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# Enablers and barriers to shifting to sustainable mobility. Takeaways from a sustainability campaign in Flanders, Belgium



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Despite Flanders' high cycling rates and good public transportation coverage, car ownership has been rising steadily, conflicting with sustainability goals. Since cars are often the default transport mode, changing behaviour can be challenging, so understanding barriers and enablers to transition at the individual level is crucial. We use focus groups to identify obstacles to sustainable mobility experienced by participants in the "30 Days with Less Cars" campaign held in June 2022, which encouraged sustainable travel and a less car-dependent lifestyle. Our findings constitute insights into barriers and enablers for adopting more sustainable mobility behaviour among participants mindful of sustainable mobility. Key barriers included the lack of alternative transportation options, especially in non-urban areas and outside business hours, as well as public transport reliability issues and the comfort of private cars. Difficulties associated with car ownership (such as cost) and the availability of alternatives are significant enablers for sustainable mobility.

The concept of car dependence was coined in the 1990's, and indicates the fact that people have built their way of life around cars, depending on them for regular journeys[1]. This remains the case even though there is a wide range of societal problems that are brought on by growing car use[2]. In Flanders, Belgium's northwestern region, issues around car-dependence are particularly visible: car ownership has been consistently increasing over the past decades, with a 24% increase registered since 2006[3]. The region also has the highest average level of car ownership in the country (1,13 cars per household, versus 1,11 in Wallonia and 0,57 in Brussels)[4]. In Belgium as a whole, projections made for the year 2040 highlighted that cars would still be responsible for 82% of passenger-kilometres, compared to 83% in 2019[5]. However, Belgium also has an above-EU average share of public transport in passenger transport[6], and a relatively high public transport coverage compared to other European countries[7]. Flanders is also the country's region with the least amount of incline and the highest rate of cycling infrastructure, making it the most cyclable region in the country[8]. The region thus has a high potential for sustainable mobility options, yet car ownership continues to increase. Car dependency and decades of automobile infrastructural developments can make it difficult to enact behavioural changes needed to transition towards sustainable mobility. Importantly, car dependence can be explained by two types of constraints[9]: *structural constraints*, i.e. constraints that are designed into the existing land use/transport system, and *situational constraints*, i.e. constraints that are person- or trip-specific. These structural and situational constraints can hinder the transition towards a more sustainable lifestyle[10]. Hence, there is a key role to be played by policy makers to address these constraints and help transition behaviour towards more sustainable practices.

Appropriate policy measures can help change behaviour from the use of the private car to more sustainable modes, reducing car dependence. This requires a paradigm shift in planning, adopting a sustainable mobility approach with actions to reduce the number of trips, to encourage alternative modes, to reduce trip lengths and to make transport systems more efficient[11]. Yet it has been difficult to actually shift the direction of planning away from cars, even though the measures to achieve sustainable mobility are often already well known[11,12]. This shows the importance of tailoring the design of sustainable mobility policies to the needs of the population, if we want them to be adopted[11,13]. These policies need to contain both *push* factors, i.e., making the private car unattractive, as well as *pull* factors, i.e., encouraging the use of alternative modes of transportation[14]. In this paper, we therefore ask the following research question: "What do people already motivated to adopt sustainable mobility behaviour experience as hindering or enabling their transition to sustainable mobility in Flanders, Belgium?"

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The goal of our research is to help inform policy makers and practitioners to design policies and services that can help transition away from the current automotive-centred mobility system towards a sustainable mobility paradigm. We do this through a focus group analysis with participants of the '30 Dagen Minder Wagen' (30 Days with Less Car) campaign[15], held in June 2022. The goal of the campaign was to give participants a taste of sustainable mobility, as well as to challenge participants to decrease their car use. As such, all participants who signed up for the focus groups had a pre-existing interest in sustainable mobility behaviour. Therefore, the findings presented in this paper should be regarded as a first set of insights into what major barriers and enablers persist regarding adopting sustainable mobility behaviours, even for those who are intrinsically motivated to do so.

This paper is structured as follows: section "Literature review" reviews the literature on (un)sustainable mobility and the barriers and enablers for a transition towards sustainable mobility. Section "Materials and methods" details our methodology, while section "Results and discussion" presents and discusses our results, followed by concluding remarks in section "Conclusion".

## Literature review

### Unsustainable mobility: the automobility system and car-dependence

Today's dominant mobility behaviour is characterized as the 'automobility system'[16], which has been shaped by constraints that have made it difficult for innovation or transformation to take place[17]. It has, however, become increasingly clear that this dominant automobility system and our current mobility behaviours are not compatible with sustainability[18]. Evolutions that were induced by, and have led to, the dominant automobile society include, among others, the process of population dispersal, seen for example in suburbanisation and de-centralisation of shopping and employment centres. Other factors are the mass marketisation of the car, as well as the individualisation of lifestyles, leading people to opt for private instead of shared modes[17]. Traffic planners, for decades, have been working to solve the problem of car traffic, and priorities have therefore been to reduce travel speed, speed up traffic, and construct large-scale infrastructure projects[11]. This context has generated a system encouraging the use of the private car, leading to structural and situational car-dependence, and resulting in today's pattern of unsustainable mobility. This results in a multitude of impacts of transport on the three pillars of sustainability (economic, social, and environmental). Economic impacts include traffic congestion and accident damages, as well as the depletion of non-renewable resources. Social impacts include impacts on human health and community liveability, and environmental impacts include air and water pollution[19].

The automobility system has resulted in the high levels of car dependence that we know today. In addition to the structural and situational constraints described in the introduction, literature has also shown that there is a difference between *structural* and *mental* car dependence. The first describes the absolute need for a car, whereas the second is the perceived reliance on a car[9,20]. Van Eenoo et al.[20]. showed that car-owners, even in an urban setting and when exhibiting multimodal travel patterns, can perceive their car as indispensable. Importantly, car ownership can unlock a 'ratchet effect', meaning that car ownership will induce individuals to use their car more, instead of considering alternative modes[21]. Institutional car-centrism and mental car dependency influence each other through a feedback loop: increased car-centric policies lead to increasing numbers of car users who in turn demand more car-centric policy-making. Additionally, even when having access to other transportation modes that are more sustainable than their private vehicle, car owners are less likely to use other transport modes, and they are also less likely to sell or decrease their car use when their income decreases[22]. Goodwin[1] made a similar differentiation between car-dependent *people* and car-dependent *trips*, arguing that focussing on car-dependent trips would more likely lead to changes in behaviour. Transitioning to sustainable mobility therefore requires actions targeting structural, situational, and mental car dependence.

