	x	x	x
Externalities	Noise					x					x			x
	Air pollution					x								x
	Congestion	x				x	x	x				x		x
	Fossil fuel dependency	x										x		
	Soil sealing	x				x								x
	Parking search traffic	x				x	x	x	x			x		x
	Level of service	x					x							
	Accidents	x							x		x		x	
Emotions	Image of car	x	x	x	x		x	x		x		x		
	Communication					x			x					
	Social exclusion	x				x			x					
	Car dependence	x	x	x	x	x		x	x	x		x		x

Table 15: Overview on possible dis-/advantages and their impact on various stakeholders

6.1 Stakeholders

The following sections shortly describe the stakeholders that are involved if the modal share of the cargobike rose. These stakeholders have been identified especially during development of chapters 4 and 5, as both the users as well as the non-users give valuable hints at who will be influenced by increased cargobike usage.

- All kinds of **public authorities**, ranging from the federal ministries, through state level down to city authorities.
- The (German) **car industry and dealers** involved in the production, sale and maintenance of cars. This includes suppliers, car-manufacturers, large sale agencies and small repair shops.
- The (German) **bicycle industry and dealers** involved in the production, sale and maintenance of bicycles. This includes suppliers, bicycle-manufacturers, large sale agencies and small repair shops.
- **Car rental companies** whose business involves the rental of cars and/or LGVs. This also includes car-sharing companies.
- All **city inhabitants**, but also those who come to the city for other purposes like working and shopping.
- **Firms** doing business in the city (centre), where increased cargobike usage occurs.
- Traffic participants that **drive a car** or other motorised vehicles, either for private or for business reasons.
- **Kindergartens** and other social facilities where a lot of pick-up and delivery of (especially children) takes place.
- **Shopping malls** and other infrastructure like e.g. leisure centres where typically large space is made available to accommodate parking for visitors.
- **Health insurance companies**, both public and private.

6 Dis-/advantages

- The **petroleum industry** involved in the process of providing petrol and diesel for use in motorised vehicles, focussing mainly on those operating gas stations and the corresponding supply chain.
- All **fitness centres** that provide special training areas for physical education and fitness.
- The general **environment** including the whole nature with animals and plants, but also atmosphere and the like.

6.2 Aspects

The following sections will look into various aspects that would occur when assuming a massive increase in the modal share of cargobikes.

Infrastructure

There will be additional **expense for cycle lanes** for cities to improve them, as the money spent for streets cannot be reduced (in the beginning). However, most cities already create reasonable cyclepaths when rebuilding the streets (cf. chapter 4.4), providing sufficient infrastructure for cargobikes.

The **car infrastructure expenses** will change, if the number of cargobikes significantly increases and the number of trips made by car drastically decreases. The reduced cost will possibly occur due to reduced maintenance, as the general availability of roads cannot be reduced. Still, also single-lane roads could replace double-lane roads in some cases (e.g. Pezzei, 2012).

An increased cargobike usage will result in an considerably higher amount needed for **cycle parking space** on the destination (city centres, shopping malls etc.). In a transition phase, the existing parking spaces for bicycles may be overcrowded, resulting in displeasure of cyclists. Furthermore, pedestrians may also be hindered by overcrowded cycle parking areas.

Electric assistance for cargobikes, which would be necessary for a large share of the cargobikes used (cf. survey results in chapters 4.2 and 5.1), would require new infrastructure to **provide electricity**: Production and distribution of power, charging stations and also the corresponding operation. These investments need to be funded by someone. This funding

6 Dis-/advantages

may be a new business case for car- or bicycle manufacturers. An example is the charging station in Wolfsburg that was built using a former gas station (Wolfsburg AG, 2012). However, it has to be kept in mind that these infrastructural changes are also necessary for an increased use of electric cars – but less space and electricity is needed for (cargo-)bikes than for cars. The additional power needed would require increased power production. Depending on the way the power is generated (using fossil fuels or renewable energy), increased use of electricity would result in increased emissions, though still be lower than the power required for electric cars. Furthermore, the emissions would not occur in the city-centre and would generally still be lower than those emissions produced when burning petrol in a car with a combustion engine (Barzel, 2012).

If cargobikes replaced a significant share of cars, the need for large **car parking areas** or multi-storey car parks would decrease and thus cut costs for operation and maintenance. Dambeck (2012) reports that four cargobikes can be parked on the same amount of space as a single car. Cars however can be 'stacked' in multi-storey car parks, thereby reducing the ground area needed. It is not clear if cargobike users are willing to cycle up to the 4th floor just for parking.

Cargobike technology

The use of a cargobike is a very **cost efficient** means of transport for the user:

- No petrol needed, independence from rising energy prices (of course, the cost for additional food as the 'fuel' for the human engine has to be taken into account)
- No compulsory insurance (as opposed to cars)
- No taxes
- No parking fees

However, it is possible that e.g. parking fees or taxes will be introduced if the usage of cargobikes significantly increased.

Public policy

With an increased use of cargobikes, there will be less need to buy and maintain cars. This would mean that the revenues for the public authorities will decrease as cargobikes are

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cheaper to purchase than cars. Therefore, the value added tax (**VAT**) would decrease. Furthermore, the maintenance shops hourly rate starts at about EUR 50 for cars, but is mostly about EUR 70-100 (cf. ADAC, 2011). The maintenance shops hourly rate for bicycles can be as low as EUR 36. (cf. Radambulanz, 2011) and may be even lower. This would further reduce VAT revenues. Additionally to this, a cargobike is not as technized as a car, resulting in a higher percentage of self-repair, producing no tax revenue at all.

Reduced tax revenues will also occur due to reduced need for fossil fuels. The **petroleum tax** is a federal tax in Germany. Every trip that is made with a cargobike instead of a car saves fuel, resulting in reduced taxes paid for fuel. According to Blaess (2012) this could be a reason why the federal government does not really want a reduced number of motorised trips in favour of ecomobility, as the petroleum tax revenues would decrease.

At the moment, Bund der Steuerzahler Nordrhein-Westfalen e.V. (2011) hints at the fact that city authorities may see **parking fees** as a source of revenue. When more and more cargobikes are used, the revenues will decrease. It can be doubted that people are willing to pay parking fees for cargobikes when simply leaving it on the street, especially as paying fees is not the case today. People may be willing to pay, if their bicycle is parked in a protected and secured area. This could compensate some of the parking fee loss, but the amount can be expected to be lower as parking a cargobike is cheaper than parking a car (e.g. due to less space needed).

Generally, an increased use of cargobikes would increase the **health** of the people. The Bundesministerium für Landwirtschaft und Ernährung (n.d.) or ADFC (2012b) show that increased physical activity, e.g. cycling, can increase general health. Therefore, the Umweltbundesamt (2011) (Federal Environment Agency) or ADFC (2012a) state that cycling has a positive effect on the health. World Health Organization (n.d.) indicates that physical inactivity is responsible for about six percent of global deaths. Cargobikes do also emit almost no noise. World Health Organization (2011) demonstrates that reduced noise-level in an urban area also has a positive effect on health of the residents.

