The intention to use real-time multimodal information to change travel behaviour. The use of psychosocial variables for the market segmentation.

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The intention to use real-time multimodal information to change travel behaviour

The use of psychosocial variables for the market segmentation

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Amandine Duboz
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"Chimpanzees, gorillas, orangutans have been living for hundreds of thousands of years in their forest, living fantastic lives, never overpopulating, never destroying the forest. I would say that they have been in a way more successful than us as far as being in harmony with the environment"

Jane Goodall

Abstract

Advanced Traveller Information Systems (ATIS) have been developed to encourage citizens to make better choices by making their travel more efficient and reliable. Another goal is to make mobility more sustainable. More precisely, the deployment of ATIS, especially multimodal real-time information systems, aims to induce a modal shift from the car to public transports (PT) or soft modes.

This Ph.D. thesis assesses the impact on travel behaviour of an ATIS, TUeTO, developed for the city of Torino within the European project Opticities. To reach this objective, a mixed method analysis has been adopted, allowing the use of both quantitative and qualitative data gathered before and after the test of TUeTO.

Psychosocial constructs were defined to segment the market, together with socioeconomic and travel characteristics, to understand which variables can induce a change of travel habits towards sustainable mobility. To this end, an exploratory factor analysis (EFA) was conducted on two questionnaires (one designed for the ex-ante phase of the Opticities project and the second designed ad hoc within the thesis work) to find psychosocial constructs related to the sample of 76 participants out of the 150 recruited within the project. A cluster analysis was subsequently performed to define different categories of people according to their willingness to use real-time multimodal information system to change travel behaviour. In addition, the use of qualitative data gathered through focus group discussions before and after the test of the app made possible to complete statistical analysis and investigate the cognitive mechanisms related to the use of ATIS. The textual analysis was made to verify the coherence of the clusters and gain insight regarding the issues related to the use of ATIS.

The innovative methodology of this thesis using both qualitative and quantitative data had for aim to validate, determine, and characterize the clusters created thanks to the cluster analysis method. The quantitative data from the

cluster analysis defined reliable categories of people willing to use ATIS to change travel behaviour after the test period, while the use of qualitative data was successful in deepening the understandings of the issue, although it did not validate all clusters created so far.

Segmentation better characterized the attitudes of people towards the use of ATIS. In contrast to the literature, the statistical analysis showed that people who had the intention to use TUeTO before the test, were not willing to change their travel behaviour after. On the other hand, although it was expected that people willing to use an ATIS would be mainly car users, the analysis pointed out that public transport users were more interested in using the information. However, the shift of mode from the car to more sustainable alternatives might be limited since a small amount of people willing to change travel behaviour for the most frequent trip use a car.

Content analysis opened a new perspective regarding the deployment of ATIS as a policy to change travel behaviours. While some participants pointed out the need to improve the reliability of TUeTO, others would have preferred an improvement of the public transport infrastructure either along with or instead of the deployment of the ATIS.

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Glossary of the acronyms

Acronym	Meaning
ATIS	Advanced Traveller Information System
BS	Bike sharing
CS	Car sharing
EFA	Exploratory factor analysis
FG	Focus group
GEB	General Ecological Behaviour
HCA	Hierarchical cluster analysis
ITS	Intelligent Transport Systems
O-D	Origin-destination
PAF	Principal axis factor analysis
PBC	Perceived behavioural control
PT	Public transport
TAM	Technology Acceptance Model
TAM2	Technology Acceptance Model 2
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UTAUT	Unified Theory of Acceptance and Use of Technology
UTAUT2	Unified Theory of Acceptance and Use of Technology 2
VMS	Variable Message Signs

Introduction

In 2008, European Commission (CE, 2008), following the directive 2010/40/UE (European Parliament and Council, 2010), has developed an action plan to accelerate and deploy Intelligent Transport Systems (ITS). In a context where road transport induces many disadvantages – road congestion, environmental impacts, high oil consumption, road fatalities (Potoènik, 2008) – and thus generate high costs for the society (Aïchi, 2015), ITS are seen as one of the solutions to solve transport issues (Abdel-Aty, 1996). ITS are a generic expression used to describe the integrated application of information and communication technology, processing information to make transport systems more efficient (AIPCR, 2006).

Advanced Traveller Information Systems (ATIS) are a key component of ITS and it is generally believed that ATIS are among the most cost-effective investments that a transport authority can make (Kristof et al., 2005). ATIS aims at supporting drivers and commuters to make better choices when starting a travel, during a travel (e.g. to avoid congestion), or when making a route choice (HongCheng et al., 2006). Furthermore, ATIS contribute to make people more informed when travelling (Khattak et al., 1994) and they help to reduce travel time, delays, fuel consumption and emissions by inducing a change of behaviour (Adler and Blue, 1998).

Kenyon and Lyons (2003) argue that the provision of suitable information to travellers would allow overcoming habits that affect decision making concerning travel mode (Aarts and al, 1997). Habits are challenged by the information provision that could change the cognitive foundation of intentions (Bamberg et al., 2008); however, evidence showed that individuals with strong travel habits are less likely to be affected by information about alternative transport modes than individuals with weak habits (Verplanken et al., 1997; Aarts et al., 1997).

The aim of this research is understanding what psychosocial variables – notably intentions, attitudes and expectations – influence the willingness to use multimodal information systems to change travel behaviour. To this end, a sample of people living in Torino (a city located in north-west of Italy) has been selected

to test a real-time multimodal information system, TUeTO, developed within the European project Opticities. TUeTO provides real-time information about all the transport modes (car-sharing, public transport, bike sharing, trains) as well as traffic (congestion, accidents).

The thesis is articulated in four sections:

- state-of-the-art analysis;
- objective and methodology;
- results;
- discussion and conclusions.

The *first section* includes two chapters allowing giving, on one side, a comprehensive overview about the psychosocial determinants of behavioural change related to new technologies and, on the other side, an insight on the effects of the Advance Traveller Information Systems (ATIS) on travel behaviour.

The first chapter aims at presenting the state-of-the-art literature about the different characteristics of ATIS. The benefits induced by the deployment of ATIS and the factors influencing their success are investigated. Then, the effects of such technology on travel behaviour are analysed. The first section is devoted to the change of travel behaviour – mode or route – induced by ATIS use. The second section questions the need of developing complex and expensive ATIS in order to improve their effects on travel behaviour.

The second chapter focuses – within the context of social psychology – on the understanding of the cognitive mechanisms both behind the behavioural change induced by information systems and related to the acceptance of technology. For this reason, the psychosocial determinants of behaviour will be presented: firstly, related to behavioural change - together with the role of the information -; secondly, related to the use of technology.

The *second section* presents the objective and methodology of the thesis work. After a short presentation of the context of the research and of its objectives, the methodological steps are detailed, explaining how the research work is framed within the larger context of the Opticities European project. The survey design is presented including both the survey provided in the project and an additional survey carried out within the thesis that has allowed to deepen some psychosocial aspects of individuals participating to the survey. Data analysis is finally presented, providing all the methods and models used to reach proposed objectives.

The *third section* reports the results of the thesis, both quantitative and qualitative, and is divided in four sub-sections. The first one presents a complete description of the sample. The second one reports the latent constructs identified through the Exploratory Factor Analysis (EFA) and the latent constructs created thanks to the Rasch Model. The third sub-section presents the results of the two clusters analyses applied to five latent constructs that have allowed to propose a market segmentation. The description of the clusters profiles and of their socio-economical characteristics, travel habits, attitudes and life styles are finally presented.

The last sub-section compares the results obtained through the cluster analysis with those coming from the textual analysis of the ex-ante and ex-post focus groups' discussions. More precisely, the analysis aims at verifying if the population within each cluster is coherent with what has been expressed during the discussions within the focus groups. Finally, the content analysis is used to have a better insight in the results of the cluster analysis.

The *last section* of the thesis is focused to the discussion of the results, comparing them with the current literature. Finally, a conclusion summarizes the results of the thesis discussing the future research endeavours.

1. The deployment of ATIS, a public policy to change travel behaviour

Until the end of the nineties, the main purpose of deploying ATIS was to assist travellers in planning and taking decisions concerning mode, departure time and route choice (considering congestion) to improve the convenience and efficiency of their travel. The increasing environmental impacts of transport systems have addressed the efforts to encourage the modal shift towards a more sustainable mobility.

The impact of ATIS depends on the benefits they generate to travellers that are difficult to detect due to variety of systems: from the mono-modal information systems to more complex multimodal real-time information system. While mono-modal traffic information systems aim at assisting car drivers in changing their routes, mono-modal PT information systems aim at providing information to PT users but also to attract non-PT users, notably car users. Finally, multimodal information systems are mainly deployed to change travel behaviour and to induce a more sustainable mobility.

This chapter reviews studies conducted to determine if and how the travellers' choices are affected by Advanced Traveller Information Systems (ATIS).

1.1 The benefits induced by the deployment of ATIS

The use of ATIS is intimately related to the benefits they generate to travellers as, for example, facilitating users' trips. This section aims at listing such benefits.

1.1.1 The benefits generated by traffic information systems

According to studies investigating benefits induced by ATIS, traffic information systems allow decreasing travel time uncertainty, saving time, reducing frustration and avoiding traffic congestion.

While Clemons et al. (1999) showed in a study conducted on users of a real-time traffic information systems that 99% of the users benefit of the information by avoiding traffic, saving time, reducing frustration and arriving on time, Abdel-Aty (1997) showed that traffic information had the potential to reduce travel time uncertainty. Levinson (2003) showed that real-time traffic information increase the reliability of the trip by reducing variance in travel time and that the biggest time saving happens in case of non-recurring congestion (i.e. unanticipated accidents).

Some studies have suggested that benefits generated by the use of traffic information increase with the complexity of the technology. Toledo and Beinhacker (2006) showed that the maximum benefits that drivers could get, in terms of travel time saving and travel time variability, occurs with on-route real-time information systems. Abdalla and Abdel-Aty (2006) showed that travel time decreases significantly (44.7%) as the information becomes more complete (from "no information" to "pre-trip + on-route information with advice").

From the point of view of traffic flow management, Gan et al. (2006) showed that the implementation of Variable Message Signs (VMS), giving traffic information on an expressway of Shanghai (China), allowed to decrease of 20% the congestion duration and to increase of 20% vehicles' speed.

1.1.2 The benefits generated by public transport information systems

In 2003, Schweiger highlighted the potential of ATIS in reducing the perceived waiting time at bus stop and in encouraging the use of public transport (PT) increasing the number of ridership[1]. In addition, results highlighted that potential users consider that ATIS will increase their overall satisfaction of the PT as well as improve the service.

After the publication of Schweiger (2003) analysis, other studies confirmed the potential of ATIS in reducing waiting time. Dziekan and Vermeulen (2006) showed that perceived waiting time is reduced by 20% when people consider dynamic at-stop real-time information displays; Watkins et al. (2011) raised that

[1] This last point will be investigated and discussed in the sub-section 2.3.2 The deployment of ATIS to change travel habits

people not using real-time information perceived a greater waiting time than those using real-time information.

On the other side, articles examine the influence of the deployment of ATIS on emotions of PT users'. Thus, after the deployment of OneBusAway – real-time information system at-stop – in the city of Tampa (Florida, USA), Brakewood et al. (2014) observed that the system helped to reduce the anxiety and frustration of users while waiting. Results of two waves of surveys on the effect of a real-time information system – accessible via internet and phones – about bus arrival showed that the system was useful in increasing the feeling of security of PT users at night-time (Zhang et al., 2008). Finally, Ferris et al. (2010), in addition to demonstrate that bus arrival real-time information increased the feeling of safety of 21%, explained that such feeling comes from the possibility to spend less time at bus-stop.

Finally, a laboratory experiment simulating a corridor of the Massachusetts Bay Transportation Authority (MBTA) in Boston, showed that the deployment of public transport information system would not provide significant benefits (Hickman and Wilson, 1995). According to the results, potential time saving for a trip time of 34-35 minutes would be about 3% and the travel time variability would almost not change.

1.1.3 The benefits generated by multimodal information systems

Few studies have investigated the benefits generated by the deployment of multimodal information systems.

Zografos et al. (2012), in a study on the assessment of WISETRIP – an international multimodal journey planner providing information on possible itineraries for specific segments of the trip – showed that the prerequisite to use the service is time saving. Moreover, while only 67% of people under 34 thinks that WISETRIP would allow them to save time, they were 81.9% of people having between 35-54 and 92.1% of the 55 years old and more to stated that the service would help them. The users of TravInfo – a multimodal information system – generally used the service to save time, to avoid congestion, to find the best route and to reduce the stress (Ygnace et al., 2000). Finally, Götzenbrucker and Köhl (2012) found out that the provision of multimodal information reduces the uncertainty and the stress related to the travel.

1.2 Factors influencing the success of ATIS deployment

The success of deploying ATIS is intimately related to factors that will affect their use or the change of behaviour. This section aims at listing such benefits.

1.2.1 ATIS awareness

While ATIS aim at assisting people during their travel providing travel route and mode alternatives, their diffusion can be hampered by the lack of awareness of their existence that is the main barrier to their use (Peirce and Lappin, 2005).

The most common solution proposed to diffuse the use of ATIS among population is advertising them (Peirce and Lappin, 2002; Alexandri et al. 2015). Two studies assessing the effects of real-time information in the cities of Chicago and New York confirmed the above solution showing that PT use increased more for the city that advertised the system than for the one who did not (Tang and Thakuriah, 2012; Brakewood et al., 2015). However, the use of ATIS may not be always affected by advertisement as proved by the increase usage of OneBusAway in Seattle-area where minimal advertisement and no official backing from regional transit agency had been made (Ferris et al., 2010).

Although people are unfamiliar with ATIS technologies (Peirce and Lappin, 2005), some studies have demonstrated that people already use ATIS. Thus, in 1993, Abdel-Aty observed that morning drivers of Los-Angeles area were listening pre-trip traffic information (36.5%) and also on-route traffic information (51.2%). Later, Tsirimpa and Polydoroulo (2010) showed that a strong majority of people (87.4%) use information provided by traditional information systems (TV, phone, radio). While Farag and Lyons (2008) noticed that people have a preferred source of information they use for their trips and that they in general never make a trip by PT without acceding to information.

Finally, other studies evaluated the need of real-time information at public transport stations. The report on InfoPolis2 (1998), a pilot survey conducted in the city of London (UK), showed that 70% of PT users looked at displays when arriving at stops, while 79% of the tramline users of the city of The Hague (Netherlands) look at them when arriving at their station (Dziekan and Vermeulen, 2006). Another study, related to the subway stations of Stockholm (Sweden), showed that people react to the information by accelerating their walk to take the metro (Dziekan and Kottenhoff, 2007).

1.2.2 Quality of the ATIS

The success or failure of ATIS in assisting people in their choices strongly depends on the accuracy of the information provided as well as on the quality of the advice delivered to travellers (Abdel-Aty, 2002). Thus, higher is the accuracy of the information, higher will be the compliance with travel solutions (Bonsall and Joint, 1991). In other words, the provision of bad information encourages ATIS users to not trust information and to ignore the proposed alternatives.

In line with Bonsall and Joint (1991), Schweiger (2003) showed that the lack of reliability of real-time bus arrival information may divert people from the use of public transport, while other studies (Mahmassani and Liu, 1999; Chen et al., 1999) pointed out that reliable services are more capable to influence drivers' travel behaviour.

As shown by TravInfo users, the perceived reliability of the information may be affected by the travel habits of the user. Thus, while car users perceived traffic information as more reliable and accurate, PT users considered transit information as less efficient. However, and in contradiction with Abdel-Aty (2002) and Bonsall and Joint (1991), the unreliability of the system did not affect ATIS use since the travellers were current users of the service.

1.2.3 Attributes of the information that may influence travel behaviour

The enhancement of ATIS with new information is generally investigated with the purpose to improve the service experience of current users and to attract new users. The aim is to increase the impact of these services on travel behaviour.

Concerning mono-modal traffic information, Mehndiritta et al. (2000) found out that drivers using TravInfo would prefer automatic update of the information while driving and a larger geographic coverage of the service; instead, a minority would prefer a customized ATIS (personalized route reports and automatic personal alerts).

While the information is one of the most desired attributes of PT users in order to improve the public transport systems, it is important to *investigate what are the most desired* information. Molin and Timmermans (2006) showed that real-time information is the most desired attribute, followed by the possibility to

better plan the trip (i.e. to search the cheapest route or to minimise transfer time) and to localise places where tickets are sold. Harmony and Gayah (2017) showed that PT users want to know the position of the vehicle, while seating availability, emergency information (e.g. evacuation due to fire), numbers of carriages on next train or type of next bus (e.g. regular or articulated) were considered less important.

About multimodal real-time information systems, Grotenhuis et al. (2007) showed that wayside information is more desired when people want to take the right vehicle during the travel and on-board users want information about arrival at interchanges in order to catch connected modes. Götzenbrucker and Köhl (2012) highlighted that testers of AnachB.at valued more the comparison of alternative routes.

On the other side, some studies have investigated the impacts of specific attributes on people behaviour. A study on the effects of safety information on car drivers of the city of Athens showed that drivers were more influenced by information on the safety level of the alternative route than by classical information such as travel time or travel length (Yannis et al., 2008). Wardman et al. (1997) found out that messages provided by VMS (Variable message signs) giving traffic delay information about road accidents affect more behaviours than those about roadworks.

Caufield et al. (2009) showed that PT users would get benefits from the deployment of real-time bus stop information, while benefits were smaller for train users. Some studies analysing multimodal information systems try to understand which attributes may help people to consider alternative modes. According to Gan (2014), factors encouraging use of multimodal information system are the traffic congestion and the level of comfort of trains, while travel costs affect travel mode choice. Memon et al. (2017) showed that intermodal information, travel time and the cost saved by using PT induce a modal shift from car to other travel modes. Finally, Brazil and Caufield (2013) highlighted that information about CO_2 emissions had the potential to divert car drivers to PT if the level of emission associated to the use of PT was low; although Tertoolen et al. (1998) showed that general information about the negative environmental effects of the car increase public awareness but is not sufficient to change behaviour.

1.2.4 Profile definition of those willing to change behaviour or use ATIS

In order to understand to whom addressing ATIS, some articles are focused to the definition of users' profile. In general, profiling users according to their attitudes towards a service allows defining efficient market strategies and tailoring such service to the market segments most willing to use it. Mehndiratta et al. presented in 2000 a market segmentation carried out on a sample of travellers using the service TravInfo[2] in the Bay Area of San Francisco (USA). The authors observed that 14% of the sample were the most frequent users of the device, white the majority used it at least once a week:

- the "regular, stable users" (51%) used the service at least once a week. Although they felt comfortable with technologies, they used cellular phones less than the rest of the sample;
- the "occasional users" (16%) did not use frequently the device; they were mainly women, not comfortable with technologies and less educated. They did not have a strong interest for traffic information and would be more willing to use the ATIS if it was improved with other services such as route guidance;
- the "heavy users" (14%) were the strongest users of TravInfo. They were worried of arriving late at work, well organized and willing to pay to use the information;
- the "technologically trendy, regular users" (10%) were all men, they spent money for car and were technologically friendly users.

Other researchers have described the drivers using ATIS according to their socioeconomic characteristics, but they did not propose a detailed market segmentation as that proposed by Mehndiratta et al. (2000). Adler and McNally (1994) showed how the familiarity with the network influenced the preference for traffic information. In accordance with these results, Bonsall and Joint (1995) find out that drivers making occasional (more unfamiliar) trips were more willing to use information systems, as well as less experienced and less confident drivers. The same year, Abdel-Aty (1995) showed that listening traffic information is

[2] This study was concentrated only on traffic information users while TravInfo propose advanced traveler information system providing real-time updates on freeway traffic conditions, 'static' information on public transit and ridesharing, as well as information on other transportation options, such as bicycle routes and airport transportation services.

correlated with the perceived traffic conditions and that people facing daily congestions were more likely to look traffic reports up before starting a trip.

Regarding the change of route, Dia (2002) showed that young drivers having a flexible schedule are more willing to take alternative routes after looking real-time traffic information up related to expected length of delay. On the other side, Kattan et al. (2013) showed that drivers having more than 3 years of driving experience, employed, travelling during morning peaks, having shopping or recreational trips are more willing to change of route. Yi et al. (2010) showed that potential users of pre-trip traffic information are males 30-50 years old, commuting by motorized modes and having a middle or high-income level.

About profiles of users of multimodal information systems, Hope and King (2006) showed that potential users of Traveline Scotland are mainly women, 25-44-years-old, employed, with an average income of £36 400 per year and living in urban areas. According to Memon et al. (2017), socioeconomic characteristics influencing mode choice decision are the gender, the age, the educational level and the income level. Furthermore, they found that middle-age male drivers, having a lower level of income, show a higher propensity to change travel behaviour. According to Pronello et al. (2017), users of Optymod'Lyon - a real-time multimodal planner – were middle-aged with high educational level, familiar with technological tools and owned a car.

Finally, according to a group of experts interviewed about the multimodal planner AnachB.at, people willing to change travel behaviour were mainly highly educated and working women between 21 and 40 years old. Moreover, those people would be "*open-minded, sociable and flexible showing a "high level of [an] ecological sense of responsibility*" (Götzenbrucker and Köhl, 2012).

1.3 The effectiveness of ATIS to change travel behaviour

The provision of information through ATIS aims at affecting the travel behaviours in order to assist people during their trips, but also at changing their travel habits. More precisely, articles can be classified in two different topics: the articles assessing the change of route and the articles assessing the modal change.

In order to assess the effects of ATIS, studies generally refer to hypothetical systems and people opinions are investigated through SP surveys. However, some

studies have also used surveys to investigate such issue estimating ridership increase after the implementation of ATIS.

This section aims at presenting the impact of ATIS on both modal shift and route choice.

Literature focusing on route switching thanks to the use of mono-modal traffic information systems shows promising results. In a laboratory experiment, Mahmassani and Liu (1999) showed that real-time traffic information increases the frequency of route switching before and during the trip. Alexandri et al. (2015) suggested that real-time information systems had the potential to change travel behaviour, since77% of the respondents of their survey revealed they would change route if they had access to such information. A study on the effectiveness on travel behaviour of images related to traffic information (Koo and Asitha, 2016) showed that drivers would consider changing their travel plan only in case of medium congestion. However, instead of changing route as a first response to the information, they would firstly consider another departure time. If traffic continues to increase, they would then take an alternative route or cancel the trip.

The results of studies assessing the effects of PT information systems mainly deal with real-time arrival at stops and are less promising in terms of effect on travel behaviour. While users of OneBusAway, in the Seattle-area, more frequently used PT, notably for non-commuting trips (Ferris et al., 2010), the mobility of users of the same service in the city of Tampa were not affected by its use (Brakewood et al., 2014). Zhang et al. (2008) explain that if transit ridership did not increase after the implementation of ATIS, it was mainly due to a methodological bias.

A survey conducted on citizens of the Seattle area showed that 60% of the 12% looking information up during the trip did not change behaviour at all using ATIS and only 1% changed mode (Peirce and Lappin, 2002). However, 13% of the sample reported changes of departure time, the reasons being avoiding congestion (11%) and taking a new route (9%).

Abdel-Aty et al. (1996) tried to understand if PT information was able to obtain a modal diversion from car to PT and found that about 38% of non-transit users would consider PT if the appropriate transit information was available (transit route map and waiting time for the most important lines). However, such potential may be limited by some factors. Chorus et al. (2006) pointed out that

even if car-drivers consider PT as a potential alternative, the acquisition of information is limited when the information is perceived as unreliable, irrelevant and when people prefer to use the car instead of other transport modes. In addition, such limitation may occur when the information is strongly favourable to transit option.

Another survey conducted on PT users in the city of Thessaloniki, after the implementation of an advanced bus real-time information system at bus-stop, showed that 19.7% of the sample increased their PT use (Politis et al., 2010).

Tang and Thakuriah (2012) assessed the effects of PT real-time information (such as current position and expected arrival time of buses at the stop) implemented in the city of Chicago (USA). Researchers used data related to an average weekday (calculated during a month) and considered external factors (such as gas prices, weather conditions, unemployment rates, population and other socioeconomic characteristics) in the whole area of Chicago Transit Authority. Results showed that the information provided by Bus Tracker allowed to increase bus ridership of about 126 people. To justify the small effect of the information on people, researchers pointed out three principle reasons that may have limited the increase of bus ridership:

- people may not be aware of the deployment of the system, especially those who do not typically use PT;
- since the information is only available to people owning a computer or handling devices with internet access, those not having access to such devices may not use Bus Tracker;
- the model used to assess the effects of Bus Tracker may not have captured all the factors allowing to understand the limited increase of bus use.

A similar study has been undertaken in the city of New-York (USA) to assess the effects of real-time information provided through web-enabled and mobile devices on public transit ridership (Brakewood et al., 2015). In contrast with the city of Chicago, the deployment of the technology in the city of New-York was favoured by the fact that: (1) real-time information was already deployed on multiple interfaces; (2) PT users had a higher level of technology adaptation; and (3) a marketing campaign was done in order to increase the awareness of the real-time information. Results showed that real-time information caused a significant increase (340 trips per weekday corresponding to a median increase of 2.3% per weekday) on the largest route of the city, due to its higher service quality, and a smaller increase on smaller routes (118 trips per weekday corresponding to a

median increase of 1.7% per weekday). Those results are consistent with those of the study conducted by Maclean and Dailey (2002) who showed that transit information was more used for the lines where the frequency of buses was higher.

About the effects of multimodal information systems, the results of the experiment conducted on users of AnachB.at (Götzenbrucker and Köhl, 2012) showed satisfactory results. In fact, the number of car trips decreased during the test (from 56% to 38% after) as well as on the medium term (6 weeks after the end of the test). In line with those results, Hope and King (2006) showed that people using Traveline Scotland were more willing to have a multimodal behaviour than those not using the information. Moreover, results showed that public transport use increased after using the service, while car use decreased.

However, results of other studies differ from those described above. Results of the study investigating Transbasel – a multimodal information system providing travel times for car, bike, and PT in the tri-national agglomeration of Basel (France, Switzerland and Germany) – showed that the change of travel behaviour may be limited. Thus, about 4% of participants explained they changed transport mode for their most frequent trip after using the information service, while 83% answered they did not change at all (Rapp, 2003). A study on a co-modal travel planner, developed for the city of Stockholm, showed that only 9% of the sample testing the system used more frequently the PT after its test and that only one of them used less often the car (Skoglund and Karlsson, 2012). Finally, results of the study on Optymod'Lyon – a real-time multimodal information system – showed that despite a positive attitude before the test of the app, people were more willing to use the information to plan occasional trips instead of using it on a daily basis (Pronello et al., 2017). Moreover, results highlighted that the only use of the app is not sufficient to change travel habits because people should have the intention to shift mode and not have strong habits.