### Sustainable mobility: definitions, barriers, and enablers

There is a growing consensus that the car-centred mobility system described above is unsustainable, but there is less of a scientific agreement on a definition of sustainable mobility[23]. However, by going back to the 1987 WCED report on sustainable development[24], Holden et al.[25] include four main dimensions in sustainable mobility: (i) long-term ecological sustainability, (ii) satisfying basic transport needs, (iii) promoting intragenerational transport equity, and (iv) promoting intergenerational transport equity[25]. This alternative system therefore "*requires actions to reduce the need to travel (less trips), to encourage modal shift, to reduce trip lengths and to encourage greater efficiency in the transport system.*"[11]. A core challenge for the shift towards sustainable mobility is then to reduce car dependence and enable a shift towards collective and active modes of transport[11,26]. Sustainable mobility can therefore be translated into three grand narratives about the future of mobility: electromobility (of all modes), collective transport 2.0 (resting on various forms of shared mobility), and low-mobility societies (resting on car-free cities)[27]. It becomes important to design policy around the pillars of sustainable mobility to lower car-use, encouraging people to travel less far and less often, and through different modes[28]. Metz[2] classifies these alternatives to reduce car dependence into three categories: (i) providing acceptable alternatives, (ii) making car use less attractive than the alternatives, and (iii) lessening positive feelings regarding car ownership and use. These alternatives should act on both the structural and situational constraints, but also on mental car-dependence[9,20].

However, there are a number of barriers when considering alternatives to the private car. Barriers are "a problem, rule, or situation that prevents somebody from doing something"[29]. In the context of sustainable mobility, barriers prevent someone from travelling sustainably, thereby reinforcing car-dependence. For example, Madhuwanthi et al.[30] categorise the factors influencing mode choice along the characteristics of the trip maker, characteristics of the journey, and characteristics of the transportation facility. For characteristics not related to the trip maker, they find that security, comfort, and time are the factors mostly influencing car use. For factors related to the trip maker, they find that income and vehicle ownership are the most influential factors. McCarthy et al.[31]. further identify a number of structural barriers to active, public, and shared transport: (i) Inadequate or inexistent cycling and pedestrian infrastructure; (ii) Physically inaccessible public transport; (iii) Infrequent or indirect services; (iv) Low density, single land-use; (v) Increasing travel distances; (vi) High traffic speeds; (vii) Actual cost of transport. Fronteli and Pacheco Paladini[32] and Mattioli[33] also identified the inefficiency of public transportation as an important barrier to using alternatives to the private car. When analysing the factors that drive car ownership in Tokyo, Ikezoe et al.[34]. find that the emotional factor, i.e. symbolic emotions rather than instrumental reasons[35], is much stronger than the convenience factor. Fronteli and Pacheco Paladini[32] and Mattioli[33] showed that cultural factors, i.e. collective feelings and behaviours, are important in influencing car ownership. When it comes to carsharing, D'Urso et al.[36] have shown that it seems unsuitable for managing the complex daily routines of families with children. These results highlight why getting people to trade their car for alternative mobility services is a complex task.

On the other hand, enablers of sustainable mobility are those people or things that make sustainable mobility possible[37]. In this context, public transport can be considered the backbone of sustainable mobility[38]. To increase the use of public transport by users, waiting time, cleanliness, and comfort are most important. For potential users, waiting time, journey time, and the level of occupancy are considered most important[39]. Similar criteria should be met when it comes to sharing mobility.

As Fronteli and Pacheco Paladini[32] highlight, access, maintenance, and fuel costs can be an important enabler to use alternatives to the car. However, these alternatives need to be economically interesting to users. Price promotions are a good example that can disrupt the habitual behaviour of travelling by car. The point of a price promotion is that it disrupts habitual activity and makes the recipient consider the offer[40]. This can for example take the form of a free public transport travel card[41], or the use of free shared

services. Thøgersen[40] found that a free public transport travel card significantly increased commuting by public transport among recipients, both during the experiment and, to a lesser extent, five months after. Lastly, for active mobility, a well-developed pedestrian and cycling infrastructure is identified as a key point to address[42,43].

### Behavioural change campaigns and sustainability experiments

Although institutional decisions are at the core of challenging the current mobility system, it is important to involve citizens in such efforts as well. This can be done through means such as awareness campaigns as well as other forms of experimentation, such as behavioural change challenges. This is due to two reasons: first, to help change the collective customs arising from using the current mobility system, experimentation plays a crucial role[44], providing people with a taste of available alternatives. Second, after such an experiment, the input of the participants can help shape relevant sustainable mobility policies. As such, it is crucial to understand the current barriers and enablers experienced by participants in such experiments, since transport planning can greatly benefit from the insights that can be obtained from users and citizens[13]. Although this type of behavioural change campaign-oriented research has been gaining traction in the last years[45–48], considering campaigns for sustainable mobility specifically, no such research has been conducted in Belgium up until this point.

## Materials and methods

### The Flemish context

Flanders is home to 6,7 million residents, with a population density of 492 inhabitants per km² [49]. Although Flanders is relatively small (13.522 km² [50]), it has a high modal share of cars, with around 58% of travels being done by car (both driver and passenger, see Fig. 1). The Flemish share of commuters who drive their car to work (64%) is above the Belgian average of 55%[51]. However, compared to the other parts of the country, Flanders also has higher-than-average bike levels (18%, compared to 2% in Wallonia, and 9% in Brussels)[51,52].