A significant share of cargobikes on the modal split for short distance cargo transportation would favour a city of short distances and vice versa. The problems seen with increasing **urban sprawl** (e.g. long distances travelled, land use, car dependency as mentioned by

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Rodrigue et. al., 2009, pp 228) could be reduced, and the cargobike could be one measure to ease the switch to a city of short distances and car independence. This aspect is further promoted by the fact that the bicycle is usually the fastest mode of transport for distances up to 5km. This may be less for cargobikes, as they are usually driven more slowly. With electric assistance however, this disadvantage of the cargobike can be partly compensated.

For a long-lasting and sustainable change of mobility behaviour, some kind of **traffic education** is necessary. This should start with the youngest in kindergartens or schools, but should also aim at adults, especially parents as they have a great influence on their children. A change in mobility behaviour towards ecomobility can have enormous positive impacts on traffic and society in general. AGFS (2012) and Lesch (2011) are examples of initiatives that try to change the mobility behaviour. Whereas AGFS (2012) aims at city authorities to become more cycle friendly, the concept mentioned by Lesch (2011) is a project directly teaching children to use a bicycle instead of being escorted by parents.

Externalities

Cargobikes do not produce any **noise** in the form of engine sounds or aerodynamic noise. This can have positive effects, as the Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (n.d.) sees noise as one of the major environmental problems in Germany. The sound of rolling tyres is negligible. In most cases, people talking on their bicycles or children in the transport box may be the loudest kind of emission. Still, it has to be mentioned that the noise of badly maintained cargobikes or loose cargo in combination with bumpy cyclepaths can be a notable emission.

Cargobikes (like any other bicycle) do not produce any **air pollutants**. However, as with any rubber-tired vehicle, little amounts of wear debris will be produced (cf. Loibl and Brust, 2011). Still, this will be much lower than the debris produced by cars. This means, that cargobikes do not (during their use) produce CO₂, which is a major concern of many communities and countries threatened by climate change. The cargobike can also be a measure to reduce air pollutants in cities that introduced an Umweltzone (engl. Environmental zone, see Umweltbundesamt, 2008). However, if cargobikes have an electric motor assistance, the generation of the electricity needed will produce air pollutants unless

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the electricity is produced from renewable sources. But mostly electricity is not produced directly in the cities.

If more cargobikes are used, the **congestion** on streets caused by cars would decrease (cf. Rodriguez et al, 2009, pp244). This would lead to more fluent traffic, which may be beneficial for those that are really in need of using the car, LGV or trucks. Of course, the risk of congestion also exists on cycle lanes if they are used heavily. But bicycles stuck in traffic do not emit noise and air pollutants. The space needed for a bicycle traffic jam is still much smaller than the space needed for a car traffic jam.

The fuel saved by replacing car trips by cargobike trips reduces the **dependency on fossil fuels**. This aspect becomes increasingly important, as Germany does not have significant resources of fossil fuels and competes with other countries for cheap fossil fuels (especially oil). Large effort is undertaken to reduce the amount of conventional oil that is burned in combustion engines, e.g. by introducing so-called 'biofuel' (e.g. Umweltbundesamt 2010). A transportation sector that is less dependent on fossil fuels lessens the political pressure that can be imposed on Germany (e.g. Spiegel Online, 2007).

As cargobikes need less space than cars, the necessary infrastructure can also be smaller. This reduces the **soil sealing** and thus the negative impacts on the environment as mentioned e.g. by Umweltbundesamt (2004). Of course, if increased cargobikes usage is just additional to car use, potential infrastructure expansion for cargobikes creates additional soil sealing.

The search for parking space is almost stress free, as cargobikes can be parked nearly everywhere. As the cargobikes are ridden close to the destination and parked, the **parking search traffic** of cars would drastically decrease (cf. Rodriguez et al, 2009, pp 244). This would further reduce emissions and congestion in the cities. If the share of the cargobike increased drastically, the search for a parking space may also be necessary with a cargobike, but would still not produce noise and air pollution.

Businesses that are dependent on car use (e.g. craftsmen) could improve their **level of service**, as less congestion occurs on the streets. This accounts for all other users as well, that have to use motorized traffic. This would benefit the whole economy as the financial losses due to traffic jams are reduced and services can be run more reliable.

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Assuming that the number of trips remains constant when many more trips are made with cargobikes than with a car, there will be fewer **accidents** involving cars and pedestrians or cyclists, respectively. A largely increased number of cyclists will raise the awareness of car drivers, reducing accidents where the cyclist was simply overlooked. Also, with an increased modal-split, cycle traffic will be more and more respected in traffic planning (e.g. traffic light control), resulting in less traffic violations by cyclists. Of course, it has to be considered that the improvements for cyclists will result in a worsening for the car drivers, possibly inducing traffic violations.

Emotions

Especially in Germany, the production of cars is a industry that employs thousands of people. Unsere Autos (2012), an initiative by the Verband der Automobilindustrie (VDA, engl. 'association of automobile industry') states that 'every seventh job' is dependent on producing cars. Contrary to this, Adler (2010) states 'about every 25th job'. Even though these two statements can be seen as the maximum and minimum numbers, the general dependence on the automobile industry is high in Germany. Partly due to this dependence, the **image of the car** is very positive and it is seen as a status symbol. Due to this dependence, promoting alternative transportation modes (and thereby demoting the car) is unpopular.

The experiences from users (cf. chapter 4.2) show that other traffic participants show greater respect for cyclists on cargobikes, especially when transporting children. People are no longer 'hidden' in their cars, the mutual respect will rise due to increased **communication**.

Riding a cargobike is generally possible for everyone, although a good general fitness is beneficial (cf. Chapter 4.3). This means that cargo can be transported by people that do not have any other chance to transport cargo (i.e. by using a car), which accounts for youths, people without a driving licence, people without (the economic possibilities to buy) a car and similar. Cargobikes (and the corresponding infrastructure) would thus reduce the **social inequality** caused by the car-dependent society.

In combination with public transport, walking and cycling, a cargobike makes the need to own a car superfluous and breaks the **car dependence**. Thus the cargobike could be another

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inducement of a transportation mix to convince people to live without a car, especially in appropriate surroundings like compact cities and flat areas.

7 Influencing factors

So far, various information has been collected dealing with several aspects that are related to cargobikes. This chapter will carve out the factors that will influence cargobike usage in the future in any way, thereby helping to assess the possible potential.

The cargobike needs to be able to replace any mode of transport that has been used before, which is in most cases the car for private persons and LGVs for businesses. The fact that people do not like to change their behaviour very much in connection with the fact that behaviour changes mostly occur due to economic reasons leads to the idea that the cargobike needs to be able to simply replace the car or LGV. For example, if cargobikes become faster due to electric assistance, the distance covered becomes larger. Another example, if environmental restrictions make it harder to drive a vehicle with combustion engine into a city centre the cargobike may a reasonable alternative. This shows that a variety of factors will influence the development of the cargobike in the future. These factors are described in detail below.

Generally, improving the overall situation for bicycles will help the cargobike to become more attractive as well. Cargobike users will not only profit from e.g. improved infrastructure or cycle-friendly policy. If people use bicycles as a matter of course, using a cargobike will also be more common and thus be seen as a normal alternative. This can be seen e.g. in Copenhagen or The Netherlands: Cycling in general is very popular (especially in comparison with Germany), and there are many cargobikes used.