1.4 Towards the deployment of complex systems

According to the literature, the advances in information and communication technology should allow the development and implementation of a next-generation of ATIS. Such ATIS would make public transport more attractive, delivering personalized, dynamic, multimodal travel information, unknown to the travellers, such as real-time messages in case of unexpected disturbances on the transport system (Kenyon & Lyons, 2003; Chorus et al., 2006a; Chorus and al, 2007a).

Kenyon and Lyons (2003) argued that the provision of suitable traveller information systems would give the opportunity to overcome habits that affects the elaborateness of decision making regarding the use of transport mode (Aarts et al., 1997). According to them (Kenyon and Lyons, 2003), such system would provide integrated multimodal traveller information (IMTI) about more transport modes interacting together (Kenyon and Lyons, 2003). In addition to inform people about different alternatives, those systems would propose multimodal travel and would minimize cognitive efforts by providing dynamic information (i.e. automatic update of the information). As we will see in detail in the section devoted to the social psychology and behavioural theories, habits would be challenged by the information provided by changing the cognitive foundation of intentions (Bamberg et al., 2008).

However, some article demonstrated that individuals with strong travel habits are less likely to be affected by the information proposing alternative modes compared to individuals with weak habits (Verplanken et al., 1997; Aarts et al., 1997; Tang and Thakuriah, 2012, Pronello et al., 2017).

On the other side, other factors may affect the potential change of behaviour and should be investigated:

- despite the efforts made to improve ATIS in order to influence travel behaviour, nothing proves that people will adopt complex technologies instead of more traditional ones. As demonstrated by the results of the ninth wave of Puget Sound survey conducted in Seattle area (Peirce and Lappin, 2002), people could prefer to use less complex but familiar technologies (i.e. to listen to traffic reports on radio and TV in the case of the Puget Sound survey);
- people may not want to use information systems to change their travel habits. Thus, the study on a co-modal travel planner developed for the city of Stockholm showed that, despite people trust the information provided, the perceived value of the service decreased over time (Skoglund and Karlsson, 2012). Thus, results showed that only 40% of the sample used more than one time the device, and only 9% of them used more frequently the PT and only one respondent expressed to use less often the car after the period of test.

2. The mechanisms of the change of behaviour

Whereas cities worldwide try to develop a sustainable mobility by decreasing car use through several public policies, one of those policies is the use of ATIS to change users' travel behaviour. As explained above, the ongoing development and improvement of such devices should allow a behavioural change thanks to the provision of reliable information provided by complex technologies (such as multimodal real-time information systems).

As shown in the previous chapter, since the nineties, many articles dealing with ATIS have been written on various issues: from the benefits obtained by using such services to the factors affecting their use, without forgetting the change of behaviour. However, despite the efforts carried out to create efficient systems, the results are disappointing and ATIS are not effective yet to change habits. If individuals use ATIS, there is no evidence that they will effectively change behaviour by using them. Finally, when the route or modal shift are evaluated, the effective change of behaviour is mainly assessed, while the mechanism affecting the choice are not.

Social-psychology try to understand and explain the mechanisms of the change of behaviour. In the last decades, social psychologists carried out a large amount of research to understand modal choice (Gaborieau, 2016) while little research have been undertaken regarding ATIS use as well as travel change by using ATIS. Thus, although Kenyon and Lyons (2003) introduced some psychosocial constructs, the first article explaining the use of ATIS by highlighting psychosocial constructs has been proposed by Pronello et al. in 2017.

Among socio-cognitive theories predicting and explaining behaviour, the most famous one is the Theory of Planned Behaviour (Ajzen, 1991). According to this theory, behaviour is reasoned since it is the consequence of the intention to perform it. The theory was designed to explain the influence of information on behaviour (Conner and Armitage, 1998). When giving a new information, the model predicts that the cognitive foundation of intention and behaviour would be changed, also if the behaviour is habitual (Bamberg et al., 2003a; Bamberg et al.,

2003b). Thus, some researchers explained that information cannot so easily change behaviour, since habits are the main barriers to the modal change: when the habit is too strong, a new information will not be considered (Aarts et al., 1997).

On the other side, theories inspired by the TRA and TPB have been developed to understand individual's acceptance of using an information system. Although not deepening the impact of ATIS on behaviour, those theories can provide insight about the socio-psychological constructs affecting the ATIS use, considered that the acceptance of using them is the first stage of the change of behaviour.

This chapter aims at defining the socio-psychological determinants mentioned above, starting from those related to behavioural change and following with those related to the use of technology.

2.1 Psychosocial determinants of behavioural change

2.1.1 The choice as a reasoned behaviour

When the Theory of Reasoned Action (TRA) was developed, the aim of Fishbein and Ajzen (1975) was to propose a theory allowing to explain, predict and modify the behaviour of individuals. According to the TRA, the behaviour is directly determined by the intention and, indirectly, via the intention, by the attitudes and the subjective norms. Years later, the same authors (Ajzen and Fishbein, 1988) modified this theory by adding a new construct determining the intention – and/or directly the behaviour – the perceived behavioural control. The new theory was called the Theory of Planned Behaviour (TPB).

Figure 1 presents both theories: inside the blue dotted lines there is the original model composed of three factors directly (intention) and indirectly (attitude towards the behaviour and subjective norms) influencing the behaviour. The perceived behavioural control is the new factor influencing both directly and indirectly the behaviour. According to those theories, social behaviours are guided by different beliefs that influence the creation of psychological constructs that lead to the formation of the intention: 1) behavioural beliefs that influence the attitude towards the behaviour; 2) normative beliefs that precedes subjective norms and 3) control beliefs that influence the perceived behavioural control.

Both theories state that behaviours are volitional, since a behaviour always implies a choice based on the deliberation (Ajzen and Fishbein, 1980). In other words, during the decision-making process, an individual will consider all the information available at his/her disposal to assess implications and consequences of the behaviour. Thus, social behaviours are reasoned or planned since they are consistent with the beliefs determining the attitudes, the subjective norms and the perceived behavioural control (Ajzen, 2015). However, the term "reasoned" should not be confused with the term "rational", biased by objectives and rational rules (Giger, 2008). In both theories, the volitional construct is the intention; the intention is a motivational factor that directly influences the behaviour. As a general rule, *"the stronger a person's intention, the more the person is expected to try and hence the greater the likelihood that the behaviour will actually be performed"* (Ajzen et Madden, 1986).

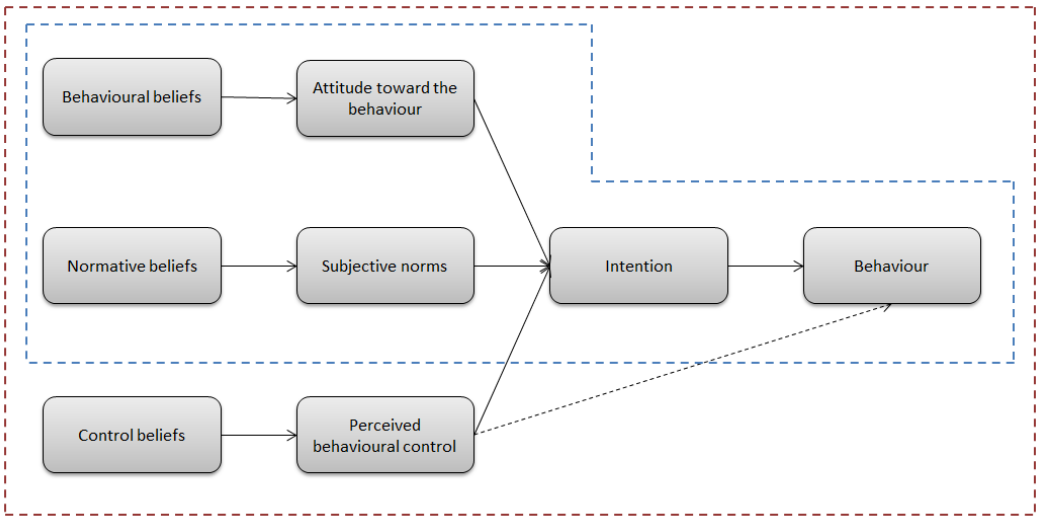

Figure 1 Relationship among the Theory of Reasoned action (Fishbein and Ajzen, 1975) and the Theory of Planned Behaviour (Ajzen and Fishbein, 1988)

The concept of attitude, defined as "*an individual's positive or negative belief about performing a specific behavior*" (Ajzen, 1988), refers to objects (i.e. house), actions, individuals, groups of individuals or institutions. Subjective norms are "*a function of beliefs that specific individuals approve or disapprove of performing the behavior*" (Ajzen,1988). In other words, subjective norms refer to the social pressure towards the behaviour that an individual will perceive from the others (from restricted group of people such as family or friends to a larger group of people such as colleagues or unknown people).

While the TRA suggests that a person's behaviour is totally volitional – that people have the capacity and possibility to act a specific behaviour – it excludes de facto behaviours that depend of non-motivational factors (Ajzen, 1991) and limit the power of prediction of the model (Ajzen, 2012). More precisely, the theory excludes internal and external factors that facilitate or hinder the performance of a given behaviour, such as requisite resources (e.g., time, money, skills or cooperation). In order to measure this degree of control over behaviour, the TRA was expanded with a new variable, "the perceived behavioural control" (Ajzen, 1991).

The perceived behavioural control refers to the extent to which an individual perceived his/her ability to perform or not a behaviour (Ajzen, 1988). According to the TPB, when an individual has a complete control on his/her behaviour, the intention alone predicts the behaviour. On the other hand, the probability that the PBC predicts directly the behaviour becomes higher (Doll and Ajzen, 1992). The perceived behavioural control can affect the behaviour directly or indirectly. When the influence is direct, the perceived behavioural control represents the real control that someone has on his/her own behaviour, while when the link is indirect the construct affects the intention.

According to Ajzen (1988), for accurate predictions of a given behaviour, the measure of attitudes, intention and perceived behavioural control must be compatible. Although the principle of compatibility firstly intended that the behaviour should be able to be predicted from measures of attitudes towards those behaviours, it has also been proved that intention and perceived behavioural control must be assessed in relation to the specific behaviour (Ajzen, 1988; Ajzen, 1991).

Since its creation, the TPB has been applied in various research fields such as health (weight loss), road safety, food consumption or absenteeism at work. A number of studies have substantiated the predictive validity of the relation intention-behaviour, when appropriately measured. A meta-analysis based on 87 separate studies showed significant results, since the average correlation of the attitudes and subjective norms with the intention was equal to 0.66, while the correlation was equal to 0.53 for the relation intention-behaviour (Sheppard et al., 1988). Sheeran and Orbell (1998), showed a low average correlation between the intention and the behaviour ($r=0.44$) and reported that intention accounts on average for 28% of the behaviour variance. In a meta-analysis conducted on 185 studies up to the end of 1997, Armitage and Conner (2001) have demonstrated

that the TPB explains 27% of the behaviour variance and 39% of the intention variance, while the average correlation with intention was equal to 0.47. In an article on the relation intention-behaviour, Sheeran (2002) showed that the correlation between intention and behaviour was equal to 0.53.

Other studies have provided evidence regarding the prediction of the intentions (Ajzen and Fishbein, 2005). Among the three constructs affecting the intention, the attitudes generally correlate well with intention, while the subjective norms and the perceived behavioural control have lower correlations. Moreover, it has been found out that the improvement of the TRA with the perceived behavioural control did not improve the prediction of the intention.

2.1.2 The habit as an obstacle to a new behaviour

Despite the success of reasoned action theories, some critics highlighted that behaviours can also be unreasoned. The idea that behaviours are reasoned and formed indirectly by beliefs is challenged by theorists who argue that behaviours can also be automatic or habitual (Bamberg et al., 2003).

The first definition of the concept of habit in a psychological context has been provided by James in 1890. According to him, the habit aims to "*economize and simplify behaviours*" (James quoted by Scheffler, 2013), highlighting that delegating action to the unconscious allows doing things that necessarily require conscious possessing. In other words, drinking a tea, going at work or lighting a cigarette would be more difficult if all these actions had to be deliberated every time they are undertaken, leaving little energy to engage on other processes such as writing a scientific article.

While habits had been ignored by social psychologists for decades, Triandis proposed in 1977 a theory including the concept of habit: the Theory of Interpersonal Behaviour. In this theory, Triandis defined the habit as an action repeated many times in the past and become automatic in its realization (Godin, 1991). According to this definition, the habit is the result of the frequency of past behaviour and it is defined as the habit strength. It is generally considered that higher is the frequency of a behaviour, stronger is the habit strength towards this behaviour and better the habit determines the future behaviour. According to this definition, the consideration of the available information and the search of new information would be altered by the habit each time a comparable situation that calls for the same behaviour would be undertaken.

The relation between habit strength and information process has been theorized by Verplanken et al. (1997) **(**Figure 2**)**. According to the authors, the process of making a choice is activated by a need (goal activation) and can be complex or minimal according to the strength of the habit. When the habit is weak, two aspects mediate the choice: 1) the appreciation of situational cues and 2) the internal/external information search on choice option. The appreciation of situational cues refers to characteristics that cannot be controlled (e.g. in the case of a travel: time constraints, weather conditions), while the second, internal/external information search on choice option, refers to the information available or acquired during the process (e.g. in the case of a travel: speed or comfort). Although this process supposes that people with a weak habit active their cognitive choice process and will consider new information, the decision-making process may also affect people with strong habit when a decision has significant consequences on them. Thus, someone being used to take the car may be motivated to consider PT alternative if a public policy constraints car use during a pollution peak.

The application of this process to travel choices highlighted that a strong habit constricts choice process and that people with strong habit elaborate less complex strategies (Verplanken et al., 1997). Later, Verplanken et al. (1998) further confirmed this model of distinction between a strong and a weak habit in a study led on a sample of 200 habitants of a Dutch village.

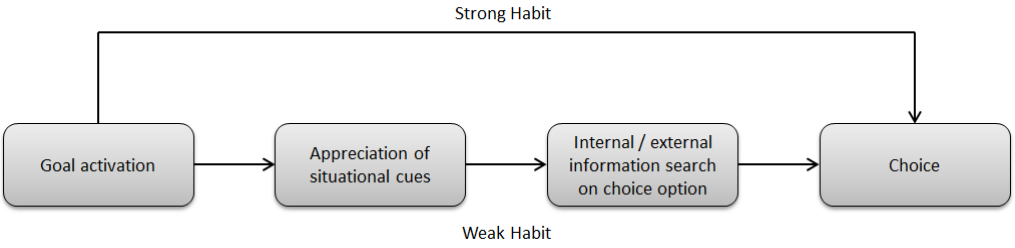

Figure 2 Process model of making choices by weak and strong habit individuals (Verplanken et al., 1997)

Following this definition of the habit, Verplanken and Aarts (1999) proposed three characteristics allowing to better understand the concept of habit, going beyond the short definition of habit as a repeated behaviour:

- firstly, habits share in general one or more of the features of the automaticity presented below:

    - habits are intentional in the sense of being goal-directed: while one decides intentionally to have a specific behaviour, the execution of the behaviour is unintentional;
    - although they seem difficult to stop, habits are also controllable. By deliberation processing, people can consider themselves capable to break habits;
    - finally, habits are efficient since habitual behaviours require low mental resources for an optimal result;
- secondly, a behaviour becomes habitual in stable contexts. That is to say that, to develop habits, people must be confronted to similar situations. In line with this characteristic, a meta-analysis conducted by Ouellette and Wood (1998) showed that behaviours performed more frequently (on daily or weekly basis) are more stable;
- thirdly, habits are functional in that sense that only rewarded behaviours become intentionally habitual.

In line with the second characteristic presented above, researches have demonstrated that habits may also be affected by the change of context. According to Wood and Tam (2005), when circumstances of a habitual behaviour are different, habits cannot be cued by recurring stimuli. As a consequence, the performance of the behaviour should be disrupted.

While various studies have successfully included the habit strength as a psychosocial construct of the TPB, Ajzen and Fishbein (2005) highlighted some issues regarding this variable as part of the theory:

- explaining a present behaviour through the concept of habit does not allow to understand why a person performed a behaviour for the first time;
- the frequency of past behaviour is not enough reliable to measure the habit since a behaviour with a low frequency can indicate a strong habit. Thus, to not wear a seatbelt can indicate a strong habitual behaviour (Mittal, 1998 by Ajzen and Fishbein, 2005).

Finally, some studies have investigated the effects of the introduction of a new information on travel behaviour. A study on the effects of the introduction of a prepaid semester bus ticket on travel habits of the students of the University of Giessen in Germany showed that habits may not be as strong as expected (Bamberg et al., 2003a). The information diffused through student's newspaper and informational meetings allowed to break the scheme of habits by changing behaviour, normative and control beliefs, and affecting intention and perception of

behavioural control. Another study analysed the effects of an intervention (combination of information and free PT ticket) in a changed decision context (moving to a new residence) on people planning to move within the next 6 months to Stuttgart (Germany); the research concluded that this incitation decreases the effect of the habit on travel mode decision and influences attitude, subjective norms and perceived behavioural control (Bamberg et al., 2003b).

In line with Verplanken et al. (2007), a study assessing the effectiveness of a real-time multimodal travel information system in changing travel behaviour, highlighted that the intention was a better predictor of future behaviour when habits are not strong (Pronello et al., 2007). However, without the intention to change behaviour, such service fails to create a modal shift.

2.2 Psychosocial determinants affecting the use of technology

The previous section has introduced the mechanisms of the change of behaviour comparing different psychosocial constructs. According to the TPB, an individual considers the information formed by his/her beliefs in order to perform a specific behaviour. According to this definition, a new information should change the cognitive foundation of this specific behaviour and determine the accomplishment of a new one. In this context, habitual behaviours should be challenged and overcome by the information.

ATIS are parts of public policies aiming at affecting mobility of citizens by creating a modal shift from the car to PT or soft modes. According to the TPB, the new information provided by the ATIS should disrupt travel habits and allow the long-awaited modal shift.

Although really useful in understanding the constructs affecting the behaviour, the TPB does not give strong evidence regarding the object providing the information: the ATIS. While studies on the change of travel behaviour provide the information on one mode through traditional channels (newspaper, meetings, etc.), the ATIS provide short information about various transport modes through one technological device. On one side, the information is explained and carefully provided while, on the other side, the information is quickly provided and the use of the device requires a time of adaptation.

The field of the acceptance of technology can provide keys of understanding regarding the use or adoption of ATIS. Although strongly inspired by reasoned theories, those models give an insight in the information system field.

This section aims at presenting models of reference and to emphasize the most relevant determinants of the adoption of a new technological device. While many models/theories have been proposed in order to understand user acceptance (Surendran, 2012), theories presented below are the most relevant ones.

2.2.1 Technology acceptance in organizational contexts

The Technology Acceptance Model (TAM), proposed by Davis (1989), is the most popular theory of prediction of the use and acceptance of information systems and technology by individuals in organizational contexts. One of the major objectives was to propose a model that would improve the understanding of processes engaged in the adoption of a technology. The second objective was to provide to designers and developers the necessary tool to the success of the implementation of new technological systems.

The TAM is widely based on TRA since the use of the technology is determined by the intention and, indirectly, by the attitudes. Likewise to TRA, the inclusion of the intention in the model highlights that the behaviour is volitional. Finally, subjective norms are not included in the model because they have a negligible effect on behavioural intention (Davis et al., 1989).

The model, presented in Figure 3, states that the attitudes determine the intention and are formed by beliefs specific to the information systems and technological fields. The *perceived usefulness* is described as "*the degree to which a person believes that using a particular system would enhance his or her job performance*" and the *perceived ease of use* is defined as "*the degree to which a person believes that using a particular system would be free of effort*" (Davis et al., 1989). Perceived ease of use has a causal effect on perceived usefulness. Finally, both beliefs are influenced by external factors such as personality traits, system characteristics or demographics information.

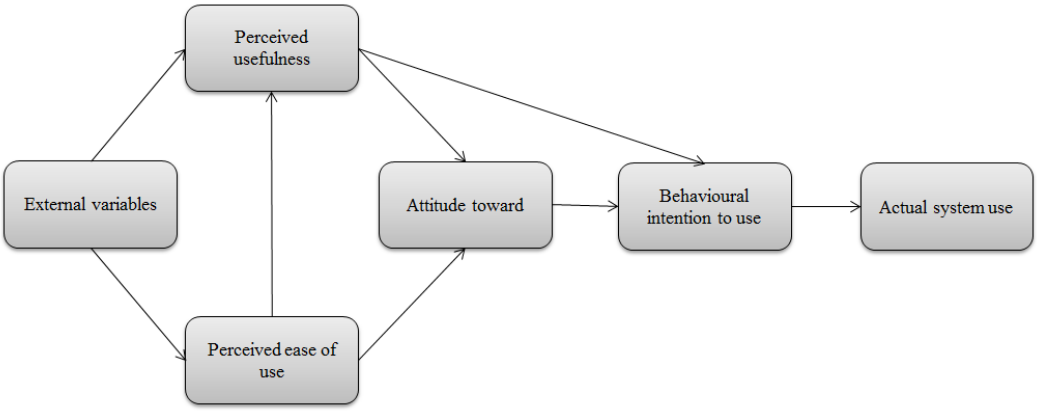

Figure 3 The Technology Acceptance Model (Davis, 1986)

However, although widely used in different fields, the low variance explained by the model (40% of the total variance) (Legris et al., 2003), has led Venkatesh and Davis (2000) to modify the theory by adding new constructs.

The new model (Figure 4) includes additional mediators of perceived usefulness and usage intention constructs. New determinants are still inspired by TRA since subjective norms have been integrated, but also by TPB with the perceived behavioural control. In contradiction with Davis (1986), subjective norms are part of the model and are both a direct and indirect determinant of the intention since they affect the perceived usefulness. According to the Technology Acceptance Model 2 (TAM2), individual acceptance to use a technology is determined by both social influence processes and cognitive instrumental processes:

- social influence processes are considered as social forces affecting the thought of adopting or rejecting the use of a new technology and they are formed by three constructs: *subjective norms*, consistent with the definition given by Ajzen; *voluntariness,* referring to the feeling of not being obliged to use the system; *image,* being the degree to which a person thinks that using a technology will heighten his/her position within a group of people (the degree to which one feels enhanced by the device);
- cognitive instrumental processes are the relation between professional objectives and the consequences of using the system: *job relevance* refers to the applicability of the system regarding the requested task; *output quality* assesses the capability of the system to perform the activity; *result*

demonstrability refers to the recognition of the results due to the system and the perceived ease of use.

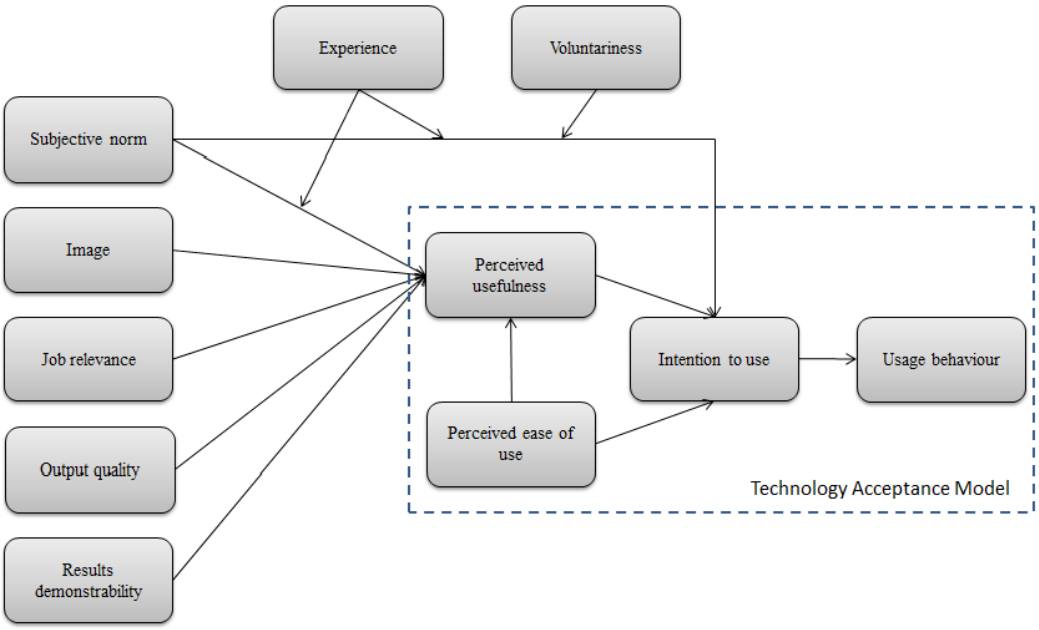

Figure 4 The technology acceptance model 2 (Venkatesh and Davis, 2000)

This second model allowed to improve the explanation of the technology acceptance, notably, social influence and cognitive influential processes significantly influence user acceptance (Venkatesh and Davis, 2000).

In order to design a model that does not ignore the contribution of alternative models in social psychology and technological use, Venkatesh et al. (2003) proposed to join together the most important determinants of these theories. To achieve this goal, the study reviewed and empirically compared eight dominant models dealing with the acceptance of using a technology. This review allowed authors proposing the Unified Theory of Acceptance and Use of Technology (UTAUT). (Figure 5)

Three final constructs of this new theory are inspired to TRA and TPB: the *behavioural intention* and *facilitating conditions,* known as the perceived behavioural control; *social influence* representing the subjective norms. Likewise to TRA and TPB, the intention and facilitating conditions directly determine the use of a technology, while social influence is a determinant of the intention.

In addition to the social influence, the intention is also affected by the *performance expectancy* and by the *effort expectancy*. The first one is the strongest predictor of the intention in all individual models used to build the UTAUT. The construct can be described as the gain expected by adopting a technology. Effort expectancy, on the other side, refers to the expected ease when using the system and it is relevant in the first stage of the use of a new system.

Finally, the constructs presented above are themselves moderated by gender, age, experience, and voluntariness of use (Venkatesh et al., 2003).