Additionally, 'ribbon development' is an important aspect of Flemish urban planning. This type of urban sprawl is more prevalent in rural areas than in suburban areas, where most urban tends to take place. This is characterised by long stretched villages without a core centre. Despite efforts to promote more compact rural development, ribbon development has increased during the period of 2015–2020[53]. In Flanders, this historical emphasis on car-centric spatial planning[54] has contributed to car dependency, further fostering urban sprawl and establishing cars as the most convenient mode of transportation for many residents[20,55].

Flanders is therefore characterised by important structural constraints when it comes to car dependence, reflected by the highest levels of car ownership for Belgium. However, it also has the highest levels of active mobility in Belgium. This combination of elements makes it an interesting context to look at with regard to opportunities for sustainable mobility, to identify obstacles for a sustainable mobility paradigm shift.

### Focus groups sampling and methods

The goal of our research was to identify what hinders transition to sustainable mobility in Flanders, Belgium among participants in the '30 Days with less Cars' campaign, through focus groups. This campaign was launched in Flanders by a group of sustainable mobility NGO's, with the Mobilise research group as research partner and the Flemish NGO Netwerk Duurzame Mobiliteit (in English: *Network for Sustainable Mobility*) as campaign coordinator. Through the campaign, 6509 residents of Flanders pledged to move around more sustainably. The goal of the campaign was to give participants a taste of sustainable mobility, as well as to challenge participants to decrease their car use. More information on the results of the campaign can be found in van Vessem et al.[56].

Focus groups are a way to gather information in an apparently informal way, based on the discussion among a group of people. They allow participants to clarify individual positions and to compare positions with each other[57], and they allow to relate and expand on other participants' statements and views, so more topics can be explored in one session. A potential disadvantage of this method is that there might be an imbalance between the different participants in speaking time, which requires a capable moderator to ensure that all participants feel safe and get enough space to share their experiences.

In total, we held four focus groups in August 2022, after the campaign had ended. The goal was to have more in-depth views of the results of the surveys held in the context of the campaign described in[56] and of the experience of participants. The overarching theme of the focus groups was the identification of barriers and enablers to sustainable mobility among participants, instead of using their private car. Based on the socio-demographic information provided by campaign participants in the survey, we identified a diverse group in terms of socio-demographic and mobility characteristics and created a list of the criteria for focus group participants. First, we started with the criterion for regional coverage: we aimed to have *at least* one participant per Flemish province (five in total), and one per urbanisation level: rural, small city, and urban area. Participants living in any of the five Flemish provinces (around 97% of the total number of campaign participants) were then classified based on the following criteria:

- Socio-demographic coverage: we aimed to find *at least* one participant under 26, one above 65, one with no children, one with 3 or more children, one lower-educated person, one actively looking for a job, one retired person and one student. We also aimed to find a gender balance in our participants.
- Modes of transport: *at least* one person with a company car, one with a private car, one without a private car, but access to carsharing or carpooling, and one non-bike owner.
- Travel behaviour: participants of the campaign could indicate changes in their travel behaviour throughout and after the campaign. Those who indicated a change were considered for the focus groups.
- Campaign benefits: campaign participants received a free subscription to either the federal train services (NMBS/SNCB) or the regional bus and tram operator (De Lijn) for the duration of the challenge. This was only communicated after signing up to avoid people enroling solely for these benefits. The focus group sample aimed to find *at least* one person who received the train subscription, and one who received the bus/tram subscription.

All of the participants that matched one or more of these criteria received emails about the focus groups and an invitation to participate. All criteria groups were contacted more than once to ensure representation in the focus groups. Those interested in participating were given the choice to join one of four groups. Three focus groups were held physically in three different locations (Brussels, Ghent, and Leuven), to make it easier for participants from different regions to participate. Additionally, we also held one online focus group. Based on the availabilities of the locations and the participants, 18 participants were selected, yielding two focus groups of five and two focus groups of four participants. Generally, between four and eight focus group participant is considered best practice, to give all participants enough speaking time[58]. Table 1 provides an overview of the recruitment effort for the different focus groups, Table 2 shows the socio-demographic overview of participants in each focus group.

The focus groups were divided in three parts: first, participants were introduced to the research and each other. Then, the main theme were reasons for participants to sign up to the campaign and the focus groups, their overall campaign experience, zooming in on what went well (enablers) and what did not (barriers), and why these occurred. The sessions ended with a presentation of the first preliminary results of the campaign surveys, with room for the focus group participants to discuss these. The full guidelines used for the focus groups as well as the participant selection criteria can be found in the supplementary information. Each focus group lasted around 1 and a half hours and was held in Dutch. All focus groups were recorded to enable the verbatim transcription and analysis of the content.

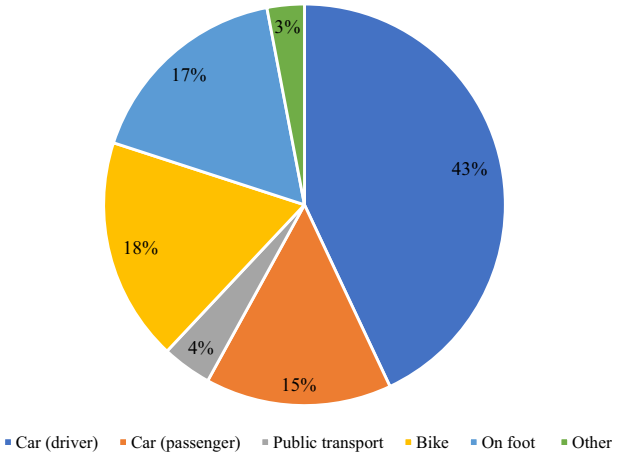


**Fig. 1 | Modal split in Flanders per number of trips[52].** From the figure, it can be seen that cars (as both driver and passenger) account for 58% of trips.

**Table 1 | Participant recruitment**

| | Brussels | Leuven | Ghent | Online |
|---|---|---|---|---|
| **Invited** | 10 | 9 | 15 | 11 |
| **Accepted** | 5 | 5 | 6 | 5 |
| **Rejected** | 1 | 1 | 5 | 0 |
| **No answer** | 4 | 3 | 4 | 6 |

For all focus groups, between 9 and 15 participants of the campaign were invited who fit the selection criteria (see Supplementary Table 2).