Influencing factors can also be grouped into the identified fields. This list is not exhaustive, but shows the main influences on future cargobike usage. Of course, some of the influencing factors may belong to more than one group.

7.1 Infrastructure

Infrastructure is one of the main points mentioned both by current users as well as non-users. To accommodate potential growth of cycle traffic, the related infrastructure needs to be extended in the future. At the beginning however, the existing infrastructure is generally

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sufficient by means of path width and network length. Smaller improvements will bring cycling forward much more than simply building new infrastructure:

- Removal of narrow bottlenecks on cyclelanes
- Lowering kerbstones to remove edges on cyclepath-street-connections
- Provision of a larger number of bicycle stands, especially for cargobikes
- Enlargement of traffic refugees to enable cargobikes to wait on them safely
- Priority for bicycles or at least better provision for the needs of bicycles on traffic lights or crossings
- Theft-secure possibilities to park a bicycle, especially at home

A crucial point for the use of a cargobike is the possibility to store the cargobike at home and at the destination (e.g. shopping centre) safely and securely. It is the responsibility of authorities to establish policies that force landlords to provide suitable keeping space for bicycles in general and cargobikes in particular. These policies are in development (Bündnis 90/Die Grünen, 2010). As bicycles are stolen or damaged much more frequently than cars, cargobike usage depends on the availability of secure storage facilities at home in every kind of building. As many of the non-users mention, the impossibility to store the bicycle securely and conveniently is a main reason that prevents them from using it on a daily basis. Convenient and secure parking facilities at e.g. shopping malls or sports centres would further favour the use of cargobikes.

7.2 Cargobike technology

Both the current users as well as the non-users state a clear sensitivity towards the weather. Especially in comparison with the car, bicycles do not offer any protection from weather. That means that cyclists need to care for weather-protective clothes. Nowadays, it is often possible for car drivers to enter the garage and thus the car without the need to care for the weather. The same accounts for many destinations like shopping malls, office buildings and similar. In this way, the car driver is not exposed to the weather at all. In contrast to that, a cyclist is exposed to the weather during the whole trip. To be comparably convenient, the

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weather protection for cargobike users needs to be more convenient, work more reliably and have a better image. This can be done by either wearing protective clothes or by designing weather protection for bicycles (and cargobikes, respectively) directly as shown by the four-wheeler in Illustration 13. Furthermore, the cycle highways proposed by Bischoff and Alrutz (2011) could also be weather protected by installing a transparent roof and/or walls, shielding the cyclists from the weather.

The distance that can be covered by a bicycle is generally lower than by a car. This accounts even more for cargobikes, as they are generally ridden slower. To be able to replace a significant share of motorized transportation, the cargobike has to have comparable travel times to the car. That means that either the distance or the speed have to be changed. Probably, the simpler approach is to raise the speed. This can be done by electric assistance that allows the cyclist to reach a high average speed. A dedicated cycling infrastructure like the proposed Radschnellwege (engl. 'cycling-highways') would also be beneficial (Bischoff and Alrutz, 2011). Reducing the distances is a long-term goal for city development, including the reduction of urban sprawl, creating zones of mixed use (living, working, shopping) and create financial incentives to live close to the city centre.

It will be crucial that the development of the cargobike itself can fulfil the needs and expectations of both current as well as potential users. One of these expectations, following a current trend, is the electric support that is required, especially in connection with the heavy loads that can be transported. The manufacturers generally respond to this need, as most cargobikes can be ordered with electric assistance. Still, there are more needs that can be discovered when looking at the surveys. It will be up to the manufacturers to develop cargobikes with the required features. To speed up the development or guide it into a certain direction, governmental action, e.g. in form of design-competitions or funding, could also be helpful. The following features have been identified in the course of this study:

- Further development of electric assistance (ease battery care and handling)
- effective, easy-to-use weather protection
- Possibility to lock cargo in the bike

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- increase flexibility for various uses (child transport, cargo transport, adult transport, disabled transport)
- compact layout or foldable for storage
- safe and easy handling
- appealing design, which is also an emotional aspect

7.3 Public Policy

As riding a bicycle is regarded to be dangerous both by users and non-users, policy measures to increase traffic safety are necessary to increase the modal share of bicycles and cargobikes. An example is the introduction of a general speed limit of 30km/h in cities, as claimed e.g. by vivavelo (2012). Of course, traffic safety is in many cases infrastructural (e.g. providing wide cyclelanes on the street), but these infrastructural changes need to be supported by a general policy of the local authorities.

Generally, cycling is nowadays not seen as a transportation mode that can fulfil many of the daily mobility needs, even though it actually can provide this especially in densely populated areas. Large efforts are made e.g. to reduce local emissions from motorized transportation (see Weirich, 2011). In Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (2012), a funding of 330 Euro is offered for equipping a diesel car or LGV with a filter that reduces particulate matter emissions. Using the same amount of money to promote or fund cargobike usage may have a larger effect, because car-trips would be avoided completely instead of making them cleaner. There is no way to disagree that motorized transportation needs to become cleaner, but this example is supposed to illustrate the order of magnitude of the finances necessary to reduce emissions. Similar programmes to fund (cargo-) bikes to promote a mobility culture that does not produce emissions at all are not known. In connection with the increased use of carsharing (cf. Mobility in Germany), investing in bicycles (and thus cargobikes) in connection with the provision of a sophisticated carsharing system and public transport may be more cost-efficient than funding private upgrades of car-exhaust-systems.

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The bicycle needs to be promoted as another way of transportation that has advantages over other modes of transport, i.a. being cheaper than owning a car. These advantages for the user have to be emphasized, creating a positive image. Topp (2012) states that personal (economic) advantages affect the mode choice much more than e.g. ecological reasons. So, campaigns promoting the use of the bicycle and cargobike, respectively, should focus on the advantages that this transport mode has for the user. The advantages for the national economy or ecology should only be mentioned additionally, successful campaigns should centre on direct personal advantages for the user.

The majority of the non-users lack knowledge about what can be done with a cargobike. Generally, the transportation of cargo is expected to be the only thing to do. Some mention the transportation of children. However, as mentioned in chapter 3.2 and the survey on the current users, a wide variety of things can be transported. For some, these additional usages may make the difference between an economic or unreasonable investment. It therefore depends on the information of people about the possibilities of cargobikes to allow them to make a sound decision about an investment. This will influence the cargobike usage in the future.

The same reason, but dealing with a different aspect, is the expectation on how cargobikes are ridden. Many non-users expect difficult handling, exhaustive pedalling, hard steering and the like. Again, as explained in chapter 3.2, this is simply not true and information is necessary to allow people to get a more objective picture of cargobikes. As mentioned by Lang et al (2010), cargobikes given away for trial periods can be a good measure to raise knowledge about them.

Furthermore, closely related is the fact that many people do not dare to cycle a cargobike. The reasons brought forward show that the non-users have no idea about the way cargobikes can be handled. The example cargobikes shown in the survey are two- and three-wheeler cargobikes that are relatively easy to handle. After a short period of familiarisation, riding a cargobike is as easy as riding a normal bicycle (cf. chapter 4.2). This even accounts for loaded cargobikes, which of course require some more power for pedalling. For the latter however, electric assistance is available. The modal share the cargobike can achieve also

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depends on whether or not people generally get an idea what a cargobike is and what it can be used for – in the same way as everyone has an idea what a car can be used for.