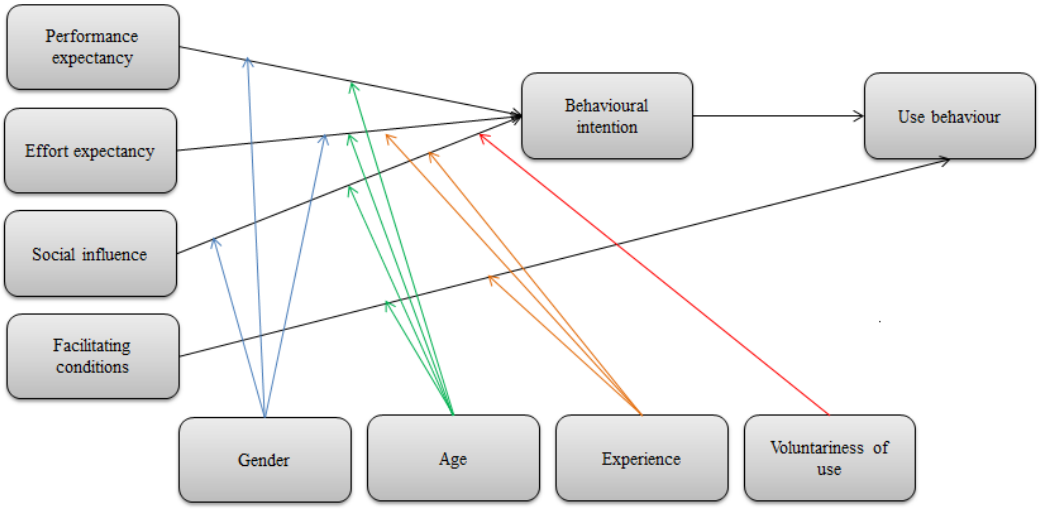

Figure 5 Unified theory of acceptance and use of technology (Venkatesh et al. 2003)

The model received good support in the domain of employee technology acceptance since it explained 70% of the variance in behavioural intention to use a technology and 48% of the variance in technology use (Venkatesh et al., 2003). Results of another meta-analysis show that variables such as performance expectancy and behavioural intention were the best predictor category (Williams et al., 2015).

2.2.2 Technology acceptance model for consumer

Theories presented above were successful in explaining the adoption of a technology in an organizational context. However, critics made on the adaptability of the model in other contexts led Venkatesh et al. (2012) to extend the model to the consumer field. Since the UAUT did not give the possibility to understand the use of technology (such as applications, services targeted at consumers) provided

by industries, the need to answer to specific contexts of the technological environment led to create an extension, specific to the consumer user context.

The UTAUT2 (Figure 6) (Venkatesh et al., 2012) proposes constructs and definition from the UTAUT, presented previously, adapted to the context of consumer technology acceptance and use context. New variables directly influencing the intention have been included: *hedonic motivation,* referring to the pleasure of using a technology, and the *price value,* that is correlated with the benefits obtained by using the device. The *habit* has also added as a direct determinant of the behaviour and it is in accordance with the definition provided by Limayem et al. (2007). The concept of habit refers to the degree to which consumers use technological products automatically, because of learning. Finally, three variables affect hedonic motivation, price value, the habit and facilitating conditions: the age, the gender and the experience.

This theory has been successfully applied in various fields. Comparing the UTAUT and the UTAUT2, Venkatesh et al. (2012) showed that the UTAUT2 explained 74% of the variance in consumers' behavioral intention to use a technology and 52% of the variance in consumers' technology use; instead, UTAUT explained, respectively, 56% and 40% of the variance in intention and use. While the construct performance expectancy was the strongest predictor of the intention in the UTAUT, hedonic motivations becomes the best predictor of the UTAUT2.

In a study on the social media acceptance, Harsono and Suryana (2014) showed that all the direct constructs influenced the use of social media. A study on the use of internet banking services revealed that performance expectancy and habits were significant determinants of the intention to use technology. However, social influence, facilitating conditions and hedonic motivation did not play a salient role in affecting the actual adoption behaviour (Arenas-Gaitàn et al., 2015). The price value, hedonic motivation, usability and intention were also highlighted in a study on the use of a medical laboratory portals by patients (Ravangard et al., 2017).

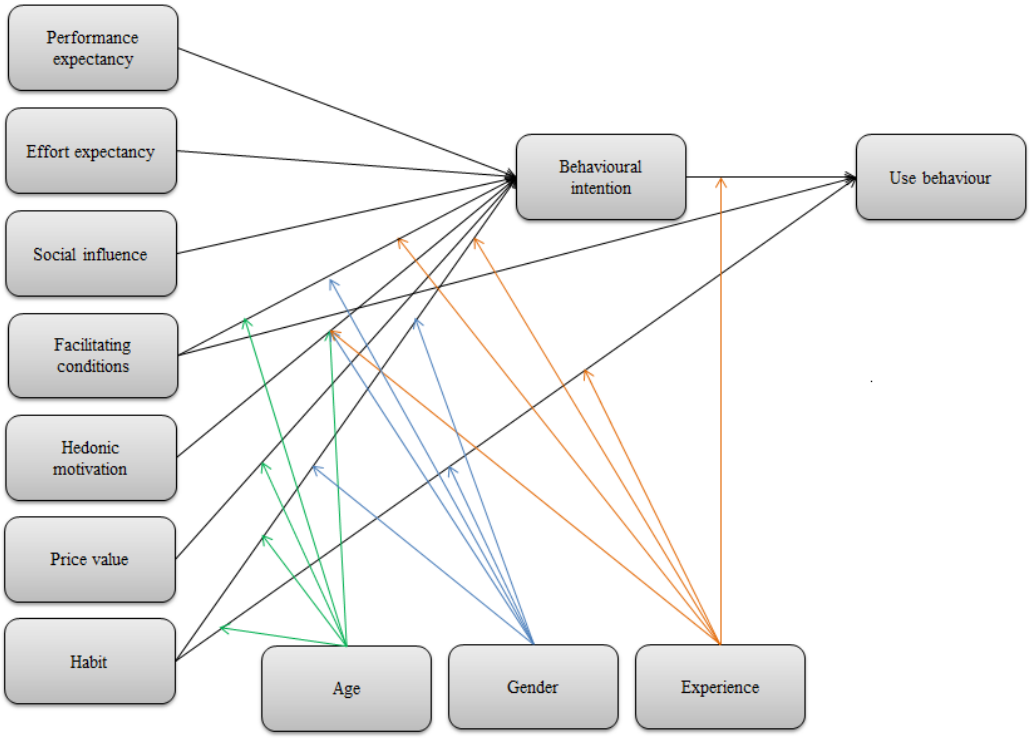

Figure 6 Unified theory of acceptance and use of technology 2 (Venkatesh et al., 2012)

2.2.3 Remarks

This section on the determinants affecting the use of information systems and technology allowed to highlight some important constructs that TRA and TPB were not able to individuate. While acceptance models are specific to the technology adoption, reasoned theories provide general constructs affecting general behavior; nevertheless, these models were widely inspired of reasoned theories and consider that the adoption of a technology is under volitional control.

Results of meta-analysis emphasized that performance expectancy was the best predictor of the intention to adopt a technology in an organizational context, while hedonic motivation was the best one in a consumer context. Such results should be carefully considered in the case of ATIS use, since the context of the use of travel information systems is more similar to the organizational context than to a typical consumer one led by hedonic motivations. Being ATIS deployed to assist people during their trips, it can be expected that potential users will call for gains by using the device, notably for the most frequent trip.

3. Objectives and Methodology

This Ph.D thesis aims at defining psychosocial constructs that, together with socioeconomic characteristics and travel habits, explain why an individual uses multimodal information systems to change travel habits. More precisely, the focus is to understand the influence of intentions, attitudes and expectations towards ATIS (TUeTO) of a sample of people living in the city of Torino, a city located in north-west of Italy.

The real-time multimodal information system, TUeTO, gives information about all the transport modes (car-sharing, public transport, bike sharing, trains) as well as traffic (congestion, accidents). TUeTO has been developed within the European project Opticities, involving six different European cities (Torino, Lyon Madrid, Birmingham, Gothenburg and Wroclaw). This project[3] aims at assessing the potential impact on travel behaviour of information systems, favouring multimodal mobility and enhancing mobility management.

Figure 7 presents TUeTO smartphone application. Observing the figure from left to right we can see the steps to get the information about a given travel. As a first step, the user writes his/her position and the destination as well as the departure time. At this stage or later, the user can also specify his/her travel preferences (e.g. if (s)he has or not a subscription to public transport services or if (s)he owns a car, bike). Then, TUeTO proposes different travel alternatives. Finally, after having analysed the different alternatives, the user chooses his/her favourite one and follows the written indications or the map (not presented in the figure).

[3] For more information about the project: http://www.opticities.com/project/objectives/

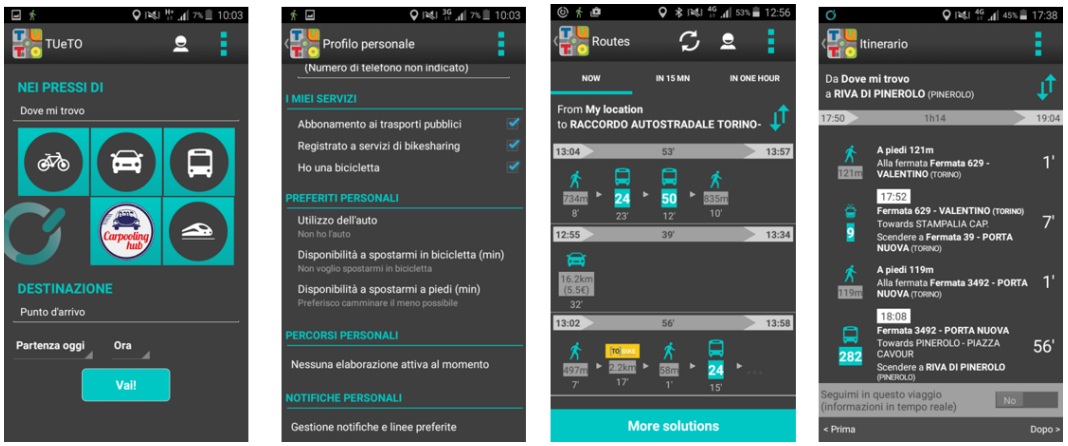

Figure 7 Presentation of TUeTO and steps of use

To reach the objectives of Opticities project, a mixed method was adopted in the four-test cities (Torino, Lyon, Madrid and Gothenburg). A longitudinal survey along the project was designed and a panel of 150 individuals was selected. To guarantee the participation of the panel all along the project, an incentive was provided: a smartphone Samsung Galaxy Grand Prime was given to each participant together with a one-year subscription to a mobile phone service including the internet. The survey was formed by three phases (Figure 8):

1) the ex-ante phase aimed at investigating the users' mobility patterns and attitudes as well as their requirements, to properly develop a multimodal real-time navigator for smartphone. This phase provided a web-questionnaire and 23 focus groups;

2) the in-itinere phase focused on the test of the app developed so far, called TUeTO, to monitor problems and bugs as well as the reaction of participants to their use when travelling. To this end, monthly web-questionnaires were administered to the panel of users;

3) the ex-post phase aimed at evaluating the potential travel behaviour changes as well as changes of perception, expectation, preferences spurred by the use of the app. Such changes have been evaluated through a web-questionnaire and 18 focus groups and 1 interview, symmetrical to the ex-ante survey. The ex-post survey started in July 2016 and ended in September 2016.

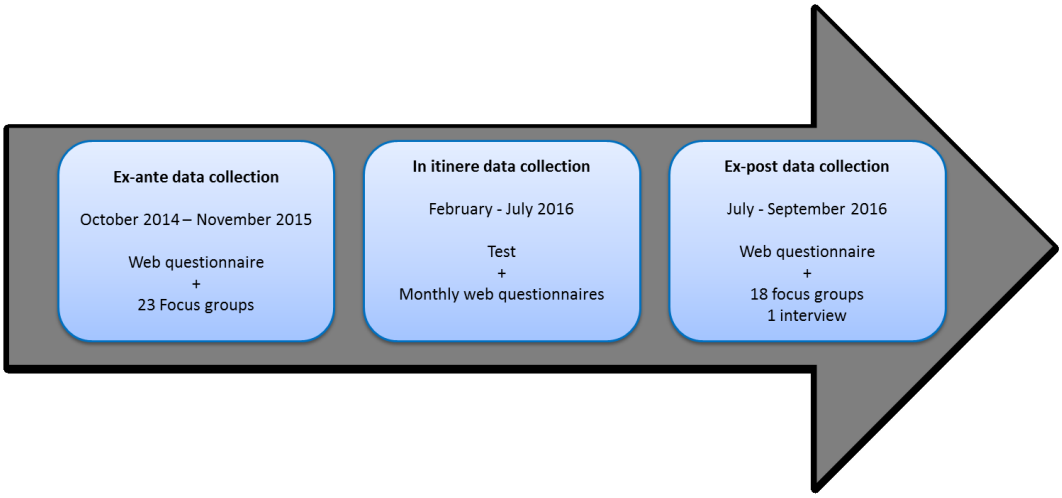

Figure 8 Opticities research framework

The methodology set up for this thesis is working in synergy with that adopted in the Opticities project, that is the main source of data, and includes five steps:

- sample selection;
- design of the survey: web-questionnaires and focus groups;
- administration of the survey;
- data analysis design:
    - definition of psychological constructs;
    - psychological-based market segmentation of ATIS users.

This research has been carried out using the data collected by the research group within the methodological framework of the Opticities project. The three main sources of data are:

1. those coming from the ex-ante and ex-post questionnaires and focus groups;
2. those coming from an additional survey carried out within the project by a previous PhD student (Gaborieau, 2016) in the in-itinere phase of the project;
3. those coming from an additional survey carried out within the project by the author of this thesis in the ex-post phase of the project.

To some extent, this research is a follow-up of Gaborieau's thesis (2016) since a measure of the GEB (General Ecological Behaviour) will be proposed integrating new items in order to update and improve the measure of attitudes towards the ecology. In addition, this thesis, as mentioned above, aims at testing psychosocial constructs and - crossing them with socioeconomic characteristics

and travel habits - at explaining why an individual would use multimodal information systems to change travel habits. In order to reach this goal, two steps are provided. The first one is geared to reveal the interdependencies between attitudinal, intentional and other variables, to find latent constructs through exploratory factor analysis. The second step aims at defining homogeneous groups of information users, using cluster analysis, based on the defined latent constructs and additional variables. The next paragraphs present the methodological phases.

3.1 Sample selection

The participants of the Opticities project were selected following a stratified sampling plan of convenience; 150 persons were selected according to the following criteria:

- gender;
- age;
- profession/educational level/income;
- presence of children under 14 years old in the household;
- transport modes used: motorised, public transport (PT), soft modes, intermodal (motorised + PT);
- residential location: urban and suburban locations.

The goal of the sample selection was to have a mixed panel of users, including different travellers' profiles, having different socio-economical characteristics.

Due to the potential withdrawal of a few participants (that effectively occurred), more than 150 persons were contacted. Thus, in the first phase (ex-ante) of the project, 159 people participated to the two-year experiment to define the users' requirements to develop the real-time multi-modal navigator, TUeTO. After the ex-ante survey, a few participants abandoned the project and 142 continued testing the app (in itinere phase ending in May 2016) and, finally, evaluating its effects on their travel behaviour (ex-post phase starting in July 2016).

3.2 Survey design

Studies using both quantitative and qualitative methods are generally named mixed method research and can be defined as a method "*integrating quantitative and qualitative data collection and analysis in a single study or a program of enquiry"* (Creswell et al., 2003) and combining both strength of qualitative and quantitative research (Pluye et al., 2009). More focused on the resolution of a problem instead that on the use of a specific method of research (Creswell, 2003), this approach has been shunned by researchers due to the difficulty to define a clear methodological approach (Pinard et al., 2004). Expansive and creative, this form of research legitimates the use of multiple approaches in answering research questions and reject dogmatisms judged as restricting and constraining (Johnson and Onwuegbuzie, 2004).

The design of the different surveys follows.

3.2.1 Design of the ex-ante survey

The ex-ante survey of the Opticities project designed for the city of Torino is one of the data sources for this research. A web-questionnaire was designed to collect the users' needs to properly develop the real-time multimodal navigator. The questionnaire is articulated in seven sections:

- the first section aimed at getting information about the most frequent trip: origin and destination; mode used; weekly frequency; duration and distance; habitual detour details; Park & Ride usage, reasons expressed for choosing their mode of transport and availability of alternative transport modes;
- the second section focused on general travel habits: weekly frequency and scope for all modes of transport; satisfaction with daily travelling condition and personal objectives about car use (increase/decrease);
- the third part investigated the attitudes towards mobility and presented a wide range of statements about the use of time when travelling and the evaluation of various travel preferences and mode preferences;
- the fourth section aimed at analysing the relationship between transport and the environment. Respondents were asked if they agree or disagree to a set of statements about relationship between own mobility and the environment, about the general environmental condition in Torino and

about their perception of what could help them to use alternative modes of transport;
- the fifth section of the questionnaire aimed at understanding the familiarity of the respondents with technological tools: ownership and usage of electronic devices; information seeking habits; knowledge about diverse operating systems and various statements they were asked to agree or disagree with about the role of technology in their daily life and on modern society in general;
- the sixth section investigated expectation, intention, anticipated feelings and willingness to pay about the multi-modal navigator (TUeTO) they ought to test in the coming months;
- finally, the last section of the questionnaire was devoted to socio-economic and personal information: gender; age; education; activity; household income; household composition; car ownership; public transport and sharing service subscription.

3.2.2 Design of the ex-post survey

The ex-post survey of the Opticities project investigated the same issues of the ex-ante survey; thus, in addition to the issues related to travel habits during the test period, the effects of TUeTO and its hypothetical use on the market were investigated. However, it was decided to not use the data of this questionnaire for the thesis, since it did not allow analysing the modal shift induced by TUeTO. Thus, a second survey - presented below - was designed and used to gather data to analyse the intention to change mode thanks to TUeTO after the test period, the ecological behaviour, the knowledge about ecology and the habits related to users' mobility.

3.2.2.1 Design of the survey to investigate ecological behaviour and habits

The survey has been designed ad hoc for the thesis after that designed in the previous PhD thesis by Gaborieau (2016). This survey aims at investigating: a) the general attitudes of participants towards the environment; b) their intention to use TUeTO in order to change travel behaviour for their most frequent trip and for their occasional trips; c) to investigate their travel habits; d) to investigate their knowledge about ecology as well as the usefulness of this knowledge in order to reduce their footprint.

Initially derived from Kaiser and Wilson (2000), the General Ecological Behaviour questionnaire aims at assessing attitudes towards the environment. Firstly adapted to the Italian context and translated by Gaborieau (2016), the previous survey provided a questionnaire including 40 dichotomous (yes/no) items, grouped in seven different categories. Seven items represented pro-social behaviours while the 33 other items represented pro-environmental behaviours, distributed in six ecological domains: garbage handling, water and power saving, consumerism, garbage inhibition, environmental activism and volunteering and transport.

The second General Ecological Behaviour questionnaire designed in this thesis added a reliable measure of habit, with the aim to confirm or not the influence of habit on the change of travel behaviour and on the influence of the app (questions 12 to 16). Questions were inspired by the questionnaire designed by Verplanken and Obell (2003) that defined habit as a psychological construct, rather than simply past behavioural frequency: the Self-Report Habit Index (SRHI). The twelve-item Self-Report Habit Index (SRHI) is mainly used in studies on energy-balance related habits and studies related to health (e.g. nutrition). The initial questionnaire is divided in five sections and contains 12 items: the history of repetition of behaviour (three items), the difficulty of controlling behaviour (three items), the lack of control (three items), and the mental efficiency (two items), and expressing self-identity (two items). To avoid a redundancy due to the various travel habit measurements (i.e. car, moto, bike, PT, walk) and contain the length of the final questionnaires (36 questions), it was decided to reduce each habit measurement to five questions.

To understand if people plan their most frequent trip taking in account all travel alternatives, the questionnaire investigated the awareness of alternative modes and routes for the most frequent trip (questions 17 and 18). It was also asked if people seek or not information in case of new origins and destinations (question 19).

In response to the negative feedbacks regarding technical issues faced by the panel during the test period, two questions were added. The users were asked if they would use TUeTO to change travel behaviour in case the app was reliable and perfectly performant (questions 20 and 21). This section was introduced by a short text to define the context of the question.

Wondering that a measurement of habit alone cannot explain a choice or a change of behaviour, it has been decided to evaluate the difficulty people can meet when they decide to behave in a new way (questions 22 to 26). By designing questions about both change of travel habits (three items) and more general subjects (i.e. diet and technologies), we tried to catch this difficulty at two different levels: a general one by considering all items and a more specific one by considering only items related to transport.

Finally, the last two questions of the questionnaire were related to the knowledge users think to have about sustainability and on the impact of this knowledge on their behaviour (questions 27 and 28).

The table 1 presents the questionnaire structure and the various sections described above.

Table 1 Structure of the questionnaire

Items description		
	General Ecological Behaviour ***Scale: Yes-No***	**Item code**
	Pro-social behaviour	
1	Sometimes, I host, for free, people I don't know (e.g Couchsurfing)	CS8
	Ecologically aware consumerism	
2	Sometimes, I sell goods I don't use anymore	CE7
3	Sometimes, I buy second hands goods	CE8
4	Sometimes, I offer goods I don't use anymore	CE9
5	Sometimes, I accept goods already used from someone who doesn't use it anymore	CE10
6	Sometimes, I borrow goods I occasionally use, rather than buy them	CE11
7	Sometimes, I rent goods I occasionally use, rather than buy them	CE12
8	Sometimes, I lend goods I occasionally use	CE13
9	Sometimes, I rent for free to someone, goods I occasionally use	CE14
10	I eat less meat than years ago	CE15
	Environmental activism	
11	I boycott companies using OGM or pesticides	V5
	Habits ***Scale: Totally disagree 1 – 2 – 3 – 4 Totally agree*** **Could you please specify your accordance level by responding to a set of questions about your use of different transport modes.**	
12	Habit measurement of car use	
	I frequently use the car Use the car is something I have been doing for a long time	

	Use the car is something that belong to my daily routine
	Use the car is something I do automatically, without thinking
	Use the car is something that is typically “me”
	It would be an effort to not use frequently the car
13	Habit measurement of moto use (facultative)
	I frequently use the moto
	Use the moto is something I have been doing for a long time
	Use the moto is something that belong to my daily routine
	Use the moto is something I do automatically, without thinking
	Use the moto is something that is typically “me”
	It would be an effort to not use frequently the moto
14	Habit measurement of bike use
	I frequently use the bike
	Use the bike is something I have been doing for a long time
	Use the bike is something that belong to my daily routine
	Use the bike is something I do automatically, without thinking
	Use the bike is something that is typically “me”
	It would be an effort to not use frequently the moto
15	Habit measurement of Public Transport use
	I frequently use the PT
	Use the PT is something I have been doing for a long time
	Use the PT is something that belong to my daily routine
	Use the PT is something I do automatically, without thinking
	Use the PT is something that is typically “me”
	It would be an effort to not use frequently the moto
16	Habit measurement of walk
	Often, I prefer travel by foot
	Travel by foot is something I have been doing for a long time
	Travel by foot is something that belong to my daily routine
	Travel by foot is something I do automatically, without thinking
	Travel by foot is something that is typically “me”
	It would be an effort to not travel by foot
	Measurement of Modal alternative possibility for the most frequent trip ***Scale: Totally disagree 1 – 2 – 3 – 4 Totally agree***
17	For my most frequent trip, I could use a MODAL alternative to the one I usually use
18	For my most frequent trip, I could use a ROUTE alternative to the one I usually perform
	Measurement about seek of information for a new O-D [4] ***Scale: Totally disagree 1 – 2 – 3 – 4 Totally agree***
19	In case of a new residence and/or work place, I seek information to understand which is the best modal alternative for my new most frequent trip

[4] Acronym of “origin-destination”

Measurement of a possible change of behaviour by using an improved version of TUeTO ***Scale: Totally disagree 1 – 2 – 3 – 4 Totally agree***	
I think that TUeTO could change my modal choice for my:	
20	Most frequent travel
21	Casual travels
Measurement of the difficulty to change of habit ***Scale: Yes-No***	
22	Could you please specify your experience about modal choice for your most frequent trip?
	Did it already happen to you to change your modal habits for your most frequent trip? If YES, was it difficult to change your modal habits for your most frequent trip? If YES, why was it difficult to change your modal habits for your most frequent trip? (facultative)
23	Could you please specify your experience toward your diets change?
	Did it already happened to you to change your eating habits? If YES, was it difficult to change your eating habits? If YES, why was it difficult to change your eating habits? (facultative)
24	Could you please specify your experience toward route choice for your most frequent trip?
	Did it already happen to you to change your route habits for your *most frequent trip*? If YES, was it difficult to change your route habits for your *most frequent trip?* If YES, why was it difficult to change your route habits for your *most frequent trip*? (facultative)
25	Could you please specify your experience about modal choice for your casual trips?
	Did it already happen to you to change your modal habits for my casual trips? If YES, was it difficult to change your modal habits for your casual trips? If YES, why was it difficult to change your modal habits for your casual trips? (facultative)
24	Could you please specify your experience about departure time change for your most frequent trip?
	Did it already happen to you to change your *departure time* habits for your *most frequent trip*? If YES, was it difficult to change your *departure time* habits for your *most frequent trip?* If YES, why was it difficult to change your *departure time* habits for your *most frequent trip*? (facultative)
26	Could you please specify your experience about the use of a new technology?
	Did it already happen to you to change an outdate technology for a better one? If YES, was it difficult to change an outdate technology for a better one? If YES, why was it difficult to change an outdate technology for a better one?

(facultative)

	Measurement of ecological knowledge *Scale: Totally disagree 1 – 2 – 3 – 4 Totally agree*
27	In general, I think I am well informed on environmental issues
28	In general, I think I have all necessary information to reduce my ecological footprint

3.2.3 Design of the ex-ante and ex-post focus groups to investigate mobility patterns and users' requirements towards ATIS

Focus groups are a qualitative data collection method considering that the opinion of someone helps to form the opinions of others through interactions among participants, unlike individual interviews, giving the opportunity to everyone to develop their own viewpoint (Kitzinger, 1995; Marshall and Rossman, 2006). The data collection method through the focus groups is particularly interesting when researches aim at exploring knowledge and experience of individuals. Specifically, it allows, besides to understand what people think, to explore how they think and why (Kitzinger, 1995). Thus, focus groups are mainly used in studies to understand the feelings of individuals in relation to an object, the factors that influence their opinions and behaviours, and to develop ideas that could be hardly developed individually (Krueger and Casey, 2000). More precisely, the goal is to discover and explore unexplored ways (Morgan, 1993).

The outline of the ex-ante focus groups included seven sections:

- the first section aimed at gathering personal information about participants: name; age; occupation/profession (if retired, previous profession); family composition; where they live; where is their most frequent destination; available transport modes (personal car, Car Sharing, Car Pooling, Public Transport, train, personal bike, Bike Sharing, walking, etc.);
- the second section investigated the personality traits of the participants: behaviour concerning unknown travels (for work or leisure), that is to say if they prefer to plan or get information when arrived; where they find the information (the internet, tourism office, travel guide, etc.); habits related to information seeking;

- the third section focused on their most frequent trip: habitual detour details, that is to say if they experiment new alternatives or if they prefer to follow the same route; why they do or not do detours; the influence of traffic; detours for occasional travels; how they plan a new systematic travel (change of origins-destinations) and if it can influence their modal habits;
- the fourth section aimed at analysing their use of technologies: smartphone ownership; relationships with technologies (how they use it); if they trust e-shopping services and which kinds of products they buy (concert tickets, clothes, etc.); if technologies are invasive as regards their daily life; privacy issues;
- the fifth section investigated the potentiality of real-time information: the possible influence of real-time information on their travel habits; which kind of real-time information they would expect from the device; what they think about TUeTO and if they would be willing to use it; situations where TUeTO can be useful; which benefits they can get by using TUeTO; if they would change their most frequent travel behaviour by using TUeTO;
- the sixth section focused on participants' willingness to pay for TUeTO and potential investors for understanding who can support the costs of the app;
- the final section analysed potential barriers of the device: waiting time for information; barriers to use the device.