### Data processing

The focus group recordings were transcribed using the HappyScribe software[59], and two researchers manually checked the resulting transcriptions. After this, we performed a content analysis using the qualitative Nvivo software[60]. Content analysis is the analysis of written, verbal, and visual communication[61]. The results of the focus groups were coded inductively, whereby the data is analysed without trying to fit into a pre-existing coding frame[62]. Two researchers each independently coded two focus groups. Subsequently, each researcher reviewed the coding of the other two focus groups. In total, three rounds of coding were needed. Throughout these different rounds, items that had been coded in a similar fashion by the two researchers were merged, and codes that belonged to the same themes were grouped.

## Results and discussion

In the first coding round, 274 codes were identified (162 barriers and 112 enablers). In the third and last round, 36 barriers and 25 enablers were found. In total, 10 overarching themes were found under 'Barriers', and 5 under 'Enablers' (see Figs. 2 and 3). The final coding structure for the barriers and enablers can be found in Table 3, as well as the number of times each code occurs. Sections "Barriers to sustainable mobility" and "Enablers of sustainable mobility" describe these more in detail.

Based on the results of our focus groups, we can see that barriers were discussed more by participants than enablers were (191 occurrences of barriers, and 79 occurrences of enablers in the final round of coding). It therefore appears that, in the context of the campaign, participants experienced more difficulties than enablers regarding the adoption of sustainable mobility. Additionally, participants were more easily able to provide specific examples of barriers than they were of enablers. For example, under the barrier of 'comfort' and 'public transport that is too full', one participant pinpointed the specific tramline that she finds uncomfortable. But under the enabler for 'shared mobility', for example, participants would simply refer to the fact that "*there are shared bikes available at train stations*", without necessarily referring to a specific train station. When it comes to the intention for behaviour change, participants indicated that they were already moving around quite sustainably before the campaign, so that the campaign had only a small effect. Additionally, the focus groups were held only a month after the campaign ended, not allowing to see any long-term effects on mobility behaviour.

**Table 2 | Participant characteristics**

| | Brussels (*n* = 4) | Leuven (*n* = 5) | Ghent (*n* = 5) | Online (*n* = 4) |
|---|---|---|---|---|
| Women | 3 | 2 | 1 | 2 |
| Men | 1 | 3 | 4 | 2 |
| Urban setting | 2 | 3 | 1 | 0 |
| Rural setting | 2 | 2 | 4 | 4 |
| Children | 0 | 2 | 1 | 1 |
| No children | 4 | 3 | 4 | 3 |
| Working | 2 | 5 | 2 | 2 |
| Unemployed | 1 | 0 | 3 | 1 |
| Retired | 1 | 0 | 0 | 1 |
| Own car | 2 | 2 | 3 | 1 |
| Company car | 0 | 1 | 0 | 0 |
| Own bike | 4 | 5 | 5 | 4 |
| Car sharing subscription | 2 | 3 | 1 | 2 |
| Public transport subscription | 3 | 2 | 5 | 2 |

The goal for all focus groups was to have a diverse set of participants, representing different types of experiences in the campaign.

### Barriers to sustainable mobility

The majority of the barriers to sustainable mobility identified by participants appeared to be structural ones: (i) accessibility, (ii) car-centrism, (iii) cost, (iv) offer of alternatives, (v) reliability of public transport, (vi) safety and security, and (vii) company cars. These findings reinforce many well-documented structural barriers to sustainable mobility, such as limited transport alternatives, high costs, and car-centric infrastructure[31,32]. The top barrier experienced by participants concerns the limited offer of alternative sustainable mobility options (42 occurrences out of the 191 barriers, see Fig. 1), aligning with prior work showing that accessibility constraints disproportionately impact modal shift efforts[30]. Here, participants highlighted that, in general, there is an insufficient offer of public transport and shared mobility, but that this becomes especially problematic outside business hours (i.e., outside of the usual working hours typically ranging from 9am until 5 pm) and outside urban areas. One participant, for example, explained how she had to attend a funeral in a smaller town on a Sunday morning at 10am, and how this was not possible with public transport. The earliest she could arrive was 12 pm, so she had to book a hotel on the Saturday evening. In the context of public transport, participants also highlighted that cost (16 occurrences out of 191) can be a significant barrier. According to one participant in Ghent, *"(…) there is a high initial investment for a family, because everyone needs subscriptions to the different transport operators"*. One participant shared how, when she needs to travel by herself, she takes the train, but if she's travelling with her husband, they will drive instead. For the two of them, travelling by public transport is more expensive than using their car, especially since they have one available. This highlights the need for alternatives to the car to be financially interesting for users[32], especially to mitigate potential 'ratchet effects' of car ownership[21]. To leverage the potential of public transport to be the backbone of sustainable transport, affordability needs to therefore be a priority criterion to lower the dominance of car use[31]. In the focus group in Ghent, for example, participants discussed that an unlimited yearly train subscription costs 3683€[63]. Participants found this *"scandalously high… Imagine having to buy that for a family with children?"*.