As shown by the non-user survey, many people simply don't know cargobikes. Raising the awareness level could be a simple measure to increase the usage of cargobikes, an example being Adamczyk (2012). This could be done by any stakeholder interested in an increased usage of cargobikes or a cooperation of them. An increased awareness level could possibly reduce the generally acclaimed necessity of a car as soon as a child is in the household (cf. Mobility in Germany)

The usage of cargobikes through cargobike-sharing or a collective (e.g. in Vienna, as mentioned by some respondents of the survey in chapter 4.2) can have advantages over owning a cargobike. The same trend is currently occurring with car-sharing, as the advantages are comparable: There is no need to invest a lot of capital for a vehicle that is used comparably seldom. No maintenance has to be done. Cargobike-sharing would further increase the choice between various vehicles according to the actual needs, and may further reduce car-usage.

For a general and substantial change in mobility behaviour, in which the cargobike can play a significant role, already children need to learn that other possibilities than using a car exist. This may be e.g. by parental behaviour (no more escorting of children to kindergarten or school by car) or school education (e.g. basic traffic geography already in primary school). Several current users mention this as a reason to use cargobikes to transport their children. Another possibility are campaigns aiming at children which promote alternative transportation modes like the cargobike.

To extend the range of cargobikes, the possibility to take a cargobike on a bus, tram or train could be helpful. However, to allow this, massive changes in infrastructure and vehicles are necessary. Lifts are mostly dimensioned to allow wheelchair-users and probably cyclists easy access. As cargobikes are much longer, this would require expensive changes. Further, already today the situation within public transport vehicles is often crowded with strollers and bicycles, and there is usually no space to extend the multi-functional areas. It can therefore be doubted that taking a cargobike on a train is a realistic future scenario.

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Currently, the bicycle is often seen as a means of transport for leisure activities, shopping and/or commuting. As an example, Adamczyk (2012) argues that it is necessary to use the car to take/bring children to kindergartens or schools, and that this, in relation with trip chains including shopping, cannot be done using a bicycle. Public transport is considered to be too slow. There seems to be a large potential with younger families that currently use two cars to fulfil their mobility needs and live in or close by the city. Adamczyk (2012), although being an ardent cyclist, wasn't aware at all that cargobikes exist. After being introduced to these kind of bikes, she immediately thought about selling one of the two cars that currently exist in the household and replace it with a cargobike. Most important, the same trip chains could be produced with the cargobike as are currently with the car.

7.4 Emotions

At the moment, the automobile is seen as a status symbol, especially in Germany. Opposed to that, a bicycle is usually just a means of transport, often even only for leisure trips (cf. chapter 5.1). The ordinary bicycle is not perceived as a status symbol. If the cargobike shall be established as an alternative mode of transportation, its image needs to be improved. At the same time, the car as a status symbol ideally needs to be degraded to be perceived as 'just' a means of transport. This can however be ranked as quite impossible in Germany.

For many people, the car goes without saying. They do not think about a cargobike (in connection with other alternative mobility behaviour), as they don't see any need or do not know it. The cargobike would profit from a general rethinking of mobility behaviour. As Blaess (2012) mentions, this also depends on the history of every single person. Growing up with a cargobike for transportation is likely to make persons use a cargobike themselves – this of course does not account for people who grow up knowing mainly cars.

Several respondents of the non-users mentioned an odd or strange design of the cargobikes displayed. The acceptance of the cargobike in general largely depends on the availability of modern, attractive and appealing cargobike-design. The current image of the cargobike as being a 'boring' and 'grey' vehicle for 'tree-huggers' needs to be removed. The future design for cargobikes needs to be able to catch emotions. Special focus should be put

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on women's needs and expectations, as a cargobike could replace the second car which is often used for shopping and escorting trips by women (cf. Mobility in Germany).

There is a current trend, especially with younger people, that car ownership is reduced and that transport modes are used according to the actual need. This trend relies on the increasing availability of carsharing, a sophisticated public transport network, walking and cycling in connection with the availability of real-time information using smartphones. The cargobike can be an additional means to fuel this trend. This could be e.g. as cargobike-sharing, offering environmentally aware people even more chances to avoid the use of a car. The cargobike could also be a comparably inexpensive basis for transportation needs, further reducing the need to use carsharing.

Many respondents mention laziness as a reason not to use a cargobike. One respondent explicitly states that if he wants to do sports, he is going to the gym. The use of (cargo-)bikes instead of a car in the daily routine may in many cases be sufficient for physical activity. People need to be aware that e.g. the additional time spent on a bicycle can be saved in the gym. Including more physical activity in the daily routine also leads to a general healthier society.

7.5 Externalities

The use of electric assistance is nowadays already widespread and developing in normal bicycles. Many survey respondents (cf. chapter 4.2) mention electric assistance as being extremely helpful or that a cargobike is hard to pedal, especially going uphill. Therefore, it can be expected that many cargobikes will be bought with an electric motor, requiring a battery to provide the power. The availability of batteries and the necessary resources is already crucial today and may become worse in the future (Marsiske, 2012). If no inexpensive batteries are available for use in cargobikes, many potential users will not use a cargobike due to the stated restrictions.

Energy is necessary to move any vehicle. In recent years, energy has become more and more expensive. This accounts especially for fuel that is needed to power cars and LGVs with a combustion engine. But no matter what form of energy will be used in the future to power our vehicles (may it be fuel refined from oil, biological fuels, electricity, natural gas or any

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other), the price of energy will be important. Energy needs to be used as efficient as possible, and driving a 35kg cargobike to a shopping mall is far more efficient than sitting in a 1000kg car.

Possibly another external effect that has significant impact on the cost for motorised transportation is the legislation imposed by the European Union to reduce emissions. For motorised vehicles, this means a steady increase in cost, making cars and LGVs more expensive. At the moment, cargobikes do not have to adhere to any legislation with regards to emissions. However, in the future there may be something similar for electric motors or a requirement to use renewable energy. This would incur additional expenses as well.

8 Potential and impacts

This chapter has two purposes: First, it will give an idea about the future potential of cargobike usage in Germany. Second, by assuming a very positive development, the impacts that a drastically increased modal share of cargobikes would have are detailed. The development of an extreme scenario will clearly illustrate the possible effects.

8.1 Commercial use

The general potential for commercial use of cargobikes can be summarised as 'there must be a business case'. Due to the nature of companies, things are generally only done if they are profitable. This does not only include direct profits (e.g. in the form of return-on-investment), but also improvements of the image of a company or advertising. The same accounts for the means of transportation that is used. The cargobike needs to be more profitable than any other means of transport to be used by commercial companies. Transport for London (2009) states the factors that especially influence the use of cargobikes. The development of these factors will influence the future use of cargobikes by companies. Expecting a further rise in energy prices in general (and petrol in particular), the efficiency of transport becomes more important. This would favour cargobikes, as the payload-mass ratio is higher than for cars of LGVs. The continued technical development, especially of electric assistance for cargobikes in the recent years also favours cargobikes as an alternative mode. This development and possibly the introduction of even stronger motors with larger batteries will remedy the drawbacks of the limited range of cargobikes as well as driver fatigue during extended use. Possibly, a hybrid between a cargobike and an LGV may be developed. The four-wheeler presented in chapter 3.2 is a step into that direction. The comparably small payload could also be increased by technical development. However, the amount of cargo that can be transported is generally underestimated by potential users (cf. Transport for London, 2009), hinting at further need to raise awareness.