The outline of the ex-post focus groups, carried out after the experimentation, included four sections:

- the first section aimed at updating personal information about participants: name; occupation/profession (if retired, previous profession); family composition, where they live; where is their most frequent destination; available transport mode (personal car, Car Sharing, Car Pooling, Public Transport, train, personal bike, Bike Sharing, walk, …); if they change some habits, location, job and why;
- the second session focused on their experience of the device: ergonomics; real-time information reliability; waiting time; evaluation of the proposed itineraries; solutions perception; TUeTO travel influence; feelings about TUeTO during the test;
- the third session analysed the possible change of behaviour: change of behaviour by using TUeTO (which information helped them to change, if

they saved travel time or money, if they used more frequently PT services); if they would have changed behaviour if the device had worked well; if TUeTO increased the awareness about mode or route alternatives, costs and social costs; if they are willing to use TUeTO after the test; characteristic of people that could potentially use TUeTO; situations where TUeTO can be useful; possible influence of real-time information on society and social inclusion; privacy and real-time information;

- the fourth section aimed at defining a business model: key partners (supervision, data furniture, etc.); key activities to maintain TUeTO (maintenance); value offered (value provided by TUeTO, key activities; problem resolved by TUeTO, needs satisfied by TUeTO); relations with users (market segments interested to TUeTO); client segments (who will use TUeTO); key resources (barriers to the maintenance of TUeTO); promotion of TUeTO; costs structure (service premium or not); financial resources (maintenance and update, subscription or not; willingness to pay).

3.3 Administration of the surveys

Both the ex-ante and ex-post web-questionnaire were administered through the LimeSurvey platform. The ex-ante questionnaire was administered before the ex-ante focus groups and before the test of the app while the ex-post one before the ex-post focus group and after the test of the app. The administration was made in October and November 2014 for the ex-ante phase and in July-September 2016 for the ex-post phase. Due to the length of the questionnaire (average time for compilation was 45 minutes), participants had the possibility to save their answers at any time and to retrieve them later on. As mentioned before, participants received as incentive a Smartphone, also used to test TUeTO during the in itinere phase.

The GEB questionnaire proposed by Gaborieau (2016) in his Ph.D thesis was administered when the app was ready to be tested, during a meeting with the users, in early February 2016. The participants received by e-mail the link to fill in the questionnaire uploaded on the LimeSurvey platform, but they were asked if someone preferred to answer directly on paper format during the meeting. Responses were immediately collected early February 2016 (along a week). 131 out of the 159 people from the original sample, agreed to respond (81.8%).

The questionnaire designed in this thesis (investigating the General Ecological Behaviour (GEB), travel experience, travel alternatives and habits) was administered in early September 2016, after the test of TUeTO. Participants received by e-mail the link to fill in the questionnaire created through the Google Forms platform. 78 out of the 159 people from the original sample, agreed to respond (49.9%). However, two out of the 78 participants did not give the e-mail address used for the test and were not identifiable.

3.4 Data analysis

The data analysis is articulated in two steps.

The *first step* consists in the creation of latent constructs thanks to Rasch model and Exploratory Factor Analysis (EFA). The objective is to identify similar patterns among data in order to create new variables used to carry out the cluster analysis. Latent constructs are commonly used to perform cluster analysis when the number of variables is too high as regards the sample size (Dolcinar and Lazarevski, 2009).

The *second step* aims at analysing qualitative data gathered by focus groups to validate the clusters created thanks to the cluster analysis.

3.4.1 Rasch model estimation for attitude measure

The estimation of the general attitude towards the environment is based on the data gathered by the GEB questionnaire of Gaborieau (2016) and by the new items introduced in the questionnaire designed in this Ph.D. thesis. Data has been analysed thanks to the Rasch Model for scale measurement (Rasch, 1980). Rasch model is a psychometric model for analysing categorical data belonging to the Item Response Theories (IRT), a paradigm generally opposed to the Classical Test Theories (CTT), a long time considered as the standard for test development.

CTT, also called “true score mode”, are a whole set of theories that consider all items equivalent and treating them in aggregation. In “Statistical Theories of Mental Test Scores”, Lord and Novick’s (1968) proposed to reformulate CTT by using modern statistical approach (Embretson et al., 2013) to give more importance to items and their characteristics (Baker and Kim, 2004). IRT, or “latent trait theory”, supposes that “*the probability of a positive response to an item is assumed to be a function of the characteristics assessed by the scale or*

test" (Drasgow, 1990). In other words, the theory focuses on the measurement of the probability to answer positively to a question or a behaviour. Thus, it is expected that a person having higher values of the measured attributes will have a higher probability to answer positively to the item.

The Rasch model for scale measurement (Rasch, 1968) is a simple but powerful case of IRT (Fisher and Moleenar, 2012). It assumes only one parameter per item – the difficulty βi – as opposed to two or three parameters IRT, where additional parameters, like discrimination (slope of the ICC) or pseudo-guessing (that forces a lower asymptotic limit, so that the probability never reaches zero), can be included. The model considers a dichotomous random variable where $\chi = 1$ denotes a correct answer and $\chi = 0$ an incorrect one, the probability of person *n* answering correctly on item *i* is given by equation (2):

$$P(x_{ni} = 1) = \frac{e^{x_{ni}(\theta n - \beta_i)}}{1 + e^{(\theta n - \beta_i)}} \quad (2)$$

where θ_n is the ability of person *n* and β_i is the difficulty of items *i*.

The Rasch Model was performed using the R software with the Package eRm (Mair et al., 2009) that estimates the scores thanks to Conditional Maximum Likelihood function (CML; Mair and Hatzinger, 2007). To control if the measure is performed on a one-dimensional latent trait (i.e. one latent factor), analysis and tests were performed following the guidelines proposed by Gaborieau (2016) and Linacre (2005).

As a first step, items and persons parameters are estimated, and the point-biserial correlation and the fit statistics are observed and compared in order to select items that misfit the model. The point-biserial correlation is an adaptation of Pearson's correlation when one of the variables is dichotomous (Jaspen, 1946). In order to facilitate the interpretation, the observed value of the point-biserial correlation should be compared to its expected value (Linacre, 2008). However, eRm does not allow to calculate the expected value coefficient. Literature provides different interpretations of the point-biserial correlation, but it is generally assumed that the coefficient should not be negative, and that if correlations are too difficult to interpret, the mean-squares fit should be used (Linacre, 2017). The threshold limit of 0.3 to 0.7 is also recommended (Allen and Yen, 1979), but such rule could lead to the elimination of good-fitting items

(Wright, 1992). However, a high coefficient may not be problematic since it better discriminates the item (Brown, 1992).

The fit statistics indicate how accurately data fit the model (Linacre, 2002): infit statistics are "*sensitive to the pattern of responses to items targeted on the person*" while outfit statistics are "*sensitive to responses to items with difficulty far from a person*". Mean-square value of fit statistics should be between 0.5 and 1.5, and standardised value of fit statistics should be between -1.9 and 1.9.

After fitting items were selected, the one-dimensionality of the Rasch measure was tested. The one-dimensionality assumption is the strongest assumption of the model, and is controlled thanks to the Martin-Löf (1970) test that verifies if the latent measure is the only one existing dimension inside the dataset (Linacre, 2005). The p-value of the test should not reject the null hypothesis.

In order to observe if Rasch Model produce similar item difficulty independently from the population sample, subgroup homogeneity and differential item functioning were tested using the Andersen LR test (Andersen, 1973). The test proposes a Likelihood-Ratio test that consists in arbitrarily splitting the sample into two (or more) disjoint groups. The test is able to "*detect differential item functioning, which happens when individuals with the same level of an underlying latent trait differ in their response to an item depending on other characteristics*" (Gaborieau, 2016). To be valid, the test should reject the null hypothesis to conclude that items are equally discriminatory for subgroups.

Non-parametric quasi-exact tests using a Monte Carlo algorithm for goodness of fit were also adopted. Those tests have the particularity to fit on large samples as well as on small ones (Koller and Hatzinger, 2013; Ponocny, 2001). Developed by Ponocny (2001), they are based on the assumptions of sufficient statistics, where all matrices with identical margins shall have the same parameters estimates. For this research, two tests were performed:

- T_{11} global test for local stochastic independence. Like for the Andersen's LR test, the T_{11} investigates if there is a violation of local independence and/or homogeneity between items. Results of this test should not reject the null hypothesis;
- T_{10} global test for subgroup homogeneity. This test investigates the violation of the assumption of measurement invariance. Results of this test should not reject the null hypothesis.

Finally, reliability was tested on item difficulty variance and on person ability variance. While the first one "*verifies the item hierarchy*", the second one "*is used to classify people*" (Linacre, 2005).

3.4.2 Identifying the latent constructs

An exploratory factor analysis was applied on attitudinal and behavioural variables for which the respondents expressed a level of agreement using (1-5) scale or (1-4) scale. Factor analysis associates variables that have similar patterns to create a new variable called latent variable. In other words, "*to summarise the interrelationships among variables in a concise but accurate manner as an aid in the conceptualisation*" by reaching the maximum of information explained by the original variables (Richard, 2014). The exploratory factor analysis was preferred to the confirmatory factor analysis since the first one allows to "*discovering structure in the variables to hand*" (Gorsuch, 2014).

Although small, the size of the sample (N=76) is not a barrier to the reliability of the measure (MacCallum et al., 1999). However, higher levels of communality should be preferred in order to reduce the influence of the low sample size (MacCallum et al., 1999; Field, 2000).

The Shapiro-Wilk normality test was applied on variables used for the FA in order to verify that the population is normally distributed. Since the data were not normally distributed (p-value ≤ 0.05), the Principal Axis Factor (PAF) extraction method was performed using the software SPSS (IBM Corp, 2015). The use of the PAF is recommended when the assumption of multivariate normality is "severely violated" (Fabrigar et al. quoted by Costello and Osborne, 2005). The Kaiser criterion was adopted to define the number of significant factors, but the scree test was also performed. Moreover, factors whose eigenvalues are higher than 1 were usually retained. In order to assure a better interpretation of latent constructs, the oblique rotation was performed.

In order to determine if the correlation matrix of the factor analysis is an identity matrix of uncorrelated variables, the Bartlett's Test of Sphericity was performed. Then, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO test) was used to determine if the sample is adequate for the analysis (KMO value should never be less than to 0.5) (Reinard, 2006). An anti-image correlation matrix of covariance and correlations allowed to measure the adequacy of each item (values on the diagonal should be greater than 0.5) (Field, 2000).

Finally, the reliability of extracted factors was tested using the Cronbach's alpha coefficient. This test allows measuring the internal consistency of a test or a scale (Tavakol and Dennick, 2011).

3.4.3 Cluster analysis

The last part of the methodology dedicated to quantitative data analysis focused on the segmentation of the sample. Cluster analysis is a classification method that "*encompasses many diverse techniques for discovering structure within complex bodies of data*" (Micheal and Anderberg, 2014). More precisely, this method, widely used in marketing research (Tuma et al., 2009), aims at grouping together data that have similarities among each other in order to create most distinctive clusters.

In order to carry out the cluster analysis, different variables from the factor analysis, the questionnaire designed for this Ph.D thesis and the latent construct created thanks to the Rash Model were selected.

The cluster analysis was performed following the guidelines proposed by Hair et al. (2010) and Mooi and Sarstedt (2011). The method used for this Ph.D thesis is named two-step clustering and consists in the combination of two clusters analysis: 1) the hierarchical cluster analysis (HCA) and 2) the k-means cluster analysis. The use of both methods is motivated by the fact that they balance the weakness of each other (Punj, 1983).

The hierarchical cluster analysis organises "*objects into a nested sequence of partitions on the basis of data on the proximities among the objects*" (Freeman, 1994). The hierarchical cluster analysis is divided in two families of techniques (Everitt et al., 2011): 1) the agglomerative methods that treat each single data as a cluster that, successively, agglomerates pairs of clusters until all data are regrouped in a unique cluster; and 2) the divisive methods that divide clusters until individual data are reached. For this research, an agglomerative technique was chosen. The Ward's method was performed (Punj, 1983) in order to minimise the within-cluster variance (Murtagh and Legendre, 2014). The Squared Euclidean Distance measure was chosen to assess the distance between clusters since the Ward's method calculates the distance between the clusters centroids (Strauss and von Maltitz, 2017).

The K-means method assigns each observation of a dataset to the cluster having the nearest mean, called centroid, to minimise the variance within each cluster (Punj, 1983). Unlike the hierarchical cluster analysis, the k-means method better optimises clusters homogeneity by reassigning data until to reach the final solution (Hair et al., 2010). The K-means cluster analysis is suitable for continuous variables (Everitt et al., 2011; JMP and Proust, 2010) since "*it is based on Euclidean distances, finding an average of several patterns; it uses the iterative reallocation with the sum of square criteria*" (Mac Queen, 1967, cited by Rappazzo, 2011). K-means cluster analysis is generally recommended when a large sample is investigated (Bejarano et al., 2011).

While the HCA allows to define the number of clusters and the initial starting point of the k-means method, this last one allows to improve the within-cluster homogeneity. The different steps of the cluster analysis, following the guidelines proposed by Hair et al. (2010) and Mooi and Sarstedt (2011) are presented below:

- before to carry out the cluster analysis all variables were standardised, by converting each variable to standard scores (also called Z scores). Then a collinearity test was performed in order to detect correlations, although data from the factor analysis were tested thanks to the correlation matrix of factors. A bivariate correlation analysis using the coefficient of Pearson suitable for continuous variables was employed;
- the HAC was then conducted as a first step of the method in order to define the adequate number of clusters and to define centroids used for the k-means cluster analysis. To determine the number of clusters to retain, the agglomeration schedule and the dendogram were analysed. The agglomeration schedule inspects the distance between clusters (represented by coefficients) at each stage of the partition (Hahs-Vaughn, 2016). A large gap between two stages indicates a big difference between the two agglomerated clusters. The dendogram, or tree plot, represents the complete clustering procedure at each stage of the analysis and allows identifying the clusters (Everitt et al., 2011). Finally, to validate the final cluster solution obtained by the hierarchical cluster analysis, the one-way ANOVA was performed to see if clusters were significantly different (p-value ≤ 0.05). The one-way ANOVA was indeed employed to evaluate the distribution of continuous variables and observe the difference between means (Kim, 2014). Although generally used when data are normally distributed, the one-way ANOVA can also be employed for non-parametric data since the test is not sensitive to deviation from normality

(McDonald, 2009). The variables used in the ANOVA are: age, distance travelled for the most frequent trip, time duration of the most frequent trip;

- in order to run the k-means cluster analysis the number of clusters found out thanks to the hierarchical cluster analysis was used; the initial partitioning was defined by calculating the centroids of the variables of each cluster in order to improve the performance of the k-means method (Punj, 1983). Finally, the F-ratio was used to check if variables were significantly different (p-value ≤ 0.05);
- the stability of the solution proposed by the k-means method was tested:
    - the initial partition created thanks to the HCA was compared with the final one obtained from the K-means;
    - the composition of HCA clusters and of the k-means were compared;
    - the order of the observations was changed, and the two-steps cluster analysis was performed again.

Finally, the last step of the cluster analysis aims at analysing the clusters created so far. First, the final structure of each cluster should clearly show what problem has been solved (Johnson, 1967). In other words, each cluster of the final cluster solution should have a meaning for the researcher. Then the Kruskal-Wallis non-parametric test was employed to understand which socioeconomic characteristics and travel habits play a relevant role in differentiating the clusters. More precisely, the test allows identifying which variables characterise the clusters.

The socioeconomic characteristics whose categorical distributions have been tested are: gender, education, occupation, household size, number of children in the household.

The travel habits whose categorical distributions have been tested are:

- availability of a car in the household;
- ownership of:
    - a driving licence;
    - a transit pass;
    - a car sharing pass;
    - a bike sharing pass;
- main transport mode used for the most frequent trip;
- alternative transport mode for their most frequent trip;

- habit of using different modes (car, moto, PT, bike and walk);
- scope for their most frequent trip;
- weekly frequency of their most frequent trip.

3.4.4 Focus groups data analysis

The discussions during the focus groups were recorded (audio and video) and verbatim transcribed. The transcriptions were carefully read in order to draw a synoptic grid including main subjects and sub-subjects, thus creating the structure for the content analysis, following an inductive analysis as described by Blais and Martineau (2006). This work was carried out iteratively, to organise raw data in a defined structure (Krueger and Casey, 2000).

Analysis of Focus Groups data consisted in the systematic categorisation of each part of text containing a specific information related to the research subject. Information was gathered in two different ways: one consisted in summarising the information through few words to facilitate the lecture of the information, and the other consisted in copying the text word by word. To prepare the database, the software Excel was used; a table was set up where lines contain the opinion of each participant and columns contain categories of behaviour, attitudes or opinions.

The ex-ante focus groups contained 65 categories and 3 more categories were devoted to specific information difficult to categorise or to further information about a specific point of the discussion. All those categories were divided in groups corresponding to specific topics designed for the focus groups: presentation (7 categories), behaviour towards unknown travel (8 categories), behaviour towards most frequent travel (12 categories), travel information (12 categories), behaviour towards technology (11 categories), opinion about real-time information and TUeTO (11 categories), willingness to pay for TUeTO (7 categories).

The ex-post focus groups contained 36 categories divided in groups corresponding to specific subjects following the frame designed for the discussion: presentation (6 categories), experience of TUeTO (10 categories), effects and potential effects of TUeTO (6 categories), business model of TUeTO (7 categories), willingness to pay for TUeTO (7 categories).

3.4.5 Clusters validation

The last step of the methodology aims at crossing cluster results with the textual analysis of focus groups. The aim is to go deeper in the understanding of the market segmentation and to verify the results. The quantitative results got for each individual are compared with their opinions expressed during ex-ante and ex-post focus groups. The different positions expressed by the participants were synthesised in order to provide an overview of the various opinions. Some relevant phrases are also quoted in order to testify the participants opinions on the discussed topics. All quotations were transcribed in English, but the original ones, in Italian, are reported in the appendix. The quotes are in italics and the first name of the participants is mentioned afterward.

Finally, the quantitative distributions of each cluster are compared with the results of the content analysis. Such comparison allows understanding to which extent the qualitative data are able to confirm the clusters analysis.

4. Results of the questionnaires

This chapter reports the quantitative results of the thesis and it is divided in three sections. The first one presents a description of the sample. The second one reports the latent constructs identified through the Exploratory Factor Analysis (EFA) and the latent constructs obtained by the Rasch Model. The third section presents market segmentation, result of the two clusters analyses based on the five latent constructs. The description of the clusters profiles, analysed through the socio-economical characteristics, travel habits, attitudes and life styles, are finally presented.

4.1 Presentation of the sample

The sample that answered to the survey designed for this research is composed of 78 participants and it is a sub-sample of the panel of Opticities project. Two out of the 78 participants were not identified (see methodology), reducing to 76 individuals the size of the sample. The average age of the 76 participants is 41.75 years (Median = 41.75 years, range from 20 to 75 years), 47.4% were women (N = 36) (Figure 9). The average household monthly income is to 3335 Euros, referring to 70 out of the 76 participants who answered to this question.

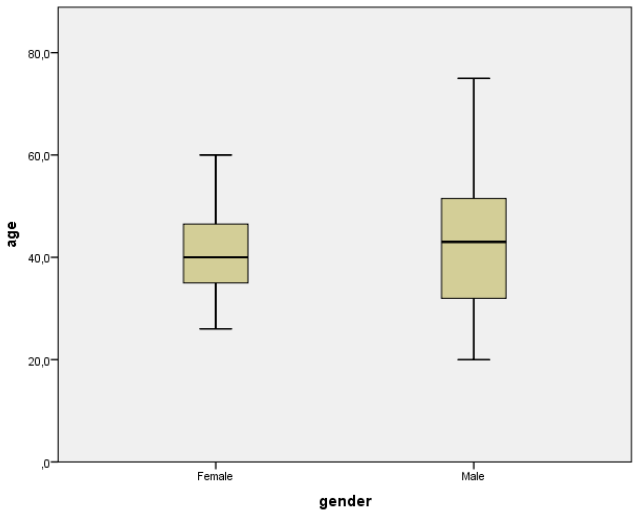

Figure 9 Respondents age classified by gender

Figure 10 presents the educational level of participants. The sample is mainly well educated; the majority of participants own a bachelor or undergraduate degree (14.5%, N=11), a master degree (50%, N=38), or a Ph.D. degree (5.3%, N=2). While 27.6% own a high school degree (N=21) and 2.6% do not own a diploma (N=2).

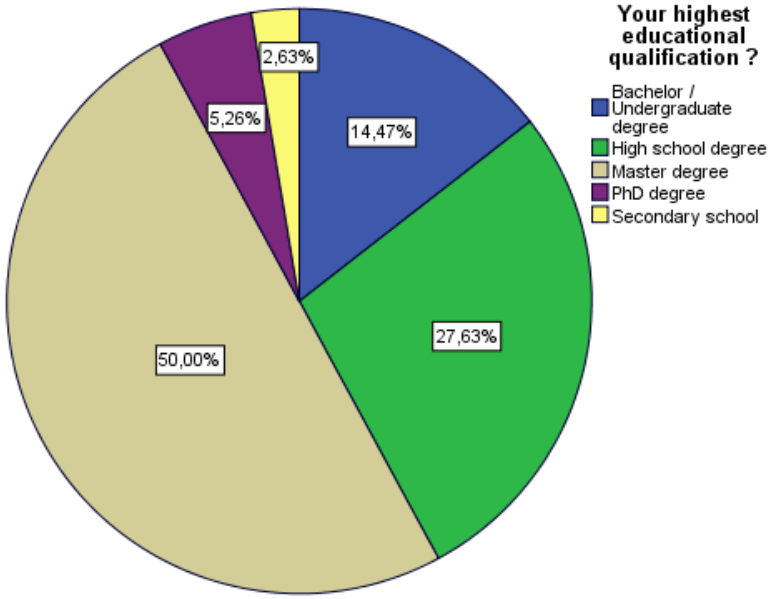

Figure 10 Respondents' educational level

About the household composition, 25% (N=19) live alone, 21.1% (N=16) live with another person while 53.9% (N=41) live with two persons or more. 39 households have not children (51.3%) while 37 ones have at least one children (15 households with one children, 20 households with two children and two households with three children). (Figure 11)

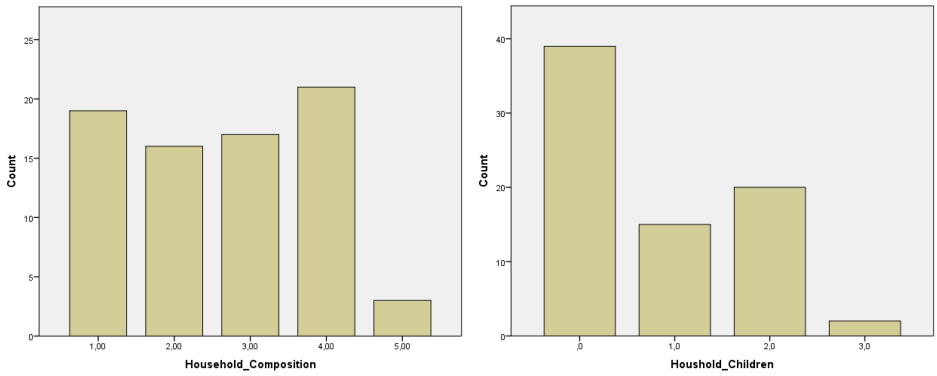

Figure 11 Household composition and number of children in the household

Concerning mobility, two out of the 76 respondents do not have a driving license (2.6%), 8 do not own a car (10.5%), 34 own one car (44.7%) and 34 own more than one car (44.7%). 35 (46.1%) have a public transport subscription, 16 (21.1%) have subscribed to the bike sharing service and two (2.6%) have a car sharing subscription.

Finally, the scope of the most frequent trip is work (77.6%, n = 59), while the other scopes (22.4%) are divided between study (9.2%, n = 7), cultural, associative or sportive activities (5.3%, n = 4), pick up/drop someone (3.9%, n = 3) (Figure 12). For their most frequent trip people prefer to use the car (32.9%), soft modes like PT (Metro 7.9%, Tram 3.9%, Bus 13.6%) and personal bike (10.5%). 21.1% of respondents use more modes during their most frequent trip. (Figure 12)

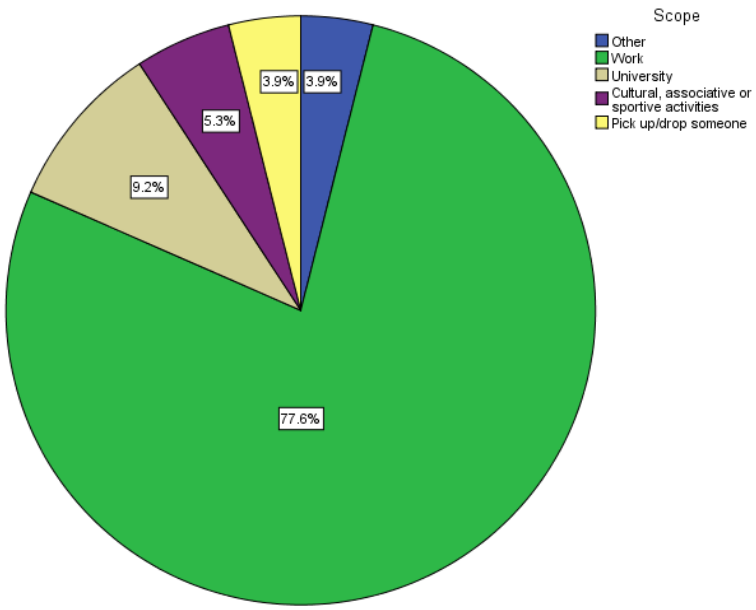

Figure 12 Scope of respondents' most frequent trip

4.2 General Ecological Behaviour measure

4.2.1 Rasch model estimation

The analysis of the GEB of the 76 respondents showed that five out of them did not fit the model estimation. Table 2 show the ID and INFIT and OUTFIT statistics of participants who do not fit the Rasch model estimation (Linacre, 2006):

- three out of the five respondents (P24, P4 and P54) were not fitting the model. They showed, as explained by their infit Z-standardised values, very predictable behaviours but acceptable Z-standardised outfit values. Their outfit mean square values are less than 0.5, not worsening the model. Considering acceptable those values, we decided to maintain these respondents in the sample;
- two out of the five respondents (P69 and P15) not fitting the model presented very high positive outfit Z-standardized values that showed unexpected behaviours (higher than 3), and infit Z-standardized values less extreme but making the model more unpredictable. Their mean square outfit statistics are distorted and their mean-square infit statistics are unpredictable. However, as the small size of the sample did not allow excluding participants and the impact on the model was negligible (see section 3.2.1), those two participants remained in the sample.