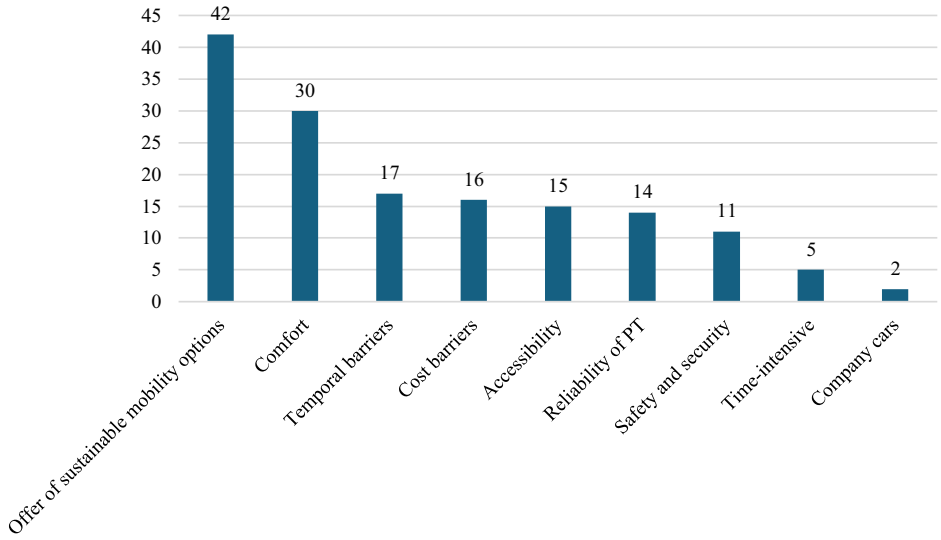


**Fig. 2 | Overview of barriers identified by participants.** From the figure, it can be seen that a lack of offer of sustainable mobility alternatives is the main barrier encountered by participants.

**Table 3 | Coding tree- Overview of final barriers and enablers to sustainable mobility**

| Code name | Code definition | Occurrences |
|---|---|---|
| **Barriers to sustainable mobility** | | **191** |
| *Accessibility* | | *15* |
| Issues with transport apps | Sometimes, dedicated apps do not work properly. | 6 |
| Digital inaccessibility | Digitalization can increase inaccessibility to certain population groups. | 6 |
| Physical inaccessibility | Public transport stops and vehicles are often physically inaccessible. | 3 |
| *Car-centrism* | | *20* |
| Cultural | Infrastructure and social norms often prioritize the position of the car and drivers over other road users. | 5 |
| Individual | Many people view cars as the standard mode of mobility and tend to compare all other modes to the car. | 4 |
| Policy | Policy developments/implementations often depart from the point of view of car drivers (also in fiscal sense, such as in subsidies). | 11 |
| *Comfort* | | *30* |
| More effort-intensive | Travelling by sustainable mobility requires more effort (for example in planning). | 6 |
| Lack of flexibility | PT operates on fixed schedules, or station-based shared modes can be accessed and dropped of only on fixed locations. | 11 |
| Lack of space | Not possible to take as much luggage on other modes as with a car. | 8 |
| Overcrowding | PT vehicles can be overcrowded | 1 |
| Bad weather | Precipitation and wind can be dissuasive to active mobility. | 6 |
| More stress | Travelling by car is less stressful, as you are not counting on for example making a PT connection, or having a shared car available. | 3 |
| *Cost barriers* | *Sustainable mobility is more expensive*. | *16* |
| *Time-intensive* | Bottom-up community changes are time-intensive. | *5* |
| *Offer of sustainable mobility options* | | *42* |
| Insufficient offer | Not enough of PT and carsharing options. | 18 |
| Limited PT offer outside of business hours | Limited PT offer outside of working hours (9AM-5PM). | 11 |
| Limited availability of PT outside urban areas | High coverage in urban areas, but not enough availability outside of cities. | 13 |
| *Reliability of PT* | | *14* |
| Inaccuracy information | Real-time announcement boards and information are often inaccurate. | 1 |
| Cancellations | Last-minute cancellations of PT. | 4 |
| Delays | Delays in PT. | 2 |
| Connectivity | Poorly planned PT connections, which can add extra time to trips. | 7 |
| *Safety and security* | | *11* |
| Lack of safety | PT at night can feel unsafe. | 2 |

**Table 3 (continued) | Coding tree- Overview of final barriers and enablers to sustainable mobility**

| Code name | Code definition | Occurrences |
|---|---|---|
| Insurance issues | Lack of clarity in responsibilities and insurance questions in peer-to-peer sharing systems. | 3 |
| Theft | Potential theft of bikes parked at shared mobility stop. | 2 |
| Injuries | Risk of injury when cycling. | 4 |
| *Temporal barriers* | | *17* |
| Children | Cycling with children is takes more time. | 1 |
| Planned leisure activities can be difficult using PT | Planned leisure activities with a definite starting time can be difficult using PT. | 2 |
| Sustainable mobility is time-intensive | More time is needed to travel sustainably. | 8 |
| *Company cars* | Having a company car incentivizes the use of a car. | *2* |
| **Enablers of sustainable mobility** | | **79** |
| *Accessibility* | | *4* |
| User-friendly apps | Some PT-apps are user-friendly. | 2 |
| Accessibility of city centres | City centres are more easily accessible by sustainable mobility than by car. | 2 |
| *Disincentivizing car use* | | *25* |
| High cost of car ownership | Owning a car is expensive (cost of buying, insurance, gas,…) | 9 |
| Lack of use | Private cars stand still most of the time. | 6 |
| Parking | Parking, especially in denser areas, can be complicated and expensive. | 2 |
| Stress associated with car use | Traffic and trying to find parking can cause stress? | 4 |
| Traffic | Cars are often stuck in traffic. | 4 |
| *Enablers for active mobility* | | *19* |
| Low cost | Active mobility is more cost-efficient. | 1 |
| Enablers for bike use | | 12 |
| Multimodality | (E-)Bikes as a good substitute to the car and complement to PT | 14 |
| Ability to transport | Cargo bikes and bike bags allow for more luggage | 2 |
| More physical activity | Using active mobility offers more physical activity. | 5 |
| *Enablers for shared mobility* | | *13* |
| Availability of car sharing | The availability of car sharing systems close by provide a good alternative to ownership. | 8 |
| Car sharing as a status symbol | Using car sharing can be seen as a status symbol | 1 |
| Carpooling | Carpooling can be an alternative to car ownership | 4 |
| *Enablers for public transport* | | *31* |
| Multimodality | Close proximity of sharing systems and PT | 4 |
| Frequency | Good provision of PT in (big) cities | 4 |
| Comfort | Public transport is comfortable | 15 |
| Commuting | Commuting (home-work patterns) are often easy with PT | 2 |
| Image of PT | Travelling by PT engages children in the journey and is seen as “adventurous” | 6 |

The coding tree is the final coding structure obtained after the different rounds of coding and discussions between the researchers.