One major drawback is seasonality, which hinders an extended use of cargobikes during periods of rain and cold weather, i.e. especially autumn and winter. On the one hand, cargobikes may be an economic investment for good weather, but still bind capital that is

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only used seasonal. On the other hand the weather protection has to be developed to allow year-round usage, an example again being the four-wheeler that offers a rainshield.

Companies also pay more and more attention to a green image, where the cargobike could at least be used for presentation. Positive experiences during these 'green' trials may also lead to a generally increased use in these companies.

To favour a business case for cargobike use, the general improvement of cycling infrastructure has to be continued. As time plays a major role for e.g. parcel services, they need to have e.g. intersection-free cycle paths or well-placed cycle stands to reduce overall travel time. In this way, the cost of congestion and searching a parking space could also be reduced. However, a lot of the commercial potential depends on whether or not public authorities will support the use of cargobikes.

Generally, given the currently foreseeable developments of the factors that influence cargobike usage by commercial companies, it can be expected that the share of cargobikes will increase. There are many companies that have a general potential which can be used: Parcel and mail services, home delivery services (e.g. pizza or other food, drink crates, pharmacies), taxi / rickshaw, craftsmen, and so forth.

8.2 Public use

The potential for use of the cargobike by public bodies is similar to the commercial use: Both have to act economically. However, a big difference exists as public bodies may also make uneconomical investments and decisions. The reasons for that include (but are not limited to): giving an example of good practice to stimulate others to follow or to act according to a general policy that is not economical in the short run (e.g. environmentally friendly). Therefore, if the cargobike will become well known and more common, it is likely that public bodies increase its usage wherever it makes sense to give a good example especially for private persons.

8.3 Private use

Taking the current situation as it is, the potential for cargobikes is rather low, as the economic necessity to switch to alternative transport modes is still too low. But both mobility

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behaviour as well as external influences are changing rapidly and may thus give a rise to cargobike use. One aspect is that about one quarter of Germans avoided making a trip due to financial reasons (Allianz pro Schiene, 2012), showing the rising awareness of the economic aspects in mobility behaviour.

One fact that supports the currently rising modal split of cycling is the advancement of infrastructure. Bicycles are more and more seen as an important part of (inner city) traffic and gain their attention during construction or rebuilding of streets (cf. e.g. AGFS, n.d.). Of course, there are still a lot of deficiencies that need remedy. If the current trend is continued (e.g. rising awareness of the efficiency of cycling, the high cost-benefit-ratio of cycling infrastructure, the positive effect on public health), the modal split of cycling will further increase. And with this, it is likely that the cargobike will also become more popular and used.

For several reasons, younger people tend to reduce car use (cf. Kuhnimhof, 2012), which can be seen as a change of behaviour in relation to their parents or older people in general. This is a very important insight, as e.g. Ahrend and Schwedes (2012) state that it is not up to technological advancement alone to reach a sustainable transportation. They see behaviour change as an important factor to accompany technological improvements. For the cargobike, the technology is generally available and has even been improved in the recent years by e.g. electric assistance. So, both the technology is available as well as a general behaviour change that could advance the use of cargobikes in the future. Support by public authorities has to be seen as necessary and helpful to push this trend.

Historic European cities are traditionally very compact. Only in the recent decades have people been enabled by the car to live in suburbs. Still, a large share of a city's population lives within five kilometres from the city centre (cf. survey results in chapters 4.2 and 5.1). This distance can easily be covered with a bicycle and is often considered as the threshold below which the bicycle is the fastest mode of transport. The urban sprawl that occurred during the last decades cannot be reverted in a short time. But assuming rising costs for transportation, living close to the city will become attractive again. If this trend is supported by an according urban planning and policy, there is, in the long run, a large potential for cargobikes.

8 Potential and impacts

For private users, the availability of shops offering cargobikes is also important, both for purchasing as well as maintenance. The results from the user-survey show, that most users live in cities with more than 250.000 inhabitants. Possibly, the potential especially in smaller and medium-sized cities could be increased if cycle-shops would offer cargobikes. This could also be supported by local authorities.

The enormous rise in availability and technology of bicycles with electric assistance in the recent years can bring an advantage for cycling in general, as alternative propulsion for cars is not yet competitive. If the bicycle industry can continue this successful way, the electrically assisted bicycles and cargobikes may be used as alternative to the car, thereby facilitating a behaviour change. This would generally increase cargobike usage as well, but however depends on the development of electric cars as alternative.

If the general awareness could be increased, more people may be think about using a cargobike instead of a car, especially as a replacement for a second car in families. Raising the awareness of cargobikes is one of the most important factors to increase cargobike-usage.

8.4 Impacts

A society where cargobikes take a major share on the modal split of short- to medium distance transportation of small amounts of goods and persons will show large differences to the current situation. The following paragraphs describe a situation where the cargobike, together with walking, cycling, public transport and carsharing have completely changed our mobility behaviour. It is supposed to describe a – from the present view – provoking situation, thereby emphasizing and clearly illustrating possible effects.

Conception of a cargobike town

As a lot of cars are no longer needed, much parking space is saved in the city centre as well as in densely populated apartment block areas. This allows to convert parking space back to streets where people can spent their time, often as Shared Space. Nevertheless, if a car is needed, a sophisticated carsharing is available. Fewer cars also mean that double-lane roads can, in some cases, be converted to single-lane roads, offering more space for the increased number of bicycles as well as wider pedestrian areas. The dominance of the car in general is reduced, increasing the amenity values of staying outside.

8 Potential and impacts

This is supported by a reduced noise-level, as the passing cargobikes do not have combustion engines. This becomes apparent when a traffic light switches to green, lesser roaring motors can be heard. As the cyclepaths have an optimised surface with e.g. drop curbs, very few bumping sounds from cargobikes are heard as well.

General communication between traffic participants as well as between traffic participants and others increases due to people cycling instead of being locked in their car. Less aggression and misunderstandings lead to a friendlier behaviour in traffic, improving the travel experience.

The large amount of cargobikes parked in the city centre has led to creation of several guarded cycle-parking areas and buildings. Small maintenance repairs can be done while the driver is shopping in the city, resulting in new jobs. The fear of getting the cargobike damaged is also tackled, inviting people to use the cargobike when going to the city centre. The service is offered free of charge by the city authority. The parking fees for cars have been raised, and multi-storey car parks have been removed, drastically reducing operation and maintenance costs. These saved costs are reinvested to promote the use of cargobikes. Furthermore, the city authority has realised the benefit for local residents and businesses due to reduced motorized transportation.

As a large number of cargobikes use electric assistance, a charging infrastructure is installed. The cost for building up the infrastructure was paid for by electricity providers. They now make a good profit with charging the cargobike batteries while people are shopping. Some initial funding by the city authority however was necessary.

The production of the electricity is still discussed widely. Many people argue that the large number of electric cargobikes and bicycles is not as environmentally friendly as usually accounted for, as the energy is still produced by burning fossil resources. Due to the conversion to electricity, the efficiency is seen worse than burning it directly in a combustion engine. Opposing to that opinion, the amount of energy needed to move a cargobike is far lower than for a car, thus it is still environmentally friendlier. And last but not least, electricity can be produced sustainable, paving the way for the conversion of the power plants to renewable energy.