Table 2 Outfit and Infit statistics of respondents not fitting the Rasch model estimation

Infit		Outfit			
MSQ	Infit t	MSQ	Outfit t	NAME	ID
0.616	-2.90	0.460	-1.51	P24	104
0.668	-2.44	0.498	-1.36	P4	48
0.661	-2.73	0.496	-1.52	P54	181
1.377	2.47	2.628	3.13	P69	218
1.439	2.86	4.194	5.02	P15	78

Table 3 presents the estimates of item parameter (“MEASURE”) obtained through R, together with their corresponding observed and expected point-biserial

correlation, INFIT and OUTFIT statistics. Additional information includes the raw score on items ("SCORE"). Items are ordered by increasing observed point-biserial correlation. As showed on the table 3 some items are problematic, as explained hereafter:

- Item CS5 ("If a friend or a relative had to stay in the hospital for a week or two for minor surgery I would visit him or her") has been automatically excluded by the statistical model, all the participants having positively answered to the item;
- Item 14- AE1 ("Before taking a shower, I let the water run so it gets to the temperature I want") shows an outfit mean-square value distorted and a very negative correlation with person measure (-0.32). This behaviour is considered difficult by the model (Measure = 3.73) and Z-standardised values are acceptable (INFIT = 0.25, OUTFIT = -1.58). Despite positive observations, the too negative point-biserial induces to exclude the item from the final model;
- Item 49-CS8 ("Sometimes, I host for free people I don't know (e.g. Couchsurfing)") appears as the most difficult behaviour to be performed (only three positive answer), it shows a very negative correlation with person measure (-0.39) and has an unproductive outfit mean-square almost distorted (1.99). Despite other acceptable scores (Infit t = 0.19, Outfit t = 1.38, MSQ Infit = 1.01), it has been decided to exclude this item from the final model;
- Item 27-RR1 ("I re-use plastic bag from the groceries") shows a negative correlation with person measures (-0.18) but acceptable Z-standardised and mean-square scores (Infit t = 0.28, Outfit t = 0.77, MSQ Infit = 0.97, MSQ Outfit = 1.51). However, the item will be excluded from the final model due to the too high negative correlation;
- Item 6-CS6 ("Sometimes I ride public transport without paying a fare") shows a very negative correlation with person measures (-0.14) but acceptable Z-standardised and mean-square scores (Infit t = 0.84, Outfit t = 1.40, MSQ Infit = 1.15, MSQ Outfit = 1.36). The item will be excluded from the final model;
- Item 7-CS7 ("I would feel uncomfortable if people from another ethnicity were my neighbours") shows a very negative correlation with person measures (-0.14) but acceptable Z-standardised and mean-square scores (Infit t = 0.58, Outfit t = 1.79, MSQ Infit = 1.10, MSQ Outfit = 1.52). The item will be excluded from the final model;

Finally, six items were excluded and the parameters were estimated using a sample of 76 persons and 45 items. (Figure 13)

Table 3 Estimates of item parameters, infit, outfit and point-biserial correlation statistic

Entry		Model		INFIT		OUTFIT		POINT-BIS. CORR.	ITEM
		Item Difficulty Parameters							
N°	Score	Measure	S.E	MSQ	Infit t	MSQ	Outfit t	OBS.	NAME
49	**3**	**4,09**	**0,59**	**1,01**	**0,19**	**1,97**	**1,38**	**-0,39**	**CS8**
14	**4**	**3,73**	**0,51**	**1,05**	**0,25**	**1,96**	**1,58**	**-0,32**	**AE1**
27	**69**	**-3,54**	**0,99**	**0,97**	**0,28**	**1,51**	**0,77**	**-0,18**	**RR1**
6	**57**	**-0,75**	**0,31**	**1,15**	**0,84**	**1,36**	**1,40**	**-0,14**	**CS6**
7	**58**	**-0,85**	**0,32**	**1,10**	**0,58**	**1,52**	**1,79**	**-0,14**	**CS7**
5	70	-	-	-	-	-	-	-	CS5
18	63	-1,49	0,40	1,03	0,20	1,14	0,48	0,07	AE5
4	23	1,56	0,26	1,13	1,22	1,20	1,53	0,07	CS4
8	58	-0,85	0,32	1,06	0,38	1,12	0,53	0,10	R1
19	53	-0,40	0,29	1,06	0,46	1,16	0,85	0,14	AE6
39	46	0,11	0,26	1,11	1,14	1,10	0,81	0,14	T4
3	68	-2,83	0,71	0,97	0,17	0,98	0,25	0,14	CS3
40	44	0,24	0,26	1,05	0,66	1,21	1,80	0,18	T5
22	48	-0,03	0,27	1,04	0,39	1,15	1,08	0,21	CE2
17	52	-0,32	0,28	1,05	0,39	1,00	0,05	0,24	AE4
15	63	-1,49	0,40	1,00	0,09	0,90	-0,15	0,25	AE2
9	50	-0,17	0,27	1,04	0,35	1,02	0,19	0,25	R2
1	47	0,04	0,26	1,03	0,33	1,03	0,24	0,28	CS1
44	69	-1,63	0,40	0,98	0,04	0,92	-0,06	0,29	CE10
36	37	0,68	0,25	1,02	0,37	1,06	0,70	0,30	T1
48	8	3,01	0,38	0,95	-0,09	0,96	0,01	0,31	CE14
47	65	-1,10	0,33	0,96	-0,09	1,06	0,31	0,31	CE13
33	10	2,69	0,35	0,98	0,00	0,95	-0,08	0,32	V2
31	22	1,63	0,27	1,02	0,22	1,00	0,06	0,32	RR5
20	51	-0,24	0,28	0,99	-0,01	0,95	-0,25	0,35	AE7
21	26	1,36	0,26	1,00	0,08	0,99	-0,02	0,36	CE1
2	51	-0,24	0,28	0,99	-0,04	0,94	-0,33	0,36	CS2
41	38	0,76	0,24	1,00	0,07	0,99	-0,10	0,38	CE7
45	57	-0,40	0,27	0,99	-0,07	0,93	-0,36	0,39	CE11

35	17	2,00	0,29	0,98	-0,08	0,93	-0,34	0,39	V4
26	22	1,63	0,27	0,97	-0,22	0,96	-0,28	0,41	CE6
11	69	-3,54	0,99	0,94	0,25	0,58	-0,04	0,42	R4
12	69	-3,54	0,99	0,94	0,25	0,58	-0,04	0,42	R5
13	69	-3,54	0,99	0,94	0,25	0,58	-0,04	0,42	R6
28	31	1,04	0,25	0,96	-0,48	0,95	-0,57	0,43	RR2
30	41	0,43	0,25	0,95	-0,69	0,93	-0,71	0,46	RR4
10	50	-0,17	0,27	0,94	-0,51	0,88	-0,71	0,46	R3
46	35	0,93	0,24	0,95	-0,69	0,92	-0,89	0,47	CE12
38	48	-0,03	0,27	0,93	-0,71	0,91	-0,60	0,48	T3
24	38	0,61	0,25	0,94	-0,95	0,93	-0,81	0,48	CE4
51	53	-0,12	0,26	0,94	-0,55	0,88	-0,81	0,49	CE15
37	6	3,28	0,43	0,89	-0,23	0,85	-0,25	0,50	T2
25	27	1,29	0,26	0,93	-0,87	0,90	-1,01	0,51	CE5
34	60	-1,08	0,34	0,90	-0,36	0,75	-0,81	0,53	V3
32	45	0,18	0,26	0,91	-1,08	0,88	-1,00	0,53	V1
43	73	-2,45	0,58	0,91	-0,02	0,56	-0,59	0,55	CE9
23	62	-1,34	0,38	0,90	-0,27	0,68	-0,91	0,56	CE3
50	36	0,88	0,24	0,90	-1,53	0,87	-1,62	0,56	V5
16	45	0,18	0,26	0,88	-1,38	0,83	-1,50	0,59	AE3
29	53	-0,40	0,29	0,87	-0,94	0,75	-1,40	0,62	RR3
42	46	0,31	0,25	0,87	-1,77	0,82	-1,83	0,63	CE9

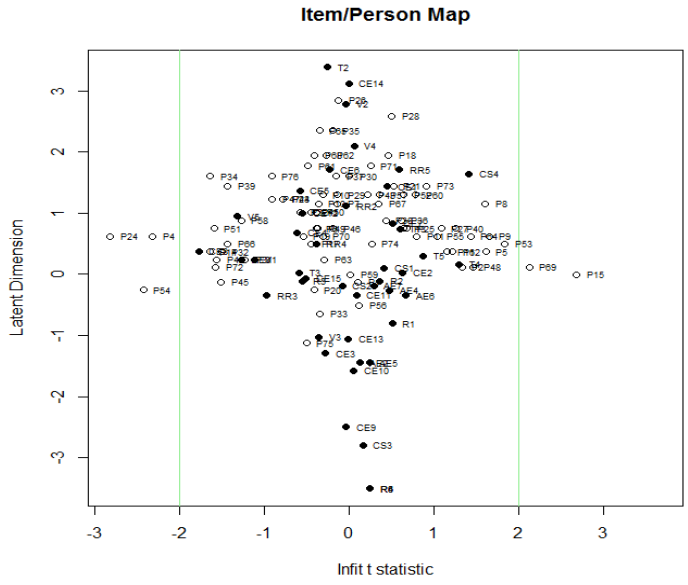

Figure 13 Item map of infit statistics for final set of items and respondents

4.2.2 Test of the Rasch model

Check for one-dimensionality. The Martin-Loef Test for one-dimensionality was conducted by grouping in one subset all items. The test gave a p-value equal to one, supporting the idea of a one-dimensional trait measure by the GEB questionnaire.

Check for local stochastic independence. The test T_{11} produced a significant result (pvalue < 0.002) and led us to reject the hypothesis of local independence and/or homogeneity. This means that at least one pair of items in the GEB questionnaire are correlated.

Check for differential item functioning or subgroup homogeneity. Figure 14 displays the differential item functioning, to detect if items difficulties' estimate are consistent between two given subgroups. Items parameters estimates for sub-group are plotted where red ellipsoids represent the 95% confidence interval**.** Likelihood-ratio test (LR test) could not lead to reject the null hypothesis of subgroup homogeneity (p-value = 0.591 for median raw score splitting), which leads us to conclude that items are equally discriminatory for subgroups, which is a good thing for the quality of the Rash measure. Ponocny's T10 test was carried out using the same splitting procedure. The conclusion is equal to that obtained for the LR test (p-value = 0.476 for median raw score splitting). However, examining figure 14, we can see that item CS6 ("Sometimes I ride public transport without paying a fare") and CS7 ("I would feel uncomfortable if people from another ethnicity were my neighbours") – although not significant at the general questionnaire level – are slightly more difficult to perform.

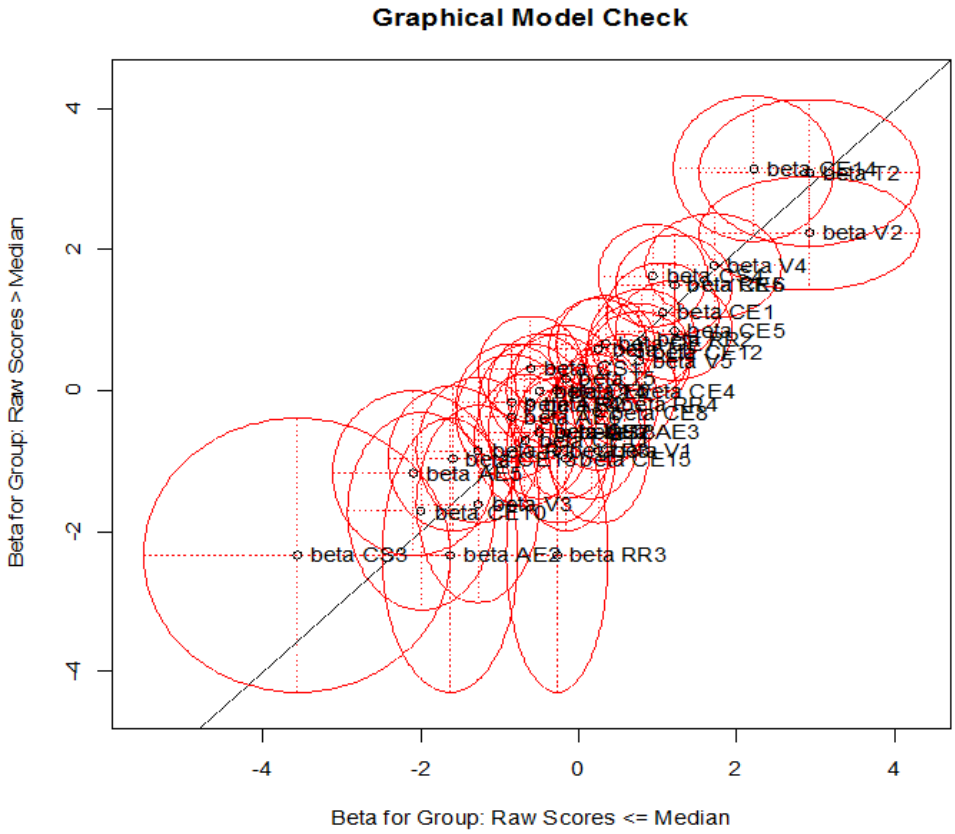

Figure 14: Representation of splitting procedure

Reliability. The reliability of item "separation", equal to 0.9383, shows a very good estimate of item hierarchy (Linacre, 2017), meaning that the items estimated as more difficult are effectively more difficult (and vice versa). The value of reliability of person separation was equal to 0.6713, pointing out that more items are necessary in order to more precisely estimating differences among respondents.

Figure 15 and 16 represent, for each item category, the joint plot of Item Characteristics Curves. Looking at those figures, two comments are noticeable:

- within each category, some items are distinguished by their difficulty or ease of execution:
    - the easiest activities to perform are related to pro-social behaviour (CS3 "If an elderly or disabled person enters a crowded PT vehicle, I offer him/her my seat"), ecological garbage handing (R6 "I sort plastic wasted for recycling"), water and power saving (AE5 "I wait until I have a full load before doing my laundry", AE2 "I

prefer to shower rather than to take a bath"), ecologically aware consumerism (CE9 "Sometimes, I offer goods I don't use anymore" and V3 "In the past, I have pointed out to someone his or her un-ecological behaviour");

- the hardest activities to perform are related to ecological aware consumerism (CE14 "Sometimes, I rent for free to someone goods I occasionally use"), pro-social behaviour (CS4 "If I were an employer, I would not hesitate hiring a person previously convicted of crime"), and environmental activism (V2 "I am a member of an environmental organization", V4 "I sometimes contribute financially to environmental organizations"), and transport (T2 "I usually drive on freeways at speeds lower than 100km/h"):

- we can also observe that ICC curves overlap for items related to:
  - garbage handling (R6 "I sort plastic wastes for recycling", R4 "I sort paper wastes for recycling", R5 "I sort glass wastes for recycling"; and R2 "I make use of rechargeable batteries", R3 "I bring unused medicine back to the pharmacy");
  - water and power (AE5 "I wait until I have a full load before doing my laundry", AE2 "I prefer to shower rather than to take a bath").

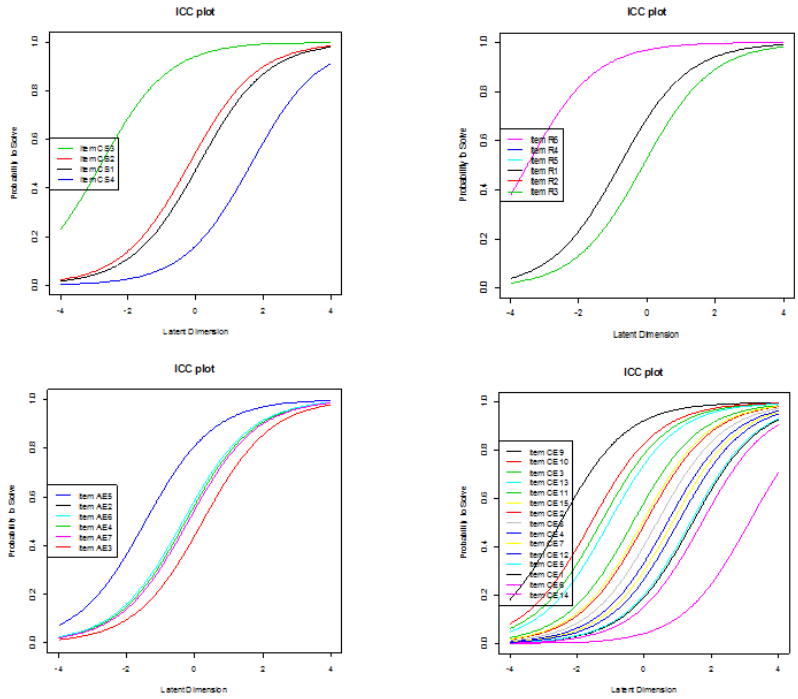

Figure 15 ICC plots for pro-social, garbage handling, power saving and consumerism items

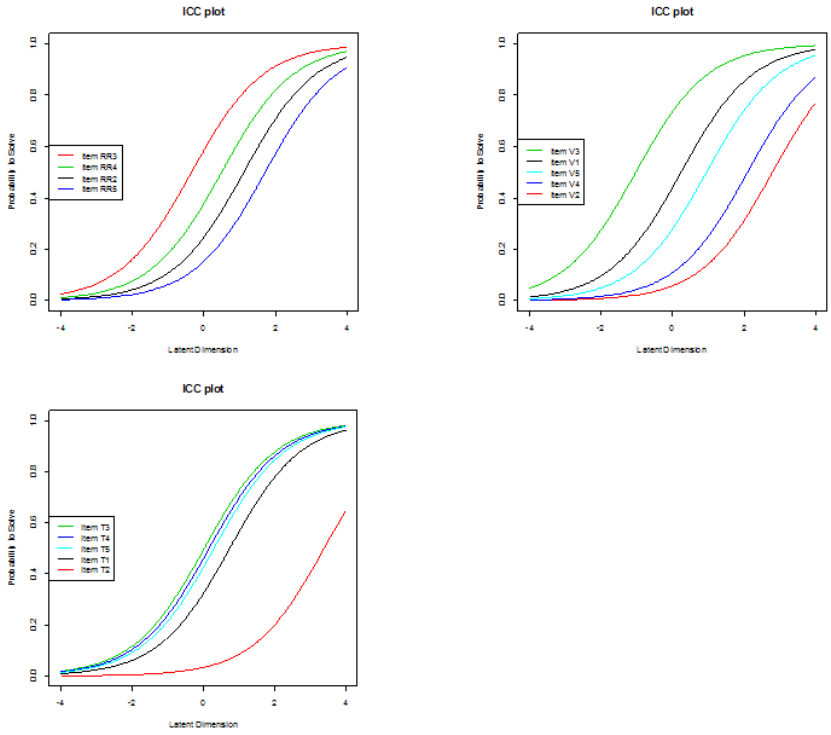

Figure 16 ICC plots for garbage inhibition, activism and volunteering and transport items

The Person-Item Map (Figure 17) presents a comparison of candidates and items according to their difficulty to be performed. The upper side of the map shows the distribution of the measured ability of the candidates from the least able to the most able. When candidates and items are in front of each other, the difficulty of the item and the ability of the candidate are comparable, so the candidate has approximately a 50% probability of answering the item correctly. Items on the upper left side represent the easiest behaviours while the ones in the lower right side the most difficult behaviours. When items are aligned (i.e. RR3 "If I am offered a plastic bag in a store, I will always take it"; AE6 "In winter, I leave the windows wide open for long periods of time to let in fresh air"; CE11 "Sometimes, I borrow goods I occasionally use, rather than buy them"), it means they have the same level of difficulty and that all except one are superfluous. Finally, strong gap between two items, show that there is an increase of the level of difficulty to answer to the question and that more items in this area are needed.

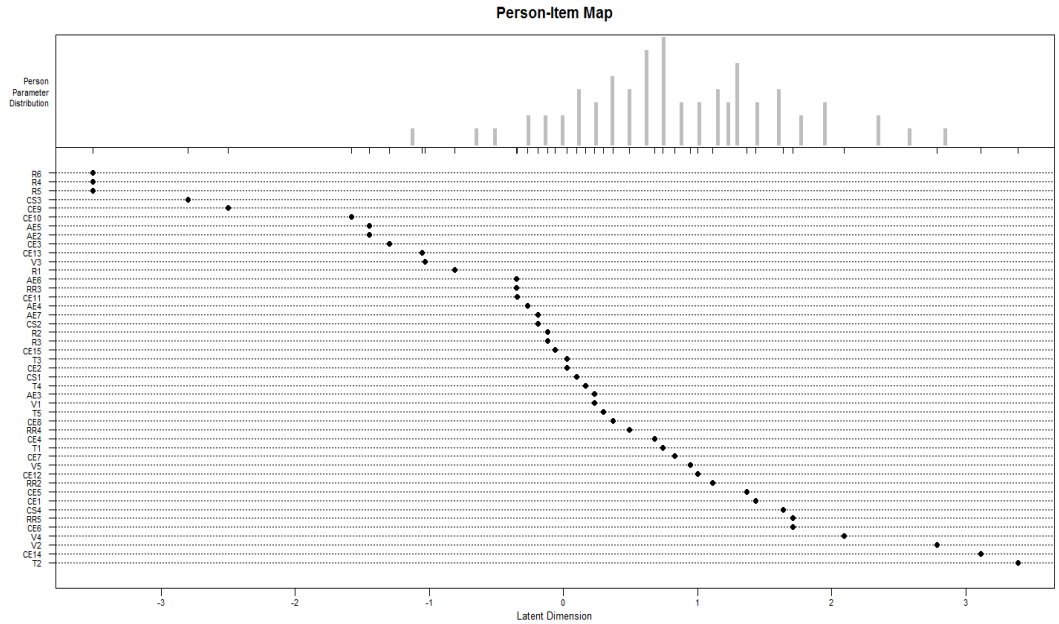

Figure 17 Person-Item map of the Rasch Model

4.3 Exploratory factor analysis

This section presents the results of the Principal Axis Factor (PAF), a factor analysis extraction method, performed on data gathered through two different questionnaires:

- 5 Likert scale (scale 1-4) items from the ex-post questionnaire developed for this thesis, sent to the whole 155 participants to the test but answered by 76 participants;
- 120 Likert scale (even scale 1-5) items from the ex-ante survey of the Opticities project administered to the whole 155 participants to the test in 2014. The data related to the 76 participants who answered to the ex-post questionnaire developed for this thesis were used.

The results of the factor analyses allowed individuating two sets of factors with a high level of explained total variance. The same items form the three factors extracted from both factor analyses, although they do not present the same percentages of total explained variance. Factors analyses differ from each other: while one factor analysis finds out the intention of using TUeTO, the other one finds out a factor related to the expectation towards TUeTO.

4.3.1 Exploratory factor analysis based on the latent constructs related to the benefits expected by using TUeTO

The first FA extracted four factors, based on 14 items. The analysis of the Kaiser-Meyer Olkin measure of sampling adequacy suggested that responses given by the sample are acceptable (KMO = 0.745). Bartlett's test of Sphericity was significant, rejecting the null hypothesis, meaning that correlation matrix was not an identity matrix (p-value = 0.000 < 0.05). The diagonals of the anti-image correlation matrix were all greater than 0.5, except for the variables Eco1 and Eco2; however, their values should not affect the model since they are almost equal to 0.5 (respectively, value = 0.456 and 0.492). Communalities were all greater than 0.3 and presented satisfactory values according to the sample size.

Table 4 presents the items used for the factor analysis as well as their meanings and their communalities.

Table 4 Items used for the factor analysis and their communalities

Items		Communalities	
Code	**Code meaning**	**Initial**	**Extra-ction**
More_CSIfRTInfoStalls	I would use more frequently CS system if it provides RT information about localization of available cars	.800	.832
More_CSIfRTInfoTraffic	I would use more frequently CS system if it provides RT information about traffic	.819	.897
Tech_LikeTry	I like to try new technologies	.798	.737
Tech_EnchPoten	I am fascinated by the potential of new technologies	.789	.839
Tech_IneterestNew	I am interested by new technologies	.766	.700
Tech_AppsHelp	Apps help me in my everyday life	.616	.590
Tech_AppsFun	Some apps are funny to use	.730	.643
Tech_AppsEnjoyNew	I like to try new apps	.835	.826
TUeTO_Expect_SaveTime	Use TUeTO would allow me to save a bit of travel time	.555	.617
TUeTO_Expect_CalmRelax	I would reach my destination with more calm and more relax using TUeTO	.553	.648
TUeTO_Expect_Env	Use TUeTO would allow me to reduce the ecological impact of my travel	.470	.503
EcoInfo1	In general, I think I am well informed on environmental issues	.615	.915
EcoInfo2	In general, I think I have all necessary information to reduce my ecological footprint	.593	.577
More_BSIfRTInfo	I would use more frequently BS system if it provides RT information about bike availability and occupation of terminals	.496	.446

Table 5 shows the rotated factor matrix as well as the initial eigenvalues, variance explained and the cumulative explained variance of the extracted factors.

Items relevant for each factor are highlighted in blue and were automatically grouped together according to their importance in explaining the factor, thanks to the software SPSS. The four recognized latent constructs account for about 77.6% of the total variance of the original data.

Table 5 Sorted rotated factors' loads from the EFA

	Factor			
	1	2	3	4
Tech_EnchPoten	.917	-.198		
Tech_AppsEnjoyNew	.899			
Tech_LikeTry	.820			-.156
Tech_IneterestNew	.812		.146	
Tech_AppsFun	.790	.154		.158
Tech_AppsHelp	.750	.119		
TUeTO_Expect_SaveTime		.801		
TUeTO_Expect_CalmRelax		.797		
TUeTO_Expect_Env		.631		-.144
EcoInfo1			.974	
EcoInfo2			.739	
More_CSIfRTInfoTraffic				-.950
More_CSIfRTInfoStalls				-.919
More_BSIfRTInfo	.193	.221		-.493
Initial Eigenvalues	4.568	2.512	1.636	1.053
Percentage of total variance	32.6%	18%	11.7%	7.5%
Cumulative variance	32.6%	50.6%	62.3%	69.9%

The **first factor** loaded six items explaining approximately 34.6% of the variance. The six items refer to the general attitudes towards the technology and, more precisely, the pleasure of experimenting new technologies. According to such characteristics and to the construct of the Unified Theory of Acceptance and

Use of Technology 2 (UTAUT2) (Venkatesh et al., 2012) – being "hedonic motivation" defined as the pleasure obtained by using a technology – the factor is called "technologic hedonist #1".