In line with Madhuwanthi et al.[30], a next important barrier described by participants relates to the level of comfort offered by a private car, with alternatives seemingly not able to provide a similar comfort level. Here, difficulties were experienced with needing to transport luggage or groceries, or the lack of flexibility of alternatives. One participant in Ghent said “*(…) I had been thinking about going to the coast with my children since the weather was nice, because we have a good train connection from home. But I did not know how full the train was going to be and I was afraid of being stranded at the train station on the way back with my two tired children and all of our beach things*”. Participants particularly mentioned that sticking to a fixed schedule, as well as the constraints of station-based shared mobility were problematic. Related to this barrier is also the element of bad weather, which can discourage the use of active modes.

From the focus groups, it also became clear that car-centrism, at various different levels, represents a barrier to sustainable mobility (20 out of the 191 occurrences). Participants highlighted first the cultural aspect to car-centrism, with the car still perceived as a status symbol, thereby enabling car ownership[32]. Additionally, participants highlighted that previous generations were raised around the use of the car. As a result, from an individual point of view, the private car seems to be the default option, as that is just what individuals have always used. In Brussels, one participant mentioned that *“people still automatically think that every trip needs to be a car trip”*. Lastly, from a policy perspective, this car-centrism translates as planning that seems to forget about alternative modes. One participant in Ghent told *“I had to go to an event, and on the invitation they only provided instructions on how to reach the event by car. (…) I decided to bike, but only one access door to the event location was open, so I had to park my bike on the car parking. (…) When exiting, I asked the parking attendants which direction I need to go in, and they direct me towards one of the exits. I arrive at the exit and only see indications for the highway. (…) I was not about to cycle on the highway, so I had to drag my bike through the grass along the parking in the middle of the night”*. In two of the focus groups, participants recounted that, when there is street construction, alternative itineraries are provided for car drivers, but not for cyclists. Similarly, participants complained about bike

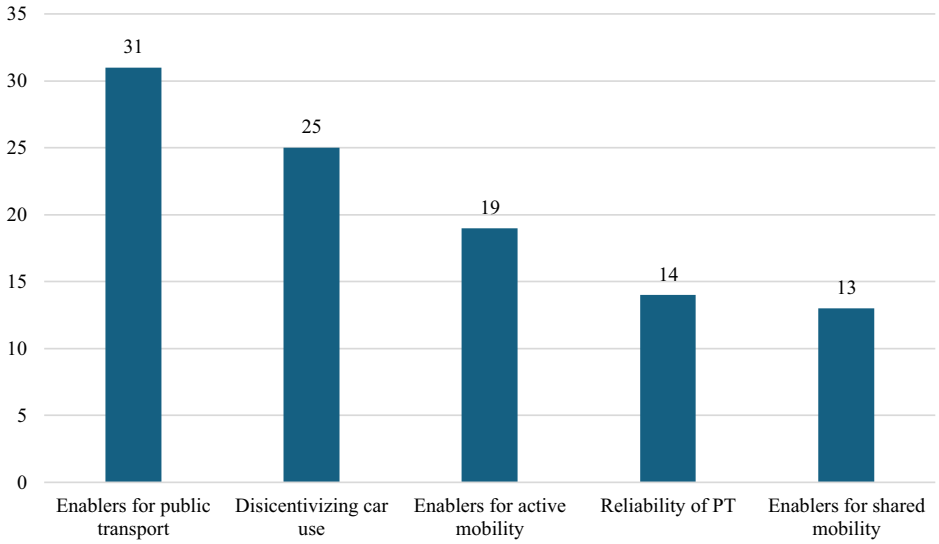


**Fig. 3 | Overview enablers identified by participants.** From the figure, it can be seen that public transport enablers are the main enablers identified by participants.

lanes that are uncomfortable and non-standardised throughout the region, further highlighting that inadequate or inexistent cycling infrastructure acts a structural barrier to active transport[31,43].

Accessibility, both physical and digital, was another important discussion point. Participants highlighted that ticket machines for public transport, or the cost incentives of buying a ticket in an app instead of at the station, could be a discouraging feature for them. According to one participant, "*digitalisation prevents people that could take public transport relatively easily by making it too complicated*". More broadly, the discussion also arose that these systems could exclude certain users, such as for example the elderly or people who do not own a smartphone.

One barrier that was only mentioned by two people in the four focus groups was the availability of a company car. As company cars and their accompanying fuel card are widespread in Belgium, this was somewhat unexpected. However, only one participant in the focus groups actually had a company car at their disposal, which constitutes a bias in our results. From the discussion, it became clear that the availability of such a company car removes the cost burdens associated with car ownership. Additionally, from findings by McCarthy et al.[31], we expected that increasing travel distances would be a barrier identified in our research as well. However, in our case, this theme did not emerge; rather, participants spoke more of trips taking too long without a car, rather than their destinations being too far. This is coherent with findings by dell'Olio et al.[39], who saw that journey time is considered as one of the most important factors for potential users of public transport. One participant in Brussels said that *"I have trips that take me 20 minutes by car but an hour and a half by public transport. (…) This can be very discouraging"*. This lack of focus on distance could be due to the fact that Flanders is relatively small, and distances can take on a different meaning compared with other regions in the world.

### Enablers of sustainable mobility

Fronteli and Pacheco Paladini[32] identified maintenance and fuel costs as important enablers of sustainable transport. Similarly, the main enabler that participants in our case found for sustainable mobility were the difficulties encountered with car ownership and car use (25 out of the 79 enablers). This includes costs associated with a private car, as well as difficulties with parking and traffic, and the stress that comes with it. As participants put it, this discourages car use and makes alternatives more attractive. One participant in Brussels said "*We recently received an invoice just for the yearly maintenance, which was 500€ and something. And then you still have insurance and so on. If you add all that up… That car is only four and a half years old*". Additionally, our research also took place in the time period during which fuel prices increased significantly and hit record highs[64]. Participants therefore also mentioned that this price increase had played a significant role in their awareness of how much their car actually costs.