8 Potential and impacts

With the reduced use of cars, the local PM-emissions are very low. The limits for PM-emissions are easily met. The reduced emissions, but mainly the increased level of physical activity have led to healthier city inhabitants. The cost of healthcare can be reduced, and less overweights are seen.

As fewer cars are on the roads, congestion levels have drastically decreased. Companies that need to use a car or LGV to do their business now can use the streets with a higher reliability. This does not only lead to shorter travel times, but also to an increased level of service. More and more companies value the advantages the fluent traffic has for their business and relocate their offices and premises to the city centre. The companies also begin to value the increased health of the people, leading to employees with less sick days off. Using a bicycle for commuting to work is also promoted to further support the employees health.

The increased use of cargobikes and bicycles in connection with carsharing has led to fewer cars owned by private persons. Many traditional garages are now either too large or completely superfluous. Work is in progress to adjust the size of the garages to cargobikes, making space for new houses or open spaces. The new houses increase the density of the city, further favouring the use of bicycles and cargobikes, whereas the open spaces increase the amenity value of the city.

At the beginning of the cargobike-boom, many people feared that a lot of jobs would be lost in the automobile industry. This however proves to be only partly right. First, still a lot of cars are produced and exported to foreign countries. Second, the bicycle and cargobike industry is also employing a lot of people. The development of the cargobike is continuing at a high pace, highly qualified engineers are needed here as well. Third, the automobile industry adjusts to carsharing by producing special cars and earning a lot of money with maintenance contracts for these cars. Fourth, the maturity of the electric assistance technology for bicycles, especially the batteries, helped the automobile manufacturers to improve electric cars.

Nowadays, this situation can hardly be envisaged, but the consequent focus on sustainable traffic will improve the life in the city.

9 Conclusion and recommendations

In this chapter, the results obtained in the previous chapters are used to draw and discuss conclusions. These conclusions are used to finalise the paper by giving recommendations that hint at expanding cargobike-usage.

Not exactly surprising, various information sources used in this study have shown that there is an enormous dominance of the car in Germany. This becomes especially apparent by the survey of the non-users (cf. chapter 5.1), as the reason not to use a cargobike is often simply that a car is available and there is no need to think of other ways of transportation. Another example is that the current trend of the government to establish electric mobility does only focus on cars, even though there is an enormous growth in the electric bicycle market (Barzel, 2012). Some users even state negative comments from other traffic participants – not for using a cargobike, but for using something else than the car.

The dominance of the car is related to the general awareness level of cargobikes. About 39% of all respondents do not know about cargobikes at all. This of course hinders them from thinking about the cargobike as an alternative mode of transportation. Whereas cars are on the mind of everyone, beginning at children's age, cargobikes are not well known. Many people only know cargobikes from Asia and think of them as an outdated, primitive way of transportation (cf. chapter 5.1). This is however not true, as there is fast development in the cargobike technology and examples from Amsterdam or Copenhagen show that it is very well possible to live a modern life using a cargobike.

The survey on the non-users reveals another very interesting aspect, namely that people are not willing to adjust their behaviour just to use another means of transport. If the new transport mode does not exactly fit in their well planned mobility pattern, there is no chance to convince them to change. Cargobikes therefore have to be further developed to be able to replace the car without the need to change the daily behaviour. That means for example that the range has to be extended (electric assistance, aerodynamic design, but also general fitness), facilities have to be available to store the cargobike easily, the box must be lockable to facilitate trip chains more easily and so forth. The cargobike needs to be adjusted to the

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users mobility behaviour and not vice versa. This also includes to provide a corresponding infrastructure.

In relation to the current trend of younger people getting more and more independent from (especially owning) the car, it can be expected that a significant change needs many years to occur. The car is deeply rooted in our society, and any change to another transportation mode takes time. However, if the cargobike and what can be done with it gain more public attention, people may see it as the missing part to use ecomobility and completely avoid using the car within the city.

Regarding a commercial use of cargobikes, the bottom line is that there needs to be a business case. The few companies that use cargobikes in their daily business see clear advantages over using a car or a LGV, at least for some special applications. They can avoid congestion and high cost due to rising fuel prices, a cargobike can be parked nearly everywhere and is allowed to access pedestrian zones. However, the same drawbacks as for private users are valid: A cargobike is weather dependent and drivers have a limited range. Most other drawbacks can be eliminated by special constructions of the cargobikes, e.g. a lockable box or the allowed payload. Again, there is a lack of general awareness of the possibilities that cargobikes can offer.

Now, back to the main fields identified during the study, shortly highlighting the most important aspects that were found for each of them.

Infrastructure

The general infrastructure is seen as sufficient, most users only complain about deficiencies at single spots like cycle barriers or too narrow cycle-paths (cf. chapter 4.2). The city authorities responsible for the development of the cycling infrastructure see the current guidelines as sufficient, the infrastructure for cargobikes is improved due to improvements made for other bicycles like trikes or carriages. Nevertheless, there are several points where the cargobike has special requirements on the infrastructure that should be taken care of. Examples are drop curbs without any edges, length and width of traffic refugees and parking space. A special aspect is the possibility to store the cargobike at home. Unlike normal bicycles, cargobikes cannot be carried into a cellar for storage easily and thus require special

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keeping spaces. So, there are two fields within the infrastructure that need to be taken care of: The public infrastructure when using a cargobike and the private infrastructure dealing with keeping of the cargobike, including both apartment blocks as well as shopping centres and similar. Depending on the development of the battery technology and charging-adapters, the availability of electricity will also be important to facilitate cargobike-usage.

Cargobike technology

The recent developments in bicycle technology in general (e.g. hub dynamos, LED-lights, puncture-proof tyres, electric assistance) have made cycling much more convenient. This technology is also used on cargobikes, improving the experience. Especially electric assistance is important to many people when (thinking about) using a cargobike (cf. chapters 4.2, 4.3 and 5.1). However, some special requirements that people expect need further development in the technology of cargobikes. A lockable box would allow people a trip chaining similar to the habitual use of a car. Weather protection, both for the rider and the cargo is crucial, as a car replacement needs to be used the whole year round, no matter if it rains or shines. The cargobike has to be able to replace the car without changing the users behaviour more than absolutely necessary.

A mixture between cargobike-technology and emotions is the design of the cargobikes. Nowadays, cars are marketed and perceived as very emotional products that users identify with. The design of cargobikes needs improvement to fulfil the needs of potential users that do not simply want to buy a product for transportation, but more a product that 'looks great', can catch emotions and can be seen as a status symbol.

Public policy

Probably the most important finding is that a large share of the people does not know cargobikes at all. On the one hand, this may be the reason why cargobikes are so extremely rare in Germany. On the other hand, it can be a good starting point for increasing cargobike usage. The simple knowledge about cargobikes can make people rethink their mobility behaviour, it is therefore possible that a wider knowledge will already increase usage. This could develop into an upward spiral, which of course is limited.