Representing 20.2% of the explained variance, three items load the **second factor**; it is called "TUeTO performance expectancy" in reference to the socio-psychological construct of the UTAUT2, "performance expectancy", measuring the expected benefits provided by the use of a technology. The expected benefits refer to the time saving, the ecological footprint and the serenity gained by using it. This factor shows high loads on items related to the save of time and travel serenity, while a lower load on environmental issues is observed. This second factor is loaded by other four variables, but they have greater loads on other latent constructs.

The **third factor** "ecological knowledge #1" presents high loads on two items and explains 13.4% of the total variance. The items belonging to this factor refer to participants' knowledge about ecological issues and the usefulness of this knowledge to reduce their footprint. This factor relates to the psychosocial construct related to the knowledge discussed in the socio-psychological section.

The **fourth factor,** the smallest one (9.4%), is named "real-time information does not encourage the use of shared transports #1". It highlights the fact that the deployment of real-time information about sharing modes will not encourage people to use them. While both variables on the CS have strong negative loads, the item related to the BS presents a lower load.

Finally, Conbrach's alpha value was calculated in order to assess the reliability of the extracted factors. Table 6 shows the alpha of each of the four recognized latent constructs and the used variables. All the extracted factors can be considered as satisfying since they are greater than 0.7.

Table 6 First EFA ouput. Conbrach's alpha calculated for each extracted factor

	Cronbach's alpha	Used variables
Factor 1 **Technologic hedonist #1**	0.921	Tech_EnchPoten, Tech_AppsEnjoyNew, Tech_LikeTry, Tech_InterestNew, Tech_AppsFun, Tech_AppsHelp

Factor 2 **TUeTO expectation**	0.799	TUeTO_Expect_SaveTime, TUeTO_Expect_CalmRelax, TUeTO_Expect_Env
Factor 3 **Ecological knowledge #1**	0.836	EcoInfo1, EcoInfo2
Factor 4 **Real-time information expectation to increase sharing modes use #1**	0.848	More_CSIfRTInfoTraffic, More_CSIfRTInfoStalls, More_BSIfRTInfo

4.3.2 Exploratory factor analysis based on the latent construct related to the intention to use TUeTO

The second factor analysis presented in this chapter allowed also extracting four factors using 15 items. The analysis of the Kaiser-Meyer Olkin measure of sampling adequacy suggested that responses given by the sample are acceptable (KMO = 0.777). Bartlett's test of sphericity was significant, confirming that the correlation matrix was not an identity matrix (p-value = 0.000 < 0.05). The diagonals of the anti-image correlation matrix were also all greater than 0.5 except Eco1 and Eco2, but their values should not affect the model since they are almost equal to 0.5 (value = 0.498). Communalities were all greater than 0.3 and presented satisfactory values according to the sample size.

Table 7 shows the items used for the factor analysis as well as their meanings and communalities.

Table 8 shows the rotated factor matrix as well as the initial eigenvalues, variance explained and the cumulative explained variance of the extracted factors. Items relevant for each factor are highlighted in blue and were automatically grouped together, according to their importance in explaining the factor, thanks to the software SPSS. The four recognized latent constructs account for about 68.6% of the total variance of the original data.

Table 7 Items used for the factor analysis and their communalities

Items		Communalities	
Code	**Code meaning**	**Initial**	**Extra-ction**
More_CSIfRTInfoStalls	I would use more frequently CS system if it provides RT information about localization of available cars	.806	.856
More_CSIfRTInfoTraffic	I would use more frequently CS system if it provides RT information about traffic	.813	.898
Tech_LikeTry	I like to try new technologies	.800	.738
Tech_EnchPoten	I am fascinated by the potential of new technologies	.789	.791
Tech_IneterestNew	I am interested by new technologies	.774	.710
Tech_AppsHelp	Apps help me in my everyday life	.609	.575
Tech_AppsFun	Some apps are funny to use	.764	.638
Tech_AppsEnjoyNew	I like to try new apps	.839	.831
EcoInfo1	In general, I think I am well informed on environmental issues	.604	.929
EcoInfo2	In general, I think I have all necessary information to reduce my ecological footprint	.547	.527
More_BSIfRTInfo	I would use more frequently BS system if it provides RT information about kike availability and occupation of terminals	.462	.397
TUeTO_UseIfSaveTime	If TUeTO allow me to save time, I intend to use it for my daily travels	.625	.723
TUeTO_UseIfReliable	If TUeTO can increase the reliability of travel time for my daily travels, I intend to use it	.596	.629
TUeTO_UseIfEnv	If TUeTO can reduce the ecological impact of my travels, I intend to use it	.477	.399
TUeTO_UseIfPlanBetter	If TUeTO allow to better plan my travels, I intend to use it	.616	.653

Table 8 Sorted rotated factors' loads from the second EFA

	Factor			
	1	2	3	4
Tech_AppsEnjoyNew	.916			
Tech_EnchPoten	.885			
Tech_LikeTry	.838	.134		
Tech_IneterestNew	.819		.182	
Tech_AppsFun	.745	-.129		.142
Tech_AppsHelp	.725			
More_CSIfRTInfoTraffic		.957		
More_CSIfRTInfoStalls	-.122	.913		.101
More_BSIfRTInfo	.192	.553		
EcoInfo1			.960	
EcoInfo2			.727	
TUeTO_UseIfSaveTime				.865
TUeTO_UseIfPlanBetter			.191	.808
TUeTO_UseIfReliable	.115			.700
TUeTO_UseIfEnv				.579
Initial Eigenvalues	5.7	2.3	1.8	1.6
Percentage of total variance	35.7%	13.7%	10.6%	8.5%
Cumulative variance	35.7%	49.5%	60.1%	68.6%

The second factor analysis found out four factors; the same items of the previous analysis form three of them, but they do not share the same level of explained variance and the same loads:

- the **first factor** is still related to the pleasure provided by the use of technology. Since it loaded exactly the same items than the factor from the first FA, it is named "technologic hedonist #2". It explains the strongest part of the variance (about 37.8%);
- while it was the fourth factor in the previous FA, it is now the **second** extracted **factor**. However, this time all items of this factor are positively loaded. Unlike the factor "real-time information does not encourage the use of shared transports #1", this factor is called "real-time information encourages the use of shared transports". It represents 15.3% of the total explained variance;
- the **third factor**, likewise the previous FA, is related to the knowledge about ecological issues and to the behavioural control on such issues. This factor, explaining 10.6% of the total variance, is named "ecological knowledge #2";
- the **last factor** expresses the intention to use TUeTO if the device allow save time, reducing footprint, proposing better travel solutions and if the solutions proposed by the app are reliable. Since the items belonging to these factors fit the definition of intention given by Ajzen and Fishbein (1988), and the concept of "behavioural intention" from the UTAUT2 (Venkatesh et al., 2012), the **fourth factor** was called "intention to use TUeTO". This factor is the smallest one since it explains only 10.6% of the variance.

Finally, Conbrach's alpha value was calculated in order to assess the reliability of the extracted factors. Table 9 shows the alpha computed for each of the four latent constructs and the variables loading such factors. All the extracted factors can be considered as satisfying since they are greater than 0.7.

Table 9 Second EFA output. Conbrach's alpha calculated for each extracted factor

	Cronbach's alpha	Variables used
Factor 1 Tech_hedonic_2	0.921	Tech_EnchPoten, Tech_AppsEnjoyNew, Tech_LikeTry, Tech_InterestNew, Tech_AppsFun, Tech_AppsHelp
Factor 4 Real-time information expectation to increase	0.848	More_CSIfRTInfoTraffic, More_CSIfRTInfoStalls, More_BSIfRTInfo

sharing modes use #2		
Factor 3 **Ecological knowledge #2**	0.836	EcoInfo1, EcoInfo2
Factor 2 **TUeTO_intention**	0.820	TUeTO_UseIfSaveTime, TUeTO_UseIfPlanBetter, TUeTO_UseIfReliable, TUeTO_UseIfEnv

4.4 Clusters analysis

This section presents the results of the two clusters analyses applied to the latent constructs, aiming at proposing a market segmentation. The description of the clusters profiles and of their socio-economical characteristics, travel habits, attitudes and life styles are finally presented.

4.4.1 Cluster analysis based on the latent constructs related to the benefits expected by using TUeTO

Before starting the cluster analysis, the test detecting collinearity in order to verify that data are unique to distinguish market segments was carried out. Table 10 presents the correlation matrix of the variables used for this first cluster analysis, using Pearson correlation coefficient; bold coefficients highlight significant correlations. Table 10 shows the correlation between one couple of variables: TUeTO_occa with TUeTO_Fre. However, those correlations should not influence the analysis since their collinearity degrees are not higher than 0.90 (Mooi and Sarstedt, 2011).

Table 10 EFA correlation matrix based on the latent construct TUeTOExpectation

	TUeTOExpectation	GEB	Tech_hedonist	TUeTO_occa	TUeTO_Fre
TUeTOExpectation	**1**	.181	**.127**	-.022	.259
GEB	.181	**1**	.065	.047	.065
Tech_hedonist	**.127**	.065	**1**	-.037	.197
TUeTO_occa	-.022	.047	-.037	**1**	**.304**
TUeTO_Fre	.259	.065	.197	**.304**	**1**

The hierarchical cluster analysis

Figure 18 presents the scree plot created by using the agglomeration schedule produced by the hierarchical cluster analysis. Because scree plot facilitates the reading of the agglomeration schedule, it is a tool generally used to identify clusters. However, in our case, the analysis of the scree plot does not allow to identify an adequate number of clusters. However, Figure 19 shows solutions with four clusters (green line) and five clusters (red line), quite interesting because the population of each cluster is large enough (Table 11). The results of the one-way ANOVA (Table 12) showed that all variables are significant except TUeTOExpectation for the 4-cluster solution. Considering the above remarks, the solution with five clusters is preferred to define the centroids needed to improve the analysis of the k-means cluster analysis.

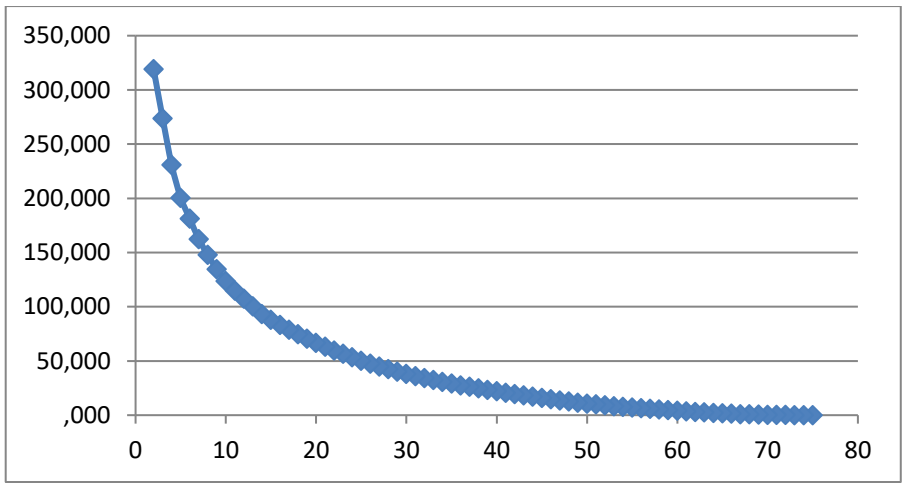

Figure 18 Scree plot of the INTENTION HCA

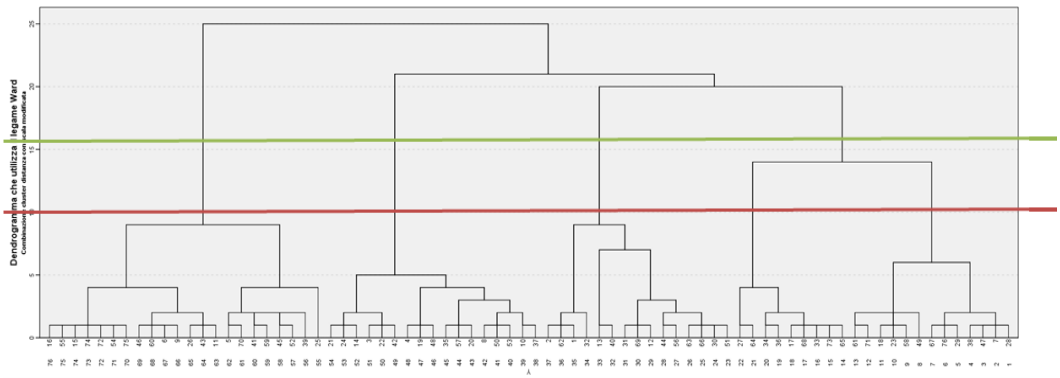

Figure 19 Dendrogram of the Expectation hierarchical cluster analysis using seven variables

Table 11 Possible solutions of cluster analysis

	4 clusters	5 clusters
Cluster 1	15	15
Cluster 2	17	17
Cluster 3	22	22
Cluster 4	22	13
Cluster 5	-	9

Table 12 F-ratio and p-values of Expectation HCA for the different clusters' solutions

	4 clusters		5 clusters	
	F-ratio	**P-value**	**F-ratio**	**P-value**
TUeTOExpectation	.921	.435	.7.723	.000
GEB	19.561	.000	18.399	.000
Tech_hedonist	25.791	.000	19.961	.000
TUeTO_occa	13.612	.000	10.169	.000
TUeTO_Fre	30.117	.000	28.882	.000

The k-means cluster analysis

After having aggregated the centres of each variable for each cluster thanks to the clusters of the HCA, the k-means cluster analysis was performed. The F-ratio shows that the means of the five variables are significantly different across groups (Table 13). Differently from the one-way ANOVA (table 12), the GEB variable is more significant, demonstrating that the k-means cluster analysis improved the clusters' solution.

Table 13 ANOVA output for the Expectation cluster analysis

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
TUeTOExpectation	6.851	4	.670	71	10.221	.000
GEB	9.602	4	.515	71	17.331	.000
Tech_hedonist	9.263	4	.534	71	18.629	.000
TUeTO_occa	11.208	4	.425	71	26.375	.000
TUeTO_Fre	8.199	4	.594	71	13.793	.000

Then, the stability of the final solution was tested. Table 14 shows the initial and final cluster centres generates by the k-means procedure where we can observe how clusters are different, but not significantly. The table 15 compares the grouping of participants into the five clusters comparing these clusters with those obtained from the HCA. It is interesting to observe that, except some individuals of cluster five, some participants of the other groups changed cluster following the k-means. Those changes could be due to the ability of the k-means to "*reassign observations between clusters, having a more even dispersion of observation among the clusters*" (Hair et al., 2010). In total, two participants from cluster 4 moved to cluster 1 and 5, two from cluster 3 were reassigned to cluster 4, one from cluster 2 moved to cluster 5 and two participants from cluster 1 were reassigned to cluster 3. Finally, the size of cluster 2 and 3 did not change as well as all participants from cluster 5 remained in the same cluster. Finally, table 16 presents the results of the solution presented above (first k-means), and the results of the final solution obtained changing the order of the cases (second k-means).

All individuals are grouped in the same way as in the first k-means, even though the clusters' order changed: cluster 1 has become cluster 2, cluster 2 has become cluster 3, cluster 3 has become cluster 4, and cluster 4 has become cluster 1.

Table 14 Initial and final cluster centres for the Intention k-means analysis

	Initial cluster centres					Final cluster centres				
	Cluster					Cluster				
	1	2	3	4	5	1	2	3	4	5
TUeTOExpectation	.36541	-.19726	-.03935	-.85008	1.08766	.28237	-.30509	.08676	-.97204	1.05964
GEB	-.93063	-.02683	-.27449	.55364	1.47301	-.87467	-.07077	-.34693	.44638	1.38246
Tech_hedonist	-.19524	-1.22147	.59776	.31577	.71534	-.24402	-1.25845	.53849	.41606	.57236
TUeTO_occa	-.99757	.79266	.21746	-.07565	-.25692	-1.21880	.77409	.30927	-.15334	-.01208
TUeTO_Fre	-.53616	-.29884	1.15098	-.93960	.00177	-.68025	-.33444	1.15098	-.75340	-.05936

Table 15 Comparison between the clusters obtained by HCA and the k-means

Cluster	Partition	
	HCA	K-means
1	15	14
2	17	16
3	22	22
4	13	13
5	9	11

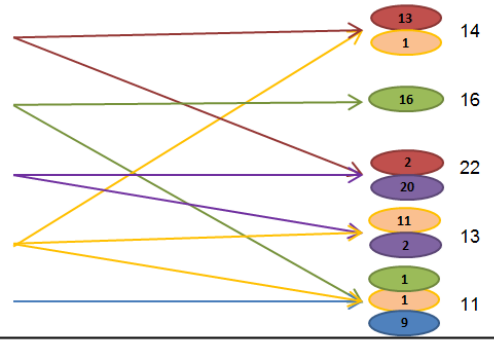

Table 16 Comparison between clusters obtained by the first k-means and the second k-means

	Grouping	
Cluster	**First k-means**	**Second k-means**
1	14	13
2	16	14
3	22	16
4	13	22
5	11	11

Clusters interpretation

Figure 20 shows the profiles of the five clusters through the average value of each variable within each cluster.

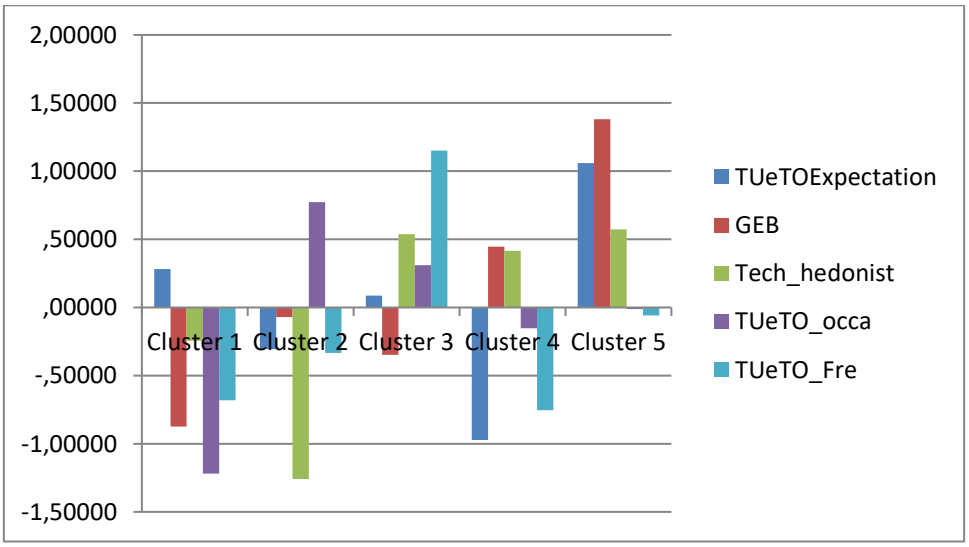

Figure 20 Cluster profiles of the expectation cluster analysis

The first cluster, **named "expectation cluster 1"**, contains 14 individuals (18.4%). People from this group stand out by their intention to use TUeTO for their occasional and most frequent trips after the test (TUETO_occa, TUeTO_Fre) and their low attitude towards the ecology (GEB).

The second cluster (N=16; 21.1%), **named "expectation cluster 2"**, is characterised by individuals' low enthusiasm towards technology

(Tech_hedonist), but by their high intention to use TUeTO for occasional trips after the test period (TUETO_occa).

Cluster 3, **labelled "expectation cluster 3",** is the largest one (N = 22; 28.9%). This cluster records the highest average value of the intention to use TUeTO to change travel habits for the most frequent trip (TUeTO_Fre) and a positive attitude towards the use of technology (Tech_hedonist).

The forth cluster, **named "expectation cluster 4"** is characterized by the lowest expectation towards the use TUeTO before the test of the app and by the lowest intention to use it in order to change travel behaviour for the most frequent trip after the test. Made up of 13 participants (17.1%).

Cluster 5, the smallest one (N = 11; 14.5%), has the highest average attitude towards the technology (Tech_hedonist), the highest expectation towards the use of TUeTO (TUeTOExpectation) and towards the ecology (GEB). This cluster is **called "expectation cluster 5"**.

Tables 17 and 18 depict the clusters as regards socioeconomic variables (Table X) and mobility-related variables (Table X). Regarding this last table, some variables from the questionnaire designed in the context of this Ph.D thesis were also used. Four of them are related to frequency of using different modes (moto, car, PT, walk, bike), two are related to the awareness alternatives for the most frequent trip (Modal alternative, Route alternative), and one to the search of information in case of a new O-D. Moreover, both tables synthesize which variables have significantly different distributions. For the categorical variables, Kruskal-Wallis non-parametric test was used while the one-way ANOVA assesses the significance of continuous variables and observes the difference between the means.

Surprisingly, the clusters are not significantly different in terms of any socioeconomic and travel habits variables. However, analysing tables 17 and 18 we can observe that:

- considering socioeconomic variables, cluster 5 is mainly made out by males (72.7%) and, together with cluster 2, shows the lowest number of people living alone (respectively 9.5% and 12.5%). Then, people from cluster 3 are less educated than people from the other clusters;
- considering travel habits, cluster 1 shows the highest percentage of people not owning a car (28.6%). In general, people belonging to this cluster use

more PT; the majority own a PT subscription (71.4%) and they use PT for their most frequent trip (highest percentage among all clusters: 35.7%). However, although those individuals effectively use PT, people in cluster 4 and 5 think to use it more frequently (respectively 69.2% and 72.7%) than people in cluster 1 (57.1%). Another common point between cluster 4 and 5 is that the travel purpose for the most frequent trip is work (respectively 92.3% and 90.9%). Moreover, people in cluster 5 do not own a PT subscription (72.7%), do not walk a lot (average = 5.1 min.), and run the lowest travel distance (average = 7.7 km). On the contrary, the travel average distance of cluster 4 is high, equal to 17.6 km. Surprisingly, people from this group have also the highest score on the use of the personal bike for the most frequent trip (23.1%). Finally, the majority of individuals belonging to cluster 2 do not have a mode alternative for their most frequent trip (75%) and have the highest travel time duration (average = 38.4 min.).

Table 17 Socioeconomic characteristics of the five clusters

		Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Cluster size		**N=14 15.8%**	**N=16 50.0%**	**N=22 17.1%**	**N=13 17.1%**	**N=11 14.5%**
Gender	**Female**	42.9%	56.3%	40.9%	61.5%	27.3%
	Male	57.1%	43.8%	59.1%	38.5%	72.7%
Age	**Mean**	45,2	44,6	40,4	38,4	39,4
Professional Status	**Worker**					9.1%
	Employee	42.9%	25.0%	36.4%	38.5%	45.5%
	Middle manager	14.3%	6.3%	9.1%	15.4%	
	Civil servant		6.3%	18.2%		18.2%
	Manager				7.7%	9.1%
	Teacher	14.3%	6.3%			
	Independent contractor	7.1%	31.3%	18.2%	15.4%	9.1%
	Retired	14.3%	6.3%			9.1%
	Unemployed	7.1%	12.5%		7.7%	
	Student		6.3%	18.2%	7.7%	

	Research fellow				7.7%	
Education	**Secondary School**	7.1%	6.3%			
	High shool	28.6%	18.8%	45.5%	23.1%	27.3%
	Undergraduate degree	14.3%	12.5%	18.2%		18.2%
	Master	50.0%	56.3%	36.4%	61.5%	45.5%
	Ph.D degree		6.3%		15.4%	9.1%
Children in the household	**0**	50.0%	56.3%	50.0%	53.8%	45.5%
	1	35.7%	12.5%	13.6%	7.7%	36.4%
	2	14.3%	31.3%	36.4%	30.8%	9.1%
	>=3				7.7%	9.1%
Household size	**1**	35.7%	12.5%	36.4%	23.1%	9.1%
	2	21.4%	31.3%	13.6%	15.4%	27.3%
	3	28.6%	25.0%	13.6%	7.7%	45.5%
	4	14.3%	31.3%	36.4%	38.5%	9.1%
	5				7.7%	9.1%

Significance level (Kruskall-Wallis for categorical, One-way ANOVA for continuous): ***p<0.001 **p<0.01 *p<0.05

Table 18 Travel habits of the five clusters

		Cluster 1	**Cluster 2**	**Cluster 3**	**Cluster 4**	**Cluster 5**
Cluster size		**N=14 15.8%**	**N=16 50.0%**	**N=22 17.1%**	**N=13 17.1%**	**N=11 14.5%**
Cars in the household	**0**	28.6%	6.3%		7.7%	18.2%
	1	35.7%	50.0%	50.0%	53.8%	27.3%
	2	35.7%	43.8%	31.8%	30.8%	45.5%
	>=3			18.2%	7.7%	9.1%
Driving license	**Yes**	100.0%	93.8%	100.0%	100.0%	90.9%
	No		6.3%			9.1%
BS subscription	**Yes**	14.3%	12.5%	40.9%	15.4%	9.1%
	No	85.7%	87.5%	59.1%	84.6%	90.9%
CS subscription	**Yes**			4.5%		9.1%
	No	100.0%	100.0%	95.5%	100.0%	90.9%

PT Subscription	**No subscription**	28.6%	62.5%	54.5%	53.8%	72.7%
	Weekly subscription		6.3%	4.5%		
	Monthly subscription	14.3%	12.5%	13.6%	23.1%	9.1%
	Annual subscription	57.1%	18.8%	27.3%	23.1%	18.2%
Walk frequency	**Not agree**	14.3%	25.0%	31.8%	38.5%	18.2%
	Agree	85.7%	75.0%	68.2%	61.5%	81.8%
PT use frequency	**Not agree**	42.9%	56.3%	40.9%	30.8%	27.3%
	Agree	57.1%	43.8%	59.1%	69.2%	72.7%
Bike use frequency	**Not agree**	64.3%	50.0%	68.2%	61.5%	45.5%
	Agree	35.7%	50.0%	31.8%	38.5%	54.5%
Moto use frequency *	**Not agree**	100.0%	93.8%	90.9%	92.3%	100.0%
	Agree		6.3%	9.1%	7.7%	
Car use frequency	**Not agree**	57.1%	43.8%	50.0%	46.2%	54.5%
	Agree	42.9%	56.3%	50.0%	53.8%	45.5%
Most frequent mode	**Car as a driver**	35.7%	31.3%	36.4%	23.1%	36.4%
	Car as a passenger			9.1%		
	Moto		6.3%		7.7%	
	PT	35.7%	18.8%	18.2%	30.8%	27.3%
	Personal bike	7.1%	12.5%	4.5%	23.1%	9.1%
	Bike Sharing (TObike)			4.5%		
	Pedestrian		6.3%	4.5%		9.1%
	Multimodal	21.4%	25.0%	22.7%	15.4%	18.2%
Seek of information for a new O-D	**Not agree**		6.3%			9.1%
	Agree	100.0%	93.8%	100.0%	100.0%	90.9%
Modal alternative	**Not agree**	42.9%	75.0%	50.0%	69.2%	54.5%
	Agree	57.1%	25.0%	50.0%	30.8%	45.5%
Route alternative	**Not agree**	50.0%	68.8%	59.1%	76.9%	90.9%
	Agree	50.0%	31.3%	40.9%	23.1%	9.1%
Time walk (min)	**Median**	9.4	8.3	7.6	7.0	5.1
Time walk (min)	**NtR[1]**		6.3%	4.5%		9.1%
	[0; 5]	35.7%	56.3%	40.9%	61.5%	45.5%
	[6; 10]	35.7%	6.3%	36.4%	23.1%	45.5%
	[11;15]	21.4%	18.8%	18.2%		

	[16+]	7.1%	12.5%		15.4%	
Distance (Km)	**Average**	9.6	15.9	13.7	17.6	7.7
Trip duration (min)	**Average**	30.5	38.4	35.8	36	29.5
Trip purpose	**Work**	78.6%	68.8%	68.2%	92.3%	90.9%
	University	7.1%	6.3%	18.2%	7.7%	
	Cultural, sportive, associative activities		6.3%	13.6%		
	Take/drop someone	7.1%	12.5%			
	Others	7.1%	6.3%			9.1%
Weekly frequency	**Less than once**			4.5%		
	Once		6.3%	4.5%		
	Twice	14.3%				18.2%
	3 times	14.3%	12.5%	18.2%	15.4%	9.1%
	4 times	57.1%	62.5%	54.5%	76.9%	45.5%
	5 times	14.3%	18.8%	18.2%	7.7%	27.3%

Significance level (Kruskall-Wallis for categorical, One-way ANOVA for continuous): ***p<0.001 **p<0.01 *p<0.05

4.4.2 Cluster analysis based on the latent constructs related to the intention to use TUeTO

As for the previous cluster analysis, the collinearity among variable was tested. Table 19 shows the correlation matrix of the variables obtained using Pearson correlation coefficient. In table 19 bold coefficients represent high correlation (≥0.3) and we can observe that TUeTO_intention is correlated with Tech_hedonist and TUeTO_occa is correlated with TUeTO_Fre. However, those correlations should not influence the analysis since their collinearity degrees are not higher than 0.90 (Mooi and Sarstedt, 2011).