A second main enabler for sustainable mobility concerns the use of public transport (23 occurrences out of 79). Participants mentioned how advantageous public transport was to them in terms of comfort, as it is possible to do something else while travelling. Additionally, the fact that public transport enabled them to arrive in the city centre, compared to having to look for a parking spot, was considered an advantage. Another important point expressed by participants with children is the fact that using public transport gets children more engaged in the journey, as compared to sitting in the back seat of a car. This idea of teaching children "*how the world works*", as expressed by one participant, was furthermore a recurring theme in the discussions. One participant with children expressed that she finds it important to "*teach her children how to be more independent and better prepared for unforeseen events, as taking public transport can sometimes not go as planned*". Exposing children to alternative modes of transport can also help fuel their imaginaries, creating support for more sustainable solutions later in life[65].

When it comes to active mobility, participants expressed that electric bikes are considered a good substitute to the car. They highlighted that the threshold to cycle with an electric bike was much lower than with traditional bikes, as they are more comfortable and faster. One participant in Brussels said: *"I used to not even cycle 500 km per year. Now, since three or four years, I have an electric bike and I cycle 5000 km per year. (…) Since we have our electric bikes, we use our cars much less than was previously the case"*. However, participants did say that, for electric bikes to be even more attractive, infrastructure improvements are needed, to ensure safety and security of cyclists, and to prevent theft. Félix et al.[42] found that infrastructural improvements can have considerable impacts on raising levels of bike use, and that coupling infrastructure with well-developed bike-sharing systems can be a game-changer for bike use.

Another interesting result concerns the theme of shared mobility. From the focus groups, it became clear that participants saw carsharing as a strong alternative to the private car, which can also mitigate the drawbacks of public transport. Participants who used carsharing highlighted the flexibility offered in terms of car size for example. One participant in Ghent said: *"We exchanged our second car for a carsharing subscription some years back, and we do not feel the need to go back"*. However, some participants did point out that station-based car sharing can be problematic: in one case, a participants needed to go to the airport early in the morning and therefore wanted to drive. With a station-based carsharing system, this would entail leaving the car at the airport and paying for it for the whole duration of their holiday. However, this drawback of station-based sharing only appeared for

carsharing; in the context of the campaign, some participants were offered free rides through a station-based bike-sharing system, available at train stations throughout Flanders. Participants found this to be very useful, since it allowed them to cover the last distances once they were off the train.

### Sustainable mobility paradigm

The analysis of barriers and enablers provides a detailed insight into the complexities of transitioning away from cars and towards sustainable mobility in Flanders. In this section, we contextualise the themes that emerged in light of the sustainable mobility paradigm[11], to identify leverage points that can be used by policymakers to support transition. Our results suggest that, for policy makers, there is a need to act on the structural barriers identified by participants, if Flanders wants to achieve sustainable mobility goals, considering that the majority of the focus group discussions centred around issues with modal shift and current inefficiencies in the transport system.

In terms of reducing the need to travel, planning plays a considerable role in in it, by establishing and implementing clear development principles based on sustainability[66]. However, throughout the focus groups, the theme of reduced travel was not evoked. The discussions were centred on how to travel *differently*, but not on how *not* to travel at all. Additionally, an aspect that was not elaborated on in the focus groups either, is the availability of technology to replace certain trips (such as for teleworking). Although monitoring is needed to avoid rebound effects[67], structural telework can further contribute to reducing the need to travel.

The majority of the themes discussed in the focus groups were centred around the possibility of a modal shift as a main action point for sustainable mobility. Our findings confirm the idea that limited availability of sustainable transport options, both in terms of time coverage (non-peak hours) and geographical coverage (outside urban areas), is a main hindrance to achieving this modal shift, together with the costs associated with it[2,31,68]. The main barrier that emerged was that sustainable mobility is more time-consuming than using a private car. This can be due to bad connectivity, or low frequency, but closing this gap would strongly benefit sustainable alternatives. For example, the focus could be on on-demand transport models to supplement traditional fixed-route services. When it comes to the cost of public transport and other sustainable mobility alternatives, we recommend that policymakers build on the experience of the campaign, offering alternatives for free or at a reduced cost, to make them more financially attractive. Furthermore, when it comes to costs, the availability of company cars diminishes the incentive to explore sustainable alternatives, as cost burdens like maintenance or fuel are often absorbed by employers. There therefore should be a clear political decision about the availability of company cars, with an alternative to it being the so-called 'mobility budget', whereby employees receive a virtual budget, instead of a company car, to meet their work-related transport needs[69]. Although the mobility budget is gaining in popularity, currently only 3.4% of employees who have the right to a company car choose this alternative, leaving an important growth opportunity[70].

Overall, a key take-away from the focus groups was the pervasive influence of car-centrism, which embeds the private car as a default travel mode in societal, cultural, and policy frameworks. This reliance is sustained by planning practices that prioritise cars, such as events designed without multimodal access or cycling infrastructure that is inadequate. At a broader level, efforts to reduce car traffic should be further pursued, by institutionalizing an approach that does not put the private car at the centre of planning[12].

Furthermore, in accordance with Goodwin et al.[1], focusing on car-dependent trips (and not people) will facilitate behavioural change. As shown, although Flanders has relatively high modal share of cycling (18%), the modal share of public transport is only at 4%[52]. As the backbone of sustainable mobility, policy makers should prioritize investments targeting this issue, making public transport more easily accessible.

Despite these barriers, enablers that facilitate a shift toward sustainable modes include the perceived advantages of public transport, such as comfort and the ability to engage in other activities while commuting. Participants also appreciated how active mobility, especially with electric bikes, offers convenience and speed. Shared mobility systems, particularly bike-sharing programs, were also seen as helpful for bridging gaps in multimodal journeys. These results align with previous studies[68].

When it comes to technological advancements to improve the efficiency of the transport system, this was not as prominent in the focus group discussions. However, two main themes did emerge. The first one is the developments in digitalization, which emerged as a double-edged sword. On one hand, the growing use of apps for ticketing and route planning can streamline sustainable transport alternatives. However, participants noted that such systems could exclude individuals who lack digital literacy or access to smartphones, such as the elderly. This limits broader adoption and may exacerbate accessibility issues. Here, there is therefore a role to play by policymakers in ensuring the inclusive design of these new digital mobility solutions[71].