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A further aspect in relation to public policy measures is denial of cargobikes in transportation planning, which does not favour the use of cargobikes. This includes infrastructural, but also monetary aspects. Although the classic ecomobility has gained some attention, specialised forms like the cargobike miss public support altogether.

Emotions

As the cargobike is mainly compared to the car, it is not only the technical aspect in which the cargobike must compete with the car, it is also the design. The car is seen as a status symbol, and the cargobike will have a hard time to compete with it. A modern design with various options to personalise the cargobike could help, as well as image campaigns and advertising.

However, when a cargobike is actually used, mainly strong positive emotions are described by the users (cf. chapter 4.2). This becomes even more evident when children are transported, as the children are reported to give very positive feedback as well. This is very important, as the children learn alternative transport from the scratch.

Externalities

As the mobility behaviour nowadays is energy intensive, the price for energy is a major influencing factor on which transport mode is used. If energy prices, especially oil prices, continue to rise, there may a great potential for the cargobike to replace the car on many trips. Even though there is no direct influence on the energy prices, the cargobike is independent from energy prices (or uses very little electric power in comparison to cars) and can thus help people to become more and more independent from high energy prices.

9.1 Recommendations

As the negative aspects are comparably small in relation to the possible positive impacts on various fields of society, the general recommendation is to increase cargobike usage. Of course, this recommendation is limited to those scenarios where the cargobike is economically and ecologically reasonable. It has to be seen as one more mode in the mix of (eco-) mobility. However, it can act as the missing piece for many people to live a car-free life. To obtain a more detailed picture about how to increase the modal-split of cargobikes for

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short distance cargo and children transportation, the following facts should be looked into more deeply.

A very important fact is the unawareness of many people that cargobikes actually exist (cf. chapter 5.1). Thus, a very simple measure to increase the modal-split could be campaigns, increased advertising of the cargobike manufacturers or dealers, public funding for e.g. purchase, reduced kindergarten admittance fees when using a cargobike to bring children to kindergartens and many more. The exact style of campaigns has to be evaluated. Similar would be projects especially in school or kindergartens that present cargobikes to the children and their parents, which could be a very effective way to educate children that there are alternative transport modes available.

Another fact mentioned very often during the survey of both the users as well as the non-users is the possibility to safely and securely store the cargobike (cf. chapters 4.2 and 5.1). The existing recommendations and laws in relation to the number of cycle and car parking spaces that have to be created depending on the inhabitants of an apartment block or a shop have to be optimized for cycling. In particular, special parking spaces should be created for cargobikes. According to Bohle (2010), special and reasonable parking spaces for bicycles advance the use of bicycles in general. It can be expected that the same is true for the use of cargobikes.

The currently rising modal-split of bicycles should be used to make cargobikes more widely known in the public. Detailed research is necessary to find the reasons for this trend and find how the cargobike could take its share of this trend. Again, many people who would be willing to reduce car use as much as possible do not see the chance as they are not aware of cargobikes. Those who know cargobikes need to have more information about the possibilities and restrictions to be able to make sound decisions.

As this study had a more general approach, further and more detailed research is necessary to get a deeper insight in the mobility behaviour in relation to the cargobike. Cargobike-users should be closely observed to find out what exactly the cargobike is used for and in which way. Socio-economic backgrounds, completely missing in this study, are also vital to identify the group of people to aim campaigns at. It should also be looked into possible further uses than the current ones. A more detailed insight into *why* people use a

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cargobike is important to convince more people to use one. And, maybe most important, why people stopped using it?

Arguments for companies, both to use cargobikes or to invest in its production and retail, are not directly available at the moment. The market for cargobikes is rather small, and business information virtually not available. Detailed research on this aspect could reveal points where improvement as well as public support is necessary to improve the business cases. This could result in more players entering the market, creating competition and thereby profiting the users. To increase the use by companies, cargobikes have to become more economical valid. This could be done either by making unwanted transportation modes (i.e. cars and LGVs) more expensive or by funding the use of cargobikes.

The cargobike is not up to replace the car in our society. But there are many activities where a cargobike has its right to exist and does so in a very economically, environmentally friendly and society benefiting way. It is now up to the authorities, supported by further research, to recognize the enormous potential that the cargobike offers to efficiently improve urban transportation. The cargobike is an important cornerstone to tackle the foreseeable challenges that mobility faces.

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11 Appendices

11.1 The questionnaire for the current users of cargobikes

This survey was carried out in German language. Please see the attached form of four pages with the heading “Nutzung von Lastenfahrrädern”.

11.2 The questionnaire for non-users

This survey was carried out in German language. Please see the attached form of six pages with the heading “Umfrage zur Verfügbarkeit von Transportmitteln und Transportverhalten”.

Nutzung von Lastenfahrrädern

Diese Umfrage dient zur Ermittlung der Nutzung von Lastenfahrrädern.
Die Umfrage findet im Rahmen der Erstellung meiner Master-Arbeit statt.
Vielen Dank, dass Sie sich die Mühe machen, den kurzen Fragebogen zu beantworten.

Christian Weirich

Die Umfrage ist anonym und die Angaben werden nur zur Auswertung im Rahmen der Abschlussarbeit genutzt.

1 Beschreiben Sie kurz das Modell (2- oder 3-Räder, Hersteller, mit/ohne E-Motor, usw...)

2 Neupreis (oder grobe Schätzung der Kosten bei Eigenbau)

- ☐ EUR 0-500 ☐ EUR 501-1000 ☐ EUR 1001-1500 ☐ EUR 1501-2000 ☐ mehr als EUR 2001

3 Seit wann steht Ihnen ein Lastenfahrzeug zur Verfügung?

- ☐ weniger als 1 Jahr
☐ 1-3 Jahre
☐ 3-7 Jahre
☐ mehr als 7 Jahre

4 Aus welchem Grund haben Sie sich ein Lastenfahrzeug angeschafft?

5 Steht Ihnen zusätzlich zum Lastenrad ein Auto zur Nutzung zur Verfügung?

- ☐ ja
☐ nein

6 Wie wird das Lastenrad überwiegend genutzt?

(Mehrfachnennungen sind möglich)

- ☐ privat
☐ beruflich
☐ Verein

☐ sonstiges

7 Wie oft benutzen Sie das Lastenfahrrad?

- ☐ täglich
- ☐ 2-4x pro Woche
- ☐ ca. 1x pro Woche
- ☐ ca. 1x in 14 Tagen
- ☐ seltener

8 Was transportieren Sie mit dem Lastenfahrrad?

(Mehrfachnennungen sind möglich)

- ☐ Babys (0-2 Jahre)
- ☐ Kinder (ab 2 Jahre)
- ☐ Einkäufe
- ☐ größere Lasten

☐ sonstiges:

**9 Welche Strecke legen Sie auf einer Tour durchschnittlich mit dem Lastenfahrrad zurück?
Eine Tour ist eine Nutzung des Lastenfahrrads, bis Sie wieder am Startpunkt angekommen sind
(z.B. Zuhause > Einkauf > Schule > Zuhause).**

- ☐ bis 1km
- ☐ bis 3km
- ☐ bis 5km
- ☐ bis 10km
- ☐ ab 10km: Wieviel?