Table 19 EFA correlation matrix based on the latent construct TUeTO_intention

	TUeTO_intention	**GEB**	**Tech_hedonist**	**TUeTO_occa**	**TUeTO_Fre**
TUeTO_intention	**1**	.087	**.431**	-.157	.198
GEB	.087	**1**	.065	.047	.065
Tech_hedonist	**.431**	.065	**1**	-.037	.197
TUeTO_occa	-.157	.047	-.037	**1**	**.304**

TUeTO_Fre	.198	.065	.197	**.304**	**1**

The hierarchical cluster analysis

As mentioned earlier, a scree plot allows identifying clusters solutions (Figure 21) but not the adequate number of clusters. Nevertheless, the dendrogram (Figure 22) shows that both four (orange line) and five (blue line) clusters have a good size (Table 20). The results of the one-way ANOVA (Table 21) show that the GEB is the variable least significant in both solution (lowest F-ratio), although the GEB of the 5 clusters solution has a p-value less significant (p-value = 0.001). Whereas the 4 clusters should be preferred, the solution with five clusters is retained since it will ease the comparison with the cluster analysis based on expectation of using TUeTO.

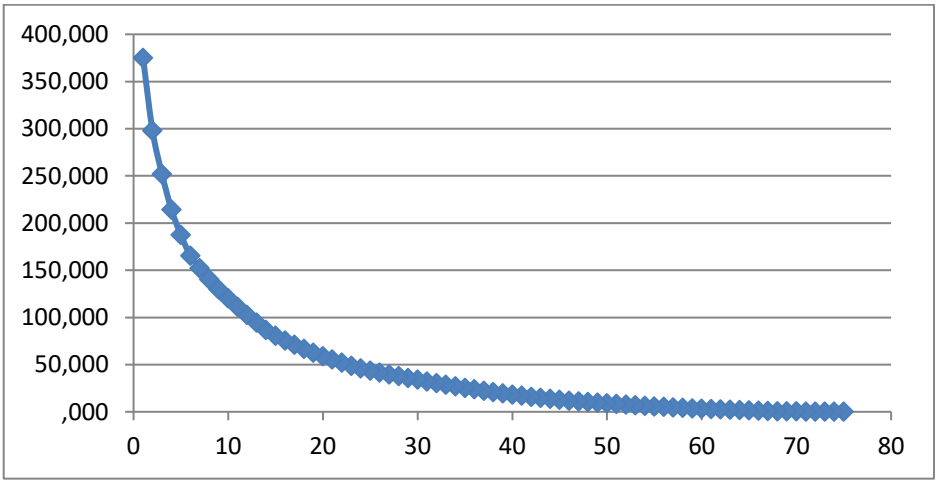

Figure 21 Scree plot of the INTENTION HCA

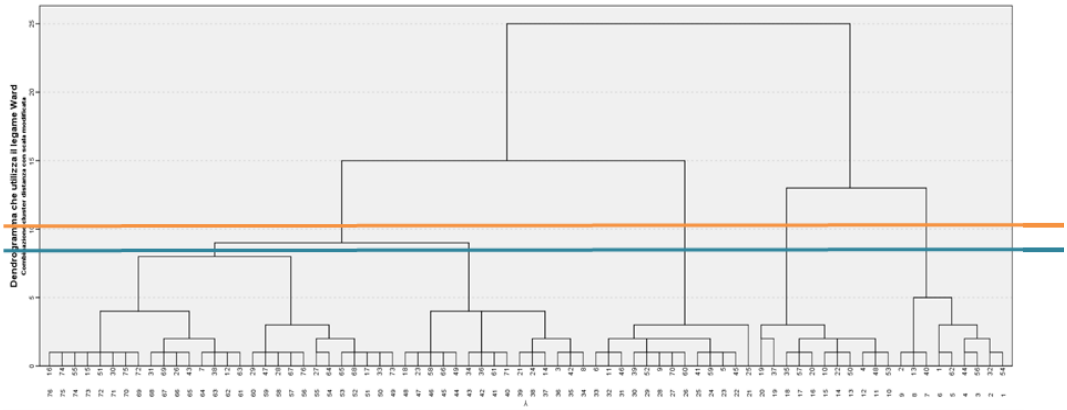

Figure 22 Dendrogram of the INTENTION hierarchical cluster analysis using seven variables

Table 20 Possible solutions of cluster analysis

	4 clusters	5 clusters
Cluster 1	9	9
Cluster 2	43	15
Cluster 3	11	11
Cluster 4	13	13
Cluster 5	-	28

Table 21 F-ratio and p-values of INTENTION HCA for the different clusters solutions

	4 clusters		5 clusters	
	F-ratio	P-value	F-ratio	P-value
TUeTO_intention	24.130	.000	19.765	.000
GEB	7.179	.000	5.310	.001
Tech_hedonist	24.380	.000	19.257	.000
TUeTO_occa	7.812	.000	21.543	.000

TUeTO_Fre	46.883	.000	36.986	.000

The k-means cluster analysis

The centroids of each cluster of the HCA have been defined before carrying out the k-means cluster analysis. Table 22 shows the results of the ANOVA; it shows which variables contributes the most to define the cluster thanks to F-ratio and p-value. The F-value shows that the means of the five variables are significantly different across groups, even though GEB is the variable having the highest p-value.

Table 22 ANOVA output for the Intention cluster analysis

	Cluster		Error			
	Mean Square	**df**	**Mean Square**	**df**	**F**	**Sig.**
TUeTO_intention	10.369	4	.472	71	21.960	.000
GEB	3.003	4	.887	71	3.386	.014
Tech_hedonist	10.287	4	.477	71	21.577	.000
TUeTO_occa	11.232	4	.424	71	26.517	.000
TUeTO_Fre	12.932	4	.328	71	39.451	.000

Then, the stability of the final solution was tested. Table 23 shows the initial and final cluster centres generated by the k-means procedure. Cluster 4 remains unchanged after the run of the k-means algorithm, while the other four clusters change, but not significantly. Table 24 compares the grouping of participants into the five clusters by examining the newly generated clusters with the ones from the HCA. Has it can be observed, little changes occurred, probably due to the ability of the k-means to "*reassign observations between clusters, having a more even dispersion of observation among the clusters*" (Hair et al., 2010). In total, only four participants were reassigned, all from cluster 5, demonstrating that the solution is stable. Two of them were reassigned to cluster 1, and the two others to cluster 2. Finally, table 25 presents the grouping of the population for the final

solution presented above (first k-means), and the grouping related to the final solution found by changing the order of the cases (second k-means). All individuals are grouped in the same way as in the first k-means, even though the clusters order changed: cluster 2 is become cluster 5, cluster 3 is become cluster 2 and cluster 5 is become cluster 3.

Table 23 Initial and final cluster centres for the Intention k-means analysis

	Initial cluster centres					Final cluster centres				
	Cluster					Cluster				
	1	2	3	4	5	1	2	3	4	5
TUeTO_intention	-.17925	.08442	-1.65742	.29401	.52702	-.21920	.10510	-1.65742	.29401	.62642
GEB	-1.24935	.27783	-.03002	-.01331	.27071	-.91735	.24267	-.03002	-.01331	.26953
Tech_hedonist	-.71262	.15244	-1.47645	.47337	.50765	-.68064	.19188	-1.47645	.47337	.59634
TUeTO_occa	-1.15468	.95504	.63063	.39050	-.56953	-1.20568	.91148	.63063	.39050	-.59358
TUeTO_Fre	-.67064	-.53616	-.27942	1.76038	-.20476	-.71954	-.51243	-.27942	1.76038	-.13271

Table 24 Comparison between the grouping of participants for HCA and k-means

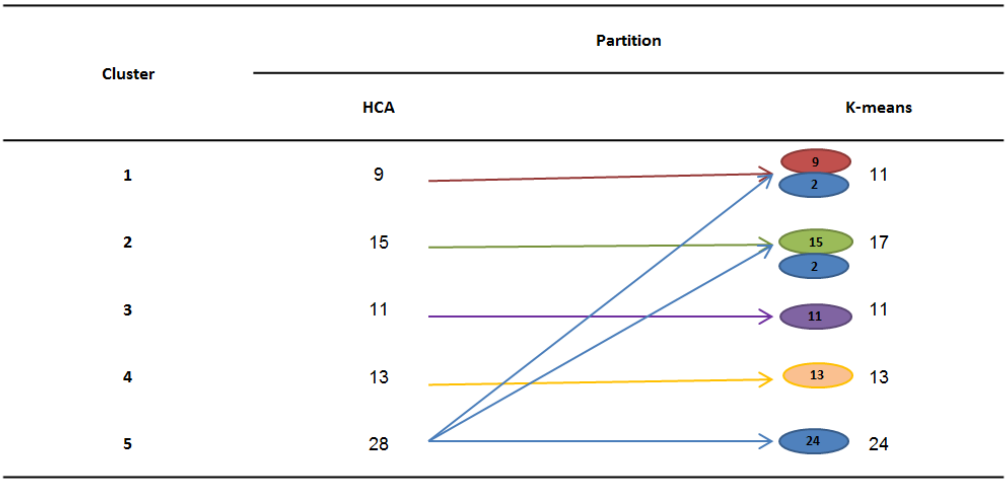

Table 25 Comparison between the grouping of participants for the first and the second k-means

	Grouping	
Cluster	**First k-means**	**Second k-means**
1	11	11
2	17	11
3	11	24
4	13	13
5	24	17

Clusters interpretation

Figure 23 shows the five clusters profiles. The values of the five variables represent the mean for each variable within each final cluster. It can be observed that all clusters differ from each other.

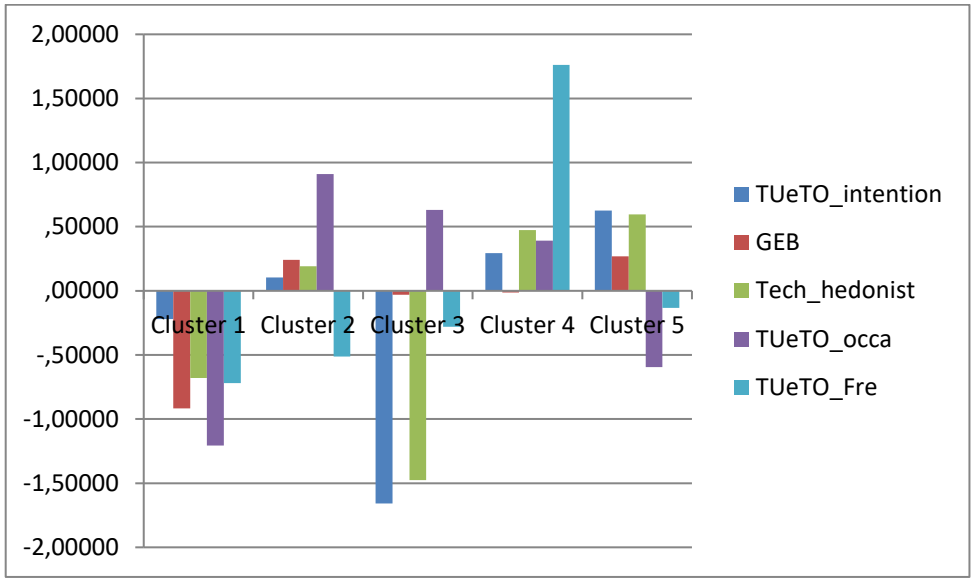

Figure 23 Cluster profiles of the intention cluster analysis

Cluster 1, the smallest one (N = 11; 14.5%) is **labelled "intention cluster 1"**. One of the most remarkable characteristic of cluster 1 is the non-intention of participants to use TUeTO for both frequent and occasional trips in order to change travel behaviour after the test (TUeTO_Fre, TUeTO_occa). They also show the lowest attitude towards the ecology (GEB) and the second lowest enthusiasm towards the use of technology.

The group formed by the second cluster, **labelled "intention cluster 2",** contains 17 individuals and is the second largest one (22.4%). This group shows the highest score on the intention to use TUeTO for occasional trips in order to change travel behaviour after the test (TUeTO_occa); it also has the second lowest mean on the intention to use TUeTO for the most frequent trip in order to change travel behaviour after the test (TUeTO_Fre).

Cluster 3 presents both the lowest intention to use TUeTO before the test and the lowest attitude towards technology (Tech_hedonist), while it shows the second highest mean for the intention to use TUeTO for occasional trips in order to change travel behaviour after the test (TUeTO_occa). This cluster contains 11 individuals (14.5%) and is **labelled "intention cluster 3"**.

The fourth group includes 13 participants (17.1%) and is **labelled "intention cluster 4".** People from this group stands out by their intention to use TUeTO to change travel behaviour for their most frequent trip after the test (TUeTO_Fre).

The fifth cluster is **labelled "intention cluster 5"** and is the biggest one (N = 24, 31.6%). This group is characterised by the highest intention to use TUeTO (TUeTO_intention) before the test period, by the highest attitude towards the use of technology (Tech_hedonist) and by a low score on the intention to use TUeTO for the most frequent trip.

Table 26 presents the differences among clusters as regard socioeconomic variables and table 27 shows the mobility-related variables. Regarding this last table, some variables from the questionnaire designed in the context of this Ph.D thesis were used. Four of them are related to the frequency of using the different modes (motorcycle, car, PT, walk, bike), two are related to travel alternatives' awareness for the most frequent trip (modal alternative, route alternative), and one to the information seek in case of a new O-D. Moreover, both tables synthesize which variables have significantly different distributions. For the categorical variables, the significance for the Kruskal-Wallis non-parametric test and the one-way ANOVA to assess the significance of continuous variables and observe the difference between means were used.

Among all variables of both tables, only one is statistically different across the clusters: BS subscription. However, although not statistically significant, the analysis of both tables highlights some interesting differences among clusters.

Considering socioeconomic variables, it is interesting to note that cluster 1 and 4 are mainly composed of males (respectively 63.6% and 61.5%), while cluster 3 contains a majority of females and cluster 5 has the lowest average age (37 years old). About the level of education, cluster 4 presents the lowest one (secondary school degree 53.8%) and the majority of participants belonging to cluster 2 own a master degree (76.5%). Finally, only 35.3% of people from cluster 3 do not have a child.

Regarding travel habits, people from cluster 1 prefer to use the car for their most frequent trip (45.5%), although a majority got a PT subscription (63.6%), little used for their most frequent trip (27.3%). On the contrary, members from cluster 5 show a more sustainable mobility since the strong majority think to use frequently the PT (83.3%), have a PT subscription (58.3%) and BS subscription (45.8%). Moreover, the majority use PT for their most frequent trip (41.7%), while a minority use the car (25.0%). Both groups are also different in terms of travel alternatives; while people belonging to cluster 1 could take another transport mode for their most frequent trip (63.6%), people from cluster 5 have

more constraints given that only 37.5% of them could use another mode for their most frequent trip. Moreover, people from cluster 5, similarly to those of cluster 2, do not have an alternative route for their most frequent trip (respectively 70.5% and 88.2%). The majority of participants from cluster 2 do not have a PT subscription (70.6%), but they use more modes (multimodality) for their most frequent trip (29.4%). This group shows the highest use of car (64.7% of them declare they use frequently the car). Members from cluster 3 say they frequently walk (90.9%) as well as frequently use the bike (63.6%). However, no one walks for the most frequent trip, and 18.2% use the bike for their most frequent trip. Finally, only one variable related to travel habits characterizes members of cluster 4; they record the second highest score on the travel alternative (53.8% of them could use another mode for their most frequent trip).

Table 26 Socioeconomic characteristics of the five clusters

		Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Cluster size		**N=11 14,5%**	**N=17 22,4%**	**N=11 14,5%**	**N=13 17,1%**	**N=24 31,6%**
Gender	**Female**	36.4%	47.1%	63.6%	38.5%	45.8%
	Male	63.6%	52.9%	36.4%	61.5%	54.2%
Age	**Mean**	44.8	43.4	43.3	44.1	37
Professional Status	**Laborer**		5.9%			
	Employee	36.4%	41.2%	27.3%	30.8%	41.7%
	Middle manager	9.1%	11.8%	9.1%	15.4%	4.2%
	Civil servant		17.6%		23.1%	4.2%
	Manager					8.3%
	Teacher	18.2%		9.1%		
	Independent contractor		17.6%	27.3%	15.4%	20.8%
	Retired	18.2%		9.1%		4.2%
	Unemployed	9.1%	5.9%	9.1%		4.2%
	Student	9.1%		9.1%	15.4%	8.3%
	Research fellow					4.2%
Education	**Secondary school degree**	9.1%		9.1%		
	High school degree	18.2%	17.6%	18.2%	53.8%	37.5%

	Undergraduate degree	18.2%	5.9%	18.2%	23.1%	8.3%
	Master	54.5%	76.5%	45.5%	23.1%	41.7%
	Ph.D degree			9.1%		12.5%
Children in the household	**0**	54.5%	35.3%	54.5%	53.8%	58.3%
	1	18.2%	11.8%	18.2%	7.7%	33.3%
	2	27.3%	41.2%	27.3%	38.5%	8.3%
	>=3		11.8%			
Household size	**1**	36.4%	11.8%	9.1%	30.8%	33.3%
	2	27.3%	23.5%	27.3%	23.1%	12.5%
	3	9.1%	11.8%	36.4%	7.7%	37.5%
	4	27.3%	41.2%	27.3%	38.5%	12.5%
	5		11.8%			

Significance level (Kruskall-Wallis for categorical, One-way ANOVA for continuous): ***p<0.001 **p<0.01 *p<0.05

Table 27 Travel habits of the five clusters

		Cluster 1	**Cluster 2**	**Cluster 3**	**Cluster 4**	**Cluster 5**
Cluster size		**N=11 14,5%**	**N=17 22,4%**	**N=11 14,5%**	**N=13 17,1%**	**N=24 31,6%**
Cars in the household	**0**	18.2%	5.9%	9.1%		16.7%
	1	36.4%	35.3%	63.6%	53.8%	41.7%
	2	45.5%	58.8%	27.3%	15.4%	33.3%
	>=3				30.8%	8.3%
Driving license	**Yes**	100.0%	100.0%	90.9%	100.0%	95.8%
	No			9.1%		4.2%
BS subscription**	**Yes**	9.1%		18.2%	15.4%	45.8%
	No	90.9%	100.0%	81.8%	84.6%	54.2%
CS subscription	**Yes**		5.9%			4.2%
	No	100.0%	94.1%	100.0%	100.0%	95.8%
PT Subscription	**No subscription**	36.4%	70.6%	63.6%	61.5%	41.7%
	Weekly subscription			9.1%		4.2%

	Monthly subscription	9.1%	11.8%	9.1%	23.1%	16.7%
	Annual subscription	54.5%	17.6%	18.2%	15.4%	37.5%
Walk frequency	**Not agree**	18.2%	35.3%	9.1%	38.5%	25.0%
	Agree	81.8%	64.7%	90.9%	61.5%	75.0%
PT use frequency	**Not agree**	45.5%	52.9%	54.5%	53.8%	16.7%
	Agree	54.5%	47.1%	45.5%	46.2%	83.3%
Bike use frequency	**Not agree**	63.6%	58.8%	36.4%	69.2%	62.5%
	Agree	36.4%	41.2%	63.6%	30.8%	37.5%
Moto use frequency	**Not agree**	100.0%	88.2%	100.0%	84.6%	100.0%
	Agree		11.8%		15.4%	
Car use frequency	**Not agree**	45.5%	35.3%	54.5%	53.8%	58.3%
	Agree	54.5%	64.7%	45.5%	46.2%	41.7%
Most frequent Mode used	**Car as a driver**	45.5%	29.4%	36.4%	38.5%	25.0%
	Car as a	9.1%			7.7%	
	Moto		11.8%			
	PT	27.3%	11.8%	27.3%	7.7%	41.7%
	Personal bike		17.6%	18.2%	7.7%	8.3%
	Bike Sharing (TObike)				7.7%	
	Pedestrian			9.1%	7.7%	4.2%
	Multimodal	18.2%	29.4%	9.1%	23.1%	20.8%
Seek of information for a new O-D	**Not agree**		5.9%			4.2%
	Agree	100.0%	94.1%	100.0%	100.0%	95.8%
Modal alternative	**Not agree**	36.4%	64.7%	72.7%	46.2%	62.5%
	Agree	63.6%	35.3%	27.3%	53.8%	37.5%
Route alternative	**Not agree**	45.5%	88.2%	54.5%	61.5%	70.8%
	Agree	54.5%	11.8%	45.5%	38.5%	29.2%
Time walk (min)	**Median**	5.8	6.6	8.3	7.9	8.8
Time walk (min)	**NtR[1]**			9.1%	7.7%	4.2%
	[0; 5]	54.5%	70.6%	54.5%	38.5%	29.2%
	[6; 10]	45.5%	5.9%	9.10%	30.8%	45.8%
	[11;15]		5.9%	18.20%	23.1%	16.7%

	[16+]		17.6%	9.1%		4.2%
Distance (Km)	**Average**	10.9	19.9	10.9	9.9	12.4
Trip duration (min)	**Average**	33.4	41.5	31.4	30	34
Trip purpose	**Work**	63.6%	94.1%	63.6%	61.5%	87.5%
	University	18.2%		9.1%	15.4%	8.3%
	Cultural, sportive, associative			9.10%	23.1%	
	Take/drop someone	9.1%		18.2%		
	Others	9.1%	5.9%			4.2%
Weekly frequency	**Less than once**				7.7%	
	Once		5.9%		7.7%	
	Twice	18.2%				8.3%
	3 times	27.3%	11.8%	9.1%	15.4%	12.5%
	4 times	45.50%	70.6%	63.6%	46.2%	62.5%
	5 times	9.1%	11.8%	27.3%	23.1%	16.7%

Significance level (Kruskall-Wallis for categorical, One-way ANOVA for continuous): ***p<0.001 **p<0.01 *p<0.05

5. Comparison of the quantitative results with the content analysis

This section compares the results obtained through the cluster analysis with those coming from the content analysis of the ex-ante and ex-post focus groups' discussions. More precisely, the analysis aims at verifying if the individuals within each cluster are coherent with what has been expressed during the FG discussions.

The general ecological behaviour (GEB) could not be validated because this topic was not discussed in both ex-ante and ex-post focus groups. Such issues were sometimes approached during the discussions, but they were only focused on individuals' intention to decrease their emissions or to change their current mobility pattern.

The factors related to the change of travel behaviour after the test period (TUeTO_occa, TUeTO_Fre) were analysed together when the cluster showed specific characteristics on both variables. The reason is that the occasional and most frequent trips were investigated together during focus groups discussions.

This section summarizes in English the opinions of the participants according to the cluster they were assigned to. To preserve the spontaneity of people expression, all used quotes are reported in Italian in Appendix III and IV. The first name of speaker is mentioned afterward, together with the corresponding focus group discussion to whom (s)he participated.

5.1Validation of clusters related to the benefits expected by using TUeTO

5.1.1 Validation of "expectation cluster 1"

Cluster 1 shows the lowest mean concerning the GEB and the use of TUeTO in order to change travel habits for occasional trips as well as a low mean regarding the most frequent trip, after the test period.

Three out of the 14 participants did not express any opinions regarding the issues discussed in this section while seven out of the other 11 were in accordance with the cluster analysis. Among the four participants who contradicted the quantitative results, two of them remained general without referring to themselves**.**

The non-use of TUeTO for both occasional trips and the most frequent trip in order to change travel behaviour

Among the participants in accordance with the cluster analysis, some explained they questioned the alternatives proposed by the device (Riccardo G., ex-post FG 2; and Claudia P., ex-post FG 1). While Riccardo G. just "criticised" the alternatives without detailing his view, Claudia P. highlighted the fact that she already known the best travel alternatives.

Vincenzo M. (ex-post FG 9) simply explained that the app did not help him to change behaviour.

The "non-feasibility" of the travel alternatives proposed by the device was also highlighted during the discussions in ex-post focus groups. Ilaria S. (ex-post FG 7) could not follow the app suggestion since the bike could not be brought on the metro; Marcello M. (ex-post FG 4) said that the proposal was not feasible and that, once new alternatives are known, the app is not useful anymore.