The second topic that emerged concerns the availability of e-bikes. This development was identified among focus group participants as a significant enabler of sustainable mobility. However, participants also pointed out the need for appropriate infrastructure to ensure safety[72]. Félix et al.[42]. found that infrastructural improvements can have considerable impacts on raising levels of bike use, and that coupling infrastructure with well-developed bike-sharing systems can be a game-changer for bike use. In Flanders, for example, this could be achieved by accelerating the development of so-called bike highways, which are bike lanes that connect different regions of Flanders to each other, spanning 15 to 20 km[73].

Similarly as with the avoidance of certain trips, the discussions in the focus groups did not relate to the reduction of travel distance. One of the reasons for this could be linked back to the specificity of the ribbon development that characterizes Flanders outside of urban centres. This type of urban sprawls renders travel necessary for core activities such as employment or education, and, at the same time, these travels often depend on the (private) car[55]. At the level of policy making, our findings therefore encourage to rethink regional zoning plans to further restrict ribbon development to act on reducing the need to travel.

### Gender and sustainable mobility behaviour

A final element that was discussed in the sessions was the influence of gender on sustainable mobility behaviour. This was included in the focus groups after the general campaign results showed an overrepresentation of female participants, when compared to the general population[56]. Focus group participants were shown this statistic and asked if they consider sustainable mobility as more feminine or masculine, or if they did not make any gendered links to the topic, and whether or not they think this might have influenced the campaign participant sample. Participants in the online group connected the willingness to adopt sustainable behaviour to women, and the use of private car ownership to masculinity and pride: "*I think that women are more likely to consider the environment etc… And men just want to have their own car and drive it -fast- to wherever they want.*" Another participant added that: "*If men rent a car, it is a Porsche to drive on a racing circuit.*" However, participants also noted that they did not feel that the campaign specifically targeted women more than men. This question did not come up in all focus groups and as it concerns the campaign more than the participant's individual experiences of sustainable mobility, this element cannot be considered either a barrier or an enabler. It is however interesting to highlight, as a growing body of literature points out that sustainability is considered as a feminine phenomenon (see for example Swim et al.[74], Brough et al.[75]; Anfinsen et al.[76]).

## Conclusion

In this paper, we identified the barriers and enablers to sustainable mobility in Flanders through focus groups with participants of the "30 Days with Less Car" campaign. Our goal, through this research, was to understand what steps need to be taken to facilitate and encourage the use of alternative transport modes on an individual level, rather than the private car, to achieve a modal shift. From our results, it became clear that participants identified more barriers than enablers to sustainable mobility during their

participation, indicating that the context is not yet supportive enough of a modal shift. This was the case even though participants in this first edition of the campaign were people who already were familiar with the concept of sustainable mobility, and therefore not strongly car dependent. Even these participants, more open to the idea of moving around sustainably, and therefore more willing than heavily car-dependent people to put in the effort to find alternatives to the car, encountered more difficulties than enablers when choosing sustainable mobility options.

However, it becomes clear that the enablers and barriers to sustainable mobility are often two sides of the same coin: a lack of affordable and accessible public or shared transport will be identified as a barrier, while the presence of it will be perceived as an enabler of sustainable mobility. This highlights the need to act both on providing acceptable alternative modes and, on the other, making car use less attractive than these alternatives, if we want to encourage sustainable mobility and reduce car dependence[2]. Importantly, Metz[2] also identified a third pillar to target car-dependence, i.e., lessening good feelings about car ownership and use. However, this aspect was not very present in our research. One possible explanation for this is that the participants in this first edition of the campaign were people who already were familiar with the concept of sustainable mobility, and therefore not strongly car dependent.

From the discussion with the participants, it became clear how important it is to have people try out alternatives to their routine mobility patterns, which could help reduce situational and mental car-dependence. The results suggest that there is no one size fits all solution, and that policy makers should offer a range of (information on) alternative solutions that citizens can use. This showcases also the important roles that such campaigns can play in potential long-term behavioural change, with a potential policy tool therefore lying in the expansion of access to temporary, cost-free mobility trials as a strategy to facilitate long-term shifts. These can help lower psychological and financial barriers to modal shift. As one participant in Brussels put it: *"The campaign helped raise awareness around the alternatives to the automatism of driving a car. The alternatives will be different for everyone, but the campaign made people reflect on what can be done differently."*. Through the campaign, participants were offered public transport or shared mobility subscriptions for a month. This allowed them to experience these alternatives without needing to commit to them, and to understand how they might benefit from more sustainable transport modes. This type of campaign can therefore play an important role in allowing people to experiment with sustainable alternatives, while at the same time informing policymakers about current pain points participants experience.

The research in this paper includes some limitations. The focus on participants of the campaign enabled us to deep-dive into the daily experiences of people consciously trying not to travel by car, resulting in an in-depth understanding of the topic. Yet the focus on campaign participants can also be a limitation to this study, since it focuses on people who, by participating in such a campaign, already show an interest in sustainable mobility. In future work, it would be interesting to also understand what could encourage non-participants, or more car-dependent participants, to use alternatives to the private car in their daily mobility. Additionally, and relating to the previous point, although a conscious effort was made to diversify the participants in the focus groups, the results are in no way representative (or even meant to be) of the Flemish population. However, it has to be acknowledged that our sample size of 18 focus group participants does not allow us to generalise our results. In future work, it would be interesting to elaborate on these findings to validate them, for example through survey research.

## Data availability

The transcripts of the focus groups that were used in the analyses are available in the OSF repository: https://osf.io/rbd8m/?view_only=84662b926fda419f97ceaf058449f4bf.

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## Author contributions

S.T.: Conceptualization, formal analysis, writing—original draft preparation (lead), review & editing. C.v.V.: Formal analysis, writing—review & editing. C.M.: Conceptualization, validation, supervision All authors contributed to the article and approved the submitted version.

## Competing interests

The authors declare no competing interests.

## Additional information

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