**10 Bitte nennen Sie Dinge, die Ihnen bei der Nutzung des Lastenfahrrades besonders auffallen
(sowohl positiv als auch negativ):**

**11 Was würde die Nutzung des Lastenfahrrades angenehmer, leichter machen?
Was müsste geändert werden, damit Sie das Lastenfahrrad häufiger nutzen?**

12 Würden Sie die Nutzung des Lastenfahrrads weiterempfehlen?

- ☐ ja
☐ nein

☐ nur unter folgender Bedingung:

Persönliche Angaben

Hier bitte ich Sie um ein paar persönliche Angaben, damit Ihre Antworten besser interpretiert werden können. Die Umfrage ist anonym und die Angaben werden nur zur Auswertung im Rahmen der Abschlussarbeit genutzt.

13 Personen im Haushalt?

- ☐ 1
☐ 2
☐ 3
☐ 4
☐ 5 oder mehr

davon Kinder

14 Einwohnerzahl der Stadt, in der das Lastenfahrrad genutzt wird

- ☐ <10.000
☐ 10.001-30.000
☐ 30.001-50.000
☐ 50.001-100.000
☐ 100.001-250.000
☐ >250.000

Name der Stadt

15 Entfernung zum Stadtzentrum

- ☐ <1km
☐ 1-3km

- ☐ 3-5km
☐ 5-10km
☐ >10km

16 Kommentare? Hinweise?

Hier haben Sie die Möglichkeit, Kommentare und Hinweise jeder Art abzugeben:

Vielen Dank für Ihre Teilnahme. Den Verfasser der Umfrage erreichen Sie unter cargobike-study/at/gmx.net.

Umfrage zur Verfügbarkeit von Transportmitteln und Transportverhalten

Diese Umfrage findet im Rahmen der Erstellung meiner Master-Arbeit statt.

Vielen Dank, dass Sie sich die Mühe machen, den kurzen Fragebogen zu beantworten.

Christian Weirich

Die Umfrage ist anonym und die Angaben werden nur zur Auswertung im Rahmen der Abschlussarbeit genutzt.

1 Steht Ihnen ein Auto zur Verfügung?

- ☐ ja **Sprung** -> "Wie oft nutzen Sie d..."
- ☐ nein **Sprung** -> "Haben Sie eine Monat..."

2 Wie oft nutzen Sie das Auto?

- ☐ täglich
- ☐ 2-4x pro Woche
- ☐ ca. 1x pro Woche
- ☐ ca 1x in 14 Tagen
- ☐ seltener

3 Wofür benutzen Sie das Auto?

(Mehrfachnennungen sind möglich)

- ☐ Arbeit / Ausbildung
- ☐ Einkaufen
- ☐ Transport größerer Lasten
- ☐ Holen / Bringen

☐ sonstiges

4 Welche Entfernung legen Sie auf einer Tour mit dem Auto durchschnittlich zurück? (Eine Tour ist dabei eine Nutzung des Autos, bis Sie wieder am Startpunkt angekommen sind, also z.B. Zuhause > Arbeit > Einkauf > Zuhause)

- ☐ bis 3km
- ☐ bis 5km
- ☐ bis 10km
- ☐ bis 15km
- ☐ bis 20km
- ☐ ab 20km: Wieviel?

5 Haben Sie eine Monatskarte o.ä. für den örtlichen öffentlichen Personenverkehr?

- ☐ ja **Sprung** -> "Wie oft benutzen sie..."

☐ nein **Sprung** -> "Steht Ihnen ein eins..."

6 Wie oft benutzen sie den öffentlichen Nahverkehr?

- ☐ täglich
☐ 2-4x pro Woche
☐ ca. 1x pro Woche
☐ ca. 1x in 14 Tagen
☐ seltener

7 Steht Ihnen ein einsatzfähiges Fahrrad zur Verfügung?

- ☐ ja **Sprung** -> "Wie oft benutzen Sie..."
☐ nein **Sprung** -> "Bitte schauen Sie si..."

8 Wie oft benutzen Sie das Fahrrad?

- ☐ täglich
☐ 2-4x pro Woche
☐ ca. 1x pro Woche
☐ ca. 1x in 14 Tagen
☐ seltener

9 Wofür benutzen Sie das Fahrrad?

(Mehrfachnennungen sind möglich)

- ☐ Arbeit / Ausbildung
☐ Einkauf
☐ Holen / Bringen

☐ sonstiges

**10 Welche Entfernungen legen Sie auf einer Tour mit dem Fahrrad durchschnittlich zurück?
(Eine Tour ist dabei eine Nutzung des Fahrrads, bis Sie wieder am Startpunkt angekommen sind, also z.B. Zuhause > Arbeit > Einkauf > Zuhause)**

- ☐ bis 1km
☐ bis 3km
☐ bis 5km
☐ bis 10km
☐ bis 15km
☐ ab 15km: Wieviel

11 Bitte schauen Sie sich die folgenden Bilder an



12 Sind Ihnen solche (oder ähnliche) Fahrräder bekannt?

- ☐ ja
☐ nein

13 Was glauben Sie, was man mit solchen Fahrrädern transportieren kann?

14 Würden Sie Sich zutrauen, ein solches Lastenrad zu fahren?

- ☐ ja
☐ nein

evtl. wenn

☐

15 Könnten Sie sich vorstellen, ein solches Lastenfahrrad zu nutzen?

☐

ja **Sprung** -> "Unter welchen Voraus..."

☐

nein **Sprung** -> "Warum können Sie sich..."

16 Unter welchen Voraussetzungen würden Sie ein Lastenfahrrad benutzen?

17 Wofür könnten Sie sich eine Nutzung vorstellen?

18 Was wären Sie in etwa bereit, für ein solches Lastenrad zu bezahlen?

Sprung -> "Persönliche Angaben..."

19 Warum können Sie sich die Nutzung eines Lastenrades nicht vorstellen?

20 Persönliche Angaben

Hier bitte ich Sie um ein paar persönliche Angaben, damit Ihre Antworten besser interpretiert werden können. Die Umfrage ist anonym und die Angaben werden nur zur Auswertung im Rahmen der Abschlussarbeit genutzt.

21 Ihr Alter?

22 Ihr Geschlecht?

- ☐ weiblich
☐ männlich

23 Personen im Haushalt

- ☐ 1
☐ 2
☐ 3
☐ 4
☐ 5 oder mehr

davon Kinder

24 Einwohnerzahl der Stadt, in der Sie wohnen:

- ☐ <10.000
☐ 10.001 - 30.000
☐ 30.001 - 50.000
☐ 50.001 - 100.000
☐ 100.001 - 250.000
☐ > 250.000

Name der Stadt

25 Entfernung zum Stadt-/Aktivitätszentrum

- ☐ < 1km
☐ 1-3km
☐ 3-5km
☐ 5-10km

- ☐ 10-15km
☐ 15-20km
☐ >20km

26 **Kommentare? Hinweise?**

Hier haben Sie die Möglichkeit, Kommentare und Hinweise jeder Art abzugeben:

Vielen Dank für Ihre Teilnahme. Sie können den Internet-Browser jetzt schließen.

Auteursrechtelijke overeenkomst

Ik/wij verlenen het wereldwijde auteursrecht voor de ingediende eindverhandeling:

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Richting: **master in de verkeerskunde-mobiliteitsmanagement**

Jaar: **2012**

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Voor akkoord,

Weirich, Christian

Datum: **27/05/2012**