Francesco P. (ex-post FG 1) explained that the improvement of the public transport infrastructure would be a better incentive than the use of TUeTO to change travel behaviour.

Finally, Claudio L. (ex-post FG 2) changed travel mode for his business trips but not thanks to the app; he currently uses less the car and more the PT because petrol is too expensive.

A few opinions contradicted the quantitative results and were positive towards the use of TUeTO; some participants thought that TUeTO had the potential to improve their travel habits. Piera C. (ex-post FG 3) said that it could help her to save time by finding new mode alternatives that she did not know. Valentina O. (ex-post FG 5) would like an improvement of TUeTO in order to use bike sharing. Domenico A. (ex-post FG 11) explained that the app could be useful for multimodal trips, since it aggregated data from all alternative modes and could avoid using Tom Tom, Maps or Moovit;

Alice (FG 9, ex-post) proposed a general comment on how such device could help to improve people's mobility. She considered that the proposal of several alternatives was crucial to change habits, more in terms of planning the trips than changing behaviour thanks to real time information.

Taking into account all the above considerations, we can consider the "expectation cluster 1" validated.

5.1.2 Validation of "expectation cluster 2"

Cluster 2 is characterised by the highest use of TUeTO to change travel behaviour for occasional trips and by the lowest enthusiasm towards technology.

Among the 16 participants belonging to this cluster, four did not express any opinion about the use of TUeTO before the test period. Amongst the other 12 only six where coherent with the cluster. Concerning the low enthusiasm towards the use of technology, despite the presence of some negative comments and fears about privacy issues, technology was part of the everyday life of the participants.

The use of TUeTO for the occasional trips in order to change travel behaviour:

Amongst the 16 participants, three did not reveal their view about this issue while one expressed opinions that do not allow to clearly understand his position;

Amongst the opinions in contradiction with the cluster characteristics, only Federica G. (ex-post FG 5) was against the idea of using TUeTO for occasional trips, explaining that she would use TUeTO preferably during her most frequent trip to know how long she has to wait at the PT stop;

Six participants would prefer to use TUeTO for occasional trips, in line with the cluster analysis:

- despite a negative experience regarding the most frequent trip (suggestion for longer routes and non-logic alternatives), Marialuisa R. (ex-post FG 8) would accept to use the device for occasional trips, when she does not know how to reach the destination. Daniele S. (ex-post FG 9) explained he would prefer to use TUeTO for occasional trips but not for the most frequent one where "times (were) tight". Floriana D. (ex-post FG 15) would also rather use the information for occasional trips, but, she recognised that the device allowed her to take unusual routes she already knew during her most frequent trip. Finally, Alessandro S. (ex-post FG 4) was "available to change any habits";
- on her side, Anna L. (ex-post FG 6) thought that instead of using it for the most frequent trip, she would prefer to follow the alternatives proposed by the app for occasional trips, but only if the device become reliable;Stefano F. (ex-post FG 4) preferred to use the device for his business trips declaring that it allowed him to save time.

Other participants were not in contradiction with the quantitative analysis, but pointed out other aspects of their experience of the app. Thus, part of the participants belonging to this group explained that the device did not help them to change travel behaviour for their most frequent trip. Although all of them tried the alternatives proposed by the device, they finally found out (Luana M., ex-post FG5; and Anna I., ex-post FG 6) that their initial alternative was the best.

Finally, some participants emphasized other factors to explain the limitation of the device regarding its use and its capability in changing behaviours. Elena C. (ex-post FG 4), pointed out the quality of the device as a factor affecting the use of TUeTO. According to her, the app should work better than during the test period to effectively attract people. Paolo V. (ex-post FG 5) highlighted a particularly interesting point; according to him, the use of the app was limited by the fact that people do not had access to all modes alternatives since they not own subscriptions to all modes (PT, bike sharing, car sharing).

The non-enthusiasm towards technology

Few participants were in line with the quantitative results and expressed their non-enthusiasm towards the use of technology. Anna L. (ex-ante FG 5) did not like technology, and she preferred to use "old systems" even though she felt dependent on some functions of new technologies (Whatsapp). Anna I. (ex-ante

FG 6) thought that technology was too invasive since she could not disconnect from work after coming back home.

In general, people used technology in their daily life both for work and for other activities. Although they had some critics towards its use, they also had positive comments. While Anna I. had a strong negative opinion towards the invasiveness of the device, Federica G. (ex-ante FG 8) preferred to see the positives sides, since she "loved" using technology. Simone D. (ex-ante FG 5), although he liked using it, he preferred to control his use of technology.

Few people were really enthusiast by the use of technology. Daniele S. (, ex-ante FG 7) defined himself as a "passionate", and Alessandro S. (ex-ante FG 13) admitted he found it really "useful for an infinity of things".

Most of the participants said they used internet (on the computer, smartphone or tablet) to buy goods online. However, some of them showed some reserve. Some preferred to buy on secure web sites or to use secure payment methods, others preferred to use their computer rather than their smartphone. Luigi G. (ex-ante FG 9) explained this last point saying that he was afraid someone could steal his smartphone with all his banking information, while Anna L. (ex-ante FG 5) was scared of paying online goods with her smartphone.

Privacy issues were also discussed by people in this cluster. Although most of participants were aware of this specific issue, some of them think that people should regulate themselves or accept the situation. While Daniele S. (ex-ante FG 7) avoided sharing personal information, Federica G. (ex-ante FG 8) accepted being tracked while using internet since it was "the smallest of the problems".

The results of the content analysis, especially those related to the variable TUeTOExpectation, did not allow to validate the "expectation cluster 2".

5.1.3 Validation of "expectation cluster 3"

Cluster 3 is characterised by the highest use of TUeTO for the most frequent trip in order to change travel behaviour after the test and by a strong attitude towards technology.

Amongst the participants in this group, the opinion of seven out of 22 was missing because they did not participate to the focus groups or did not express their opinion during the discussion. Although some participants (7) were in line

with the results of the cluster analysis, a non-negligible part of them (6) expressed opinions opposite to the quantitative analysis.

Regarding the attitude towards technology, they were all technology users and they use it in their everyday life. Some participants showed strong enthusiasm, however, critics highlighted some limits to their enthusiasm.

The use of TUeTO for the most frequent trip in order to change travel behaviour

Few opinions were in line with the results of the cluster analysis. At the end, only three participants would use TUeTO for their most frequent trip; and two of them under specific conditions.

Pasquale B. (ex-post FG 9), in line with quantitative results, explained that the app could be useful to change his behaviour since he liked looking for new travel alternatives for his most frequent trip. Some participants would also like to change but under specific conditions. Luisa M. (ex-post FG 8), who uses the car for her most frequent trip, thought the app could help her to use PT, but only if TUeTO was reliable. Dora B. (ex-post FG6) said the app could allow her to save money, to be less stressed and to change travel mode. However, in parallel, the PT infrastructure should be improved.

Another positive comment was the one of Davide C. (ex-post FG3). Without specifying a possible behavioural change, he thought the app could help people to save time or money, as well as Giovanni B. (ex-post FG3) who found the service helpful when using PT, to compare the different services (railway and bus). Micaela L. (ex-post FG 9), would use the device to change habits only in case of specific events or in case of unexpected events (such as traffic restrictions, strikes, accidents, congestion, etc.).

Other participants would also use TUeTO to change behaviour, but not on a daily basis. Andrea B.ex-post (FG 11) thought the app would be more useful for his occasional trips when he does not know how to reach his destination.

Other participants referred indirectly to the transport infrastructure in their comments. Whereas they were aware of travel alternatives, those people could not change mode to take another transport alternative. Marco P. (ex-post FG 1) could not change his behaviour, because, although he thought the app could be useful thanks to the aggregation of data on different transport modes, the car was his

most convenient transport mode (just one bus and few BS stations were available for him at his O-D). Muriel G. (ex-post FG 9) had a similar problem, since the car was the fastest alternative for her most frequent trip; however, she used the app for her leisure trips, preferring not to use the car when possible.

In line with previous opinions, other participants highlighted that they could not do better in terms of sustainable mobility to justify the fact the app would not help them to change their travel behaviour. Nadia D. (ex-post FG 3) explained the app was not useful for her trips since her most used travel mode was PT. Francesco P. (ex-post FG 1) already used various modes for his trips.

Vittoria V. (ex-post FG 8) thought the app could not be useful for most frequent trips in general. The reason being that people do not research mobility information for this kind of trips.

The enthusiasm towards the use of technology

Opinions about the use of technology were not homogeneous among people in cluster 3. While some were enthusiastic, others had a moderate use or did not like using technology. The privacy issue and the potential invasiveness of technology also divided participants.

In general, people used technology in their daily life for both work and pleasure. Few participants had a negative opinion about technology and, even in this case, the comments were moderately negative. For example, Muriel (ex-ante FG 12) explained that she uses technology because she “needs it”, Franco M. (ex-ante FG 17) used his smartphone just for calling, admitting that he was not “very techie”. On the other side, Andrea B. (ex-ante FG 15) explained he “was crazy” for technology, thinking that it had a huge potential.

Some participants argued about the invasiveness of technology showing different points of view; some of them, like Giovanni B. (ex-ante FG 15), were “afraid” to observe an excessive dependence on smartphone, others, like Valentina T. (ex-ante FG 16), thought that technology “invades the social space”.

In regard to privacy, participants’ opinions were similar. While they were aware that their personal data were collected for commercial purposes, they also thought that people should control what they did on internet. Francesco P. (ex-ante FG 16) tried “not to say important things” on internet, while Valentina T.

(ex-ante FG 16) said she was trying to find the "right balance between [privacy and] what she wanted to share with the world".

For the reasons expressed above, especially regarding the use of TUeTO, "expectation cluster 3" was not validated.

5.1.4 Validation of "expectation cluster 4"

Cluster 4 is characterised by the lowest score related to the benefits expected by using TUeTO before its test and to the use of TUeTO for the most frequent trip in order to change travel behaviour after the test period.

While five out of the 13 participants did not answer specifically to this issue, the majority of the expressed opinions (7) contradicted the cluster analysis, and only one did not contradict it.

Regarding the non-intention to use TUeTO after the test period, six out of the 13 participants did not share relevant opinions. However, a strong majority (7) of those who expressed one did not contradict it.

The benefits not expected by using TUeTO before the test

Opinions expressed during focus groups did not validate with precision this variable. Five out of the 13 participants did not express relevant opinions and most of opinions expressed do not concern the benefits that one can expect by using the app. At the end, this variable was really difficult to interpret.

Some participants would prefer to use the device for their occasional trips. Daniela C. (ex-ante FG10), and Luis S. (ex-ante FG 20) would use the information service when they need to plan a new destination, while Silvia R. (ex-post FG 5) would use it to plan a travel according to the mode she selected.

Considering the most frequent trip, Andrea M. (ex-ante FG 11) did not think the app would be useful for him; since he was a student and he felt less the stress related to travelling (waiting times, delays, etc.), he thought that workers could get more benefits from the use of the device (e.g. less stress avoiding traffic congestion).

Morena C. (ex-ante FG 11), Valentina R. (ex-post FG 22) and Bruna C. (ex-ante FG2) would consider using TUeTO only if it was highly reliable. While

Morena C. did not give reasons, Bruna C. explained that using both regional trains and urban transport, she really needed precise and reliable multimodal information.

Finally, Francesca S. (ex-ante FG 18), in contrast with Morena, and Valentina R., would use the device if she had a number of alternative transport modes amongst which she could choose (that was not the case at the time being).

The non-use of TUeTO for the most frequent trip in order to change travel behaviour after its test

Regarding the use of TUeTO for the most frequent trip, all opinions expressed were in line with the quantitative results. Three out of the 13 participants did not express opinions about this issue, while three did not share clear or developed enough comments.

Two participants pointed to the transport infrastructure as a barrier to change their travel behaviour and to the use of the device to change travel behaviour. While Cristian C. (ex-post FG 10) wanted to use the BS service, he was not able to do it due to the bad quality of the service (punctured wheels). Luis S. (ex-post FG 9) criticized the public transport system and explained that it was not efficient enough to induce him to change travel behaviour and this lack of PT efficiency hinders, in general, the modal diversion.

Some participants explained that the device was more interesting for occasional trips or in case of unexpected events:

- Bruna C. (ex-post FG1) thought that TUeTO could be useful in case of traffic disruption during the travel.
- Silvia (ex-post FG 9) would use it to change travel behaviour during the weekend or for leisure trips, but only if the app was highly reliable.
- Daniela G. (ex-post FG 5) used the device for the travels for which she did not know how to reach the destination.

Two participants added that their most frequent trip was already optimised. Francesca S. (ex-post FG 6) would use the device to optimise her business trips when she does not know how to reach the destination, while it would not be useful for the most frequent trip. According to her using several transport modes was already sustainable, she thought the app could not further improve her sustainability. Valentina R. (ex-post FG 10), did not use the app to plan her most

frequent trip because she had already optimised it, even though she would look it up when she was waiting at the bus stop or when she was in the vehicle.

Finally, Claudio R. (ex-post FG 7), seemed that he already had his most frequent trip optimised since, although he used TUeTO during all the test period, he did not change habits and he continues to use the car.

Considering the fact that both variables have a considerable impact on the cluster, it can be concluded that the content analysis allowed to partially validate "expectation cluster 4".

5.1.5 Validation of "expectation cluster 5"

Cluster 5 is characterised by the highest score on the benefits expected by using TUeTO before its test, on the GEB and on the enthusiasm towards technology.

For what concerns the benefits expected by using the device, two out of the 11 participants did not share any opinions. Results of the content analysis are in line with the results of the cluster analysis, and there are no opinions that contradict it.

Regarding the enthusiasm towards technology, the results of the content analysis were mixed. Although all participants in this cluster use technology every day, some were more critical towards its excessive use, and only one of the participants expressed real enthusiasm.

The benefits expected by using TUeTO before its test

As a general comment, it can be said that only two out of the participants belonging to this group did not share opinions related to this characteristic.

In line with the quantitative results, some participants pointed out that TUeTO could reduce stress related to travelling:

- some participants pointed out that the app could help them to travel by bike safely. Giancarlo S. (ex-ante FG 5) thought that the app could help him to arrive safely to Torino city centre by bike, showing where the cycle paths are, while Elena P. (ex-ante FG 23) explained that the app should also show her the route with less traffic. Amerigo S. (ex-ante FG 22)

would like to use the app for his most frequent trip to verify if he can travel without concerns, or if he should take another alternative;

- Federico S. (ex-ante FG 8) thought that TUeTO could be useful for his most frequent trip in order to reduce the stress related to travelling. Federico S. thought that the device could suggest alternative routes to avoid traffic, considering that the car was the most convenient mode (comfort) to take his daughter to the grandparents before going to work.

Elena S. (ex-ante FG 11) and Gianni B. (ex-ante FG 19) explained that the app could help them to save time or arrive on time to their destination. According to Elena S., TUeTO could save her time when planning a new trip thanks to multimodal information, avoiding using different applications, while Gianni B. thought the device could help him to arrive on time by proposing alternatives when the used mode (in his case the bus) is late or has some problems.

Carmen F. (ex-ante FG 20) explained that TUeTO could be useful to plan leisure trips, not to save time but for practicality (arrival time of PT) since she considered "alienating" the idea of saving time for leisure trips.

Finally, Yari (ex-ante FG 7) and Simone M. (ex-ante FG 7) thought that the app could induce them to change travel habits, from the car to more sustainable modes, but only on provision that TUeTO is "reliable".

The enthusiasm towards technology

In general, opinions towards technology were mixed. Although all participants in this cluster explained that technology was part of their daily life, some were more critical about its excessive use. Amerigo S. (ex-ante FG 22) used technology to alleviate his routine from administrative constraints by paying his bills directly on internet instead of going to the bank. Elena S. (ex-ante FG 11) used to manage her e-mails because she is never at home. She also admitted that she was "always connected" to social networks (Facebook, Instagram, etc.).

Some participants reported that they're trying to use them in moderation. Yari (ex-ante FG 7) tries not to be flooded by Facebook notifications and disactivate them.

Some were more worried about their privacy. Simone M. (ex-ante FG 7), for example, shared his concerns about privacy. According to him, on the internet

privacy does not exist anymore, although he has eventually accepted this violation.

For the reasons expressed above, especially regarding the use of TUeTO, "expectation cluster 4" was validated.

5.2 Validation of clusters related to the intention to use TUeTO

5.2.1 Validation of "intention cluster 1"

Cluster 1 loaded the lowest scores on the variables TUeTO_Fre, TUeTO_occa and GEB.

In total, three out of 11 participants did not share any opinion and two shared opinions in contradiction with issues on the change of travel behaviour. Topics addressed by members of this groups were related to the credibility and feasibility of travel issues, as well as the effectiveness of TUeTO in improving the travel.

Qualitative data regarding the non-enthusiasm towards technology were various and difficult to interpret since the majority of the participants used technology in their daily life. Although some critics were expressed, they were relatively negative, making the interpretation difficult.

The non-enthusiasm towards technology

In general, opinions expressed by participants were difficult to interpret as representing enthusiasm or not for technology.

Only two participants belonging to this first cluster had an opinion in line with the statistical partition. While Marcello P. (ex-ante FG 11) talked about his use, Franco F. (ex-ante FG 2) heavily criticised people's relation with technology. Marcello P. explained that he did not like to use technology, while Franco F. said that people should remember that they are not "slaves" of technology and should understand that it "must be to (their) service".

Simona B. (ex-ante FG 12) and Piera C. (ex-ante FG 10) were really passionate about technology. While Simona B. liked to use and try new technology, Piera C. defined the technology as "essential". Both of them appreciated the many opportunities provided by technology, such as reading

newspaper and books, listening to music, or managing their e-mails thanks to their smartphone or computer.

Most participants reported using the internet (on computer or smartphone) to buy goods online. Vincenzo M. (ex-ante FG 7) preferred using a different technology according to the goods he wanted to purchase. While he bought apps on his smartphone, he preferred to use the tablet for other goods because it was more "convenient". Marcello P. (ex-ante FG 11), without explanations, said he did not like to buy on his smartphone, but rather on his computer since he did "not trust" the first one.

Issues related to privacy were also discussed by people belonging to this cluster. While they were aware that their personal data were collected for commercial purposes, they also accepted the situation. For example, although Piera C. (ex-ante FG 10) admitted that it "annoys" her, she accepted the invasiveness of tracking on the internet.

The non-intention to use TUeTO to change travel behaviour for occasional and most frequent trips

Not in line with the results of cluster analysis, a few participants belonging to this group expressed a positive opinion about travel mode change and any possible change in general. In fact, only two participants gave positive comments: Alice (ex-post FG 9) and Chiara P. (ex-post FG 3). Alice considered TUeTO as a tool that could help people to plan a new travel. More precisely, she considered that behavioural change could come from people who use the app to organise and plan their trips. Chiara highlighted that technical problems could be a barrier to behavioural change, even though, despite some malfunctions, she found new mode alternatives that she had never considered.

In line with quantitative results, some participants pointed out that they did not enjoy their experience with TUeTO and disagreed with travel solutions proposed so far. Riccardo G. (ex-post FG 2) "questioned" the solutions proposed by the device. Similarly, Vincenzo M. (ex-post FG 9) did not change his behaviour because the solutions were not credible, even though he defines himself has a person who "*likes test new alternatives*".

Francesco P. (ex-post FG 1) was also confident with his travel choice and highlighted that the app would not help him to improve his travel behaviour since

he already had an optimized and sustainable mobility (uses various modes for his trips).

The feasibility of alternatives proposed were also discussed. Ilaria S. (ex-post FG 7) highlighted the non-feasibility of solutions proposed by the device. She was not able to undertake a multimodal travel due to the impossibility to transport her bike in the subway; the solution proposed by the device was not "feasible". Marcello P. (ex-post FG 4), decided not to follow a new travel alternative since he had to leave too early. Moreover, he thought that once new alternatives were known, the app was not useful anymore.

Finally, Luis S. (ex-post FG 9) criticised the public transport system and explained that it was not efficient enough to induce his behavioural change and this lack of PT efficiency hampers, in general, the change of mode.

Although five opinions were missing or not in line with the cluster analysis, the fact that most of the expressed opinions were in line with quantitative results made it possible to validate "intention cluster 1".

5.2.2 Validation of "intention cluster 2"

Cluster 2 is characterized by the highest intention to use TUeTO in order to change travel behaviour for occasional trips after the test period and a low mean regarding the most frequent trip.

Three out of the 17 participants in this cluster did not express meaningful opinions or expressed nothing regarding the issue discussed in this sub-section. Among the 14 participants who expressed an opinion, only two contradicted the quantitative results.

The intention to use TUeTO to change travel behaviour for occasional trips

Most of the opinions expressed by people belonging to this group suggested that TUeTO would be more useful for their occasional trips:

- some participants expressed that they would prefer to use the device for occasional trips instead of using it for the most frequent trips.
    - Mauro M. (ex-post FG 5) and Elena S. (ex-post FG 14) said they had not travel alternatives. While Mauro highlighted that it was not "possible" to use the app for his most frequent trip, Elena S. explained that the test period helped her to change her travel

behaviour for occasional trips, but not the most frequent ones, since the car was the most convenient alternative (from the car to PT);

  - Silvia R. (ex-post FG 9) and Daniele S. (ex-post FG 9) explained that their most frequent trips imply tight schedule to allow a behavioural change (having already chosen their best mode). Instead, in case of occasional travels it would be easier to "follow and enforce" the change of travel habit. In addition, Silvia said she would maybe use the app at weekends if the device was "reliable";
- Stefano F. (ex-post FG 4), Francesca S. (ex-post FG 6) and Daniela G. (ex-post FG 5) would also use the device for occasional trips. However, Stefano explained the app helped him to save time during business trips, while Francesca and Daniela would use it for new destinations.

Amerigo S. (ex-post FG 15) said that the app could be useful to inform people about disruptions related to their most frequent trip. He imagined a system where the users received automatic notifications for their most frequent trip, predefined, without even having to open the app during each single travel.

Domenico A. (ex-post FG 11) explained that the app could be useful for multimodal travel, since it aggregated data from all mode alternatives and could avoid using Tom Tom, Maps or Moovit;

Finally, regarding the most frequent trip, some participants simply declared that they did not change their travel behaviour during the test period (Claudio R., ex-post FG 7; Anna L., ex-post FG 6; and Luca G., ex-post FG9).

The topic of reliability had not been approached only by Silvia R. (ex-post FG 9). Elena C. (ex-post FG4) and Luisa M. (ex-post FG 8) also explained that an app "working" well would allow to change their travel habits. However, while Luisa M. referred to the most frequent trip, Elena C. did not specify what travel she was talking about.

Since most of the participants expressed at least positive opinions about the use of multimodal information systems for their occasional trips, "intention cluster 2" was validated.

5.2.3 Validation of "intention cluster 3"

Cluster 3 differs from other clusters by its lowest intention to use TUeTO before testing the app and by the lowest interest for technology. However, it shows a high mean on the intention to use TUeTO in order to change travel behaviour for occasional trips after the test period.

The content analysis concerning the non-intention of using TUeTO highlighted little relevant information to support the quantitative results. On the other side, although some participants were more critical towards the use of technology, they admitted it was part of their everyday life. Regarding the intention to use TUeTO for occasional trips, results were more in line with the cluster analysis since part of the opinions expressed did not contradict the partition.

The non-intention to use TUeTO before the test

Three out of the 11 participants of this group did not share relevant information regarding their non-intention to use TUeTO before the test. All the participants belonging to this cluster expressed an opinion in contradiction with the latent construct TUeTO_intention, related to the intention to use TUeTO under specific conditions.

More precisely, they intend to use the real-time information system to plan their travels better, whether the most frequent or occasional trips:

- part of the participants explained the app could be more useful for their occasional trips rather than the most frequent ones. Luana M. (ex-ante FG 6) would prefer to use it when she has to travel by PT in order to know departure times and stations positions, while Marialuisa R. (ex-ante FG 1) could use it when she did not know how to reach a destination. Floriana D. (ex-ante FG 15), said that she would use TUeTO for occasional trips instead of most her frequent trip since she did the most frequent one "automatically" and almost always following the same route. Finally, Anna H. (ex-ante FG 13) would use it to find new alternatives to her occasional trips;
- Wanda (ex-ante FG 6) pointed out the app would be more useful in case of unpredictable events, such as accidents or traffic perturbations;

- Paolo (ex-ante FG 5) challenged the usefulness of the device on the long term and thinks that it was not useful anymore once the travel behaviour had changed. He imagined the app as a planning tool and not a tool supporting daily routine;
- Anna H. (ex-ante FG 13) wondered if the app could help her to consider new travel alternatives;
- other participants supported the idea that the app was useful in planning the most frequent trips. Andrea B. (ex-ante FG 16) thought he would use the app for his most frequent trip instead of occasional ones since he needed to know departure times in real-time of his train to Turin. When expressing a general opinion, Alessandro S. (ex-ante FG 13) explained the app was designed for everyday trips rather than for occasional trip, since occasional trips were planned at the last minute while frequent trips were pre-planned.

The non-enthusiasm towards technology

Concerning technology, opinions expressed by participants were various and did not specifically reflect a low enthusiasm towards its use. While some participants demonstrated strong negative feelings, most of them did not question so much their use.

Some opinions expressed by participants showed negative attitudes towards the use of technology. Amongst negative opinions about technology, some participants considered it intrusive. They generally used this term to criticise the use of social media, the place they take over time and the danger they represent (Anna I., ex-ante FG 10; and Paolo, ex-ante FG 8). Federica G. (ex-ante FG 8) explained that the technology was intrusive because she had to be connected on her free time to answer to professional e-mails. Andrea B. (ex-ante FG 16), tried to have a minimal use of technology to safeguard his privacy.

People in this cluster generally used technology in their daily life (for work, online payment, during their free time, etc.). Luana M. (ex-ante FG 6) did not think that technology had invaded her life, but rather “simplified” it since it eases people life (i.e. it allows her to “easily book a medical examination using smartphones or computers”). Floriana D. (ex-ante FG 15) uses it to keep in touch with her friends and family.

In contradiction with the results, one participant belonging to this group showed strong enthusiasm for the use of technology. Alessandro S. (ex-ante FG 13) used technology a lot, and, more specifically made an “excessive” use of his smartphone.

The intention to use TUeTO to change travel behaviour for occasional trips after the test period

Two out of the 11 participants did not share opinions after testing the service about the intention to change their travel behaviour. While three participants expressed opinions totally in line with the cluster analysis, other opinions were not specific to the use of TUeTO for occasional trips but did not contradict the cluster analysis.

Among the participants in this cluster, a few of them highlighted their preferential use of the device for occasional trips:

- Paolo (ex-post FG 5) would use the device for occasional trips, since people have already planned most frequent trips and know well how to perform them, while in case of leisure or business trips destinations are unfamiliar;
- Floriana D. (ex-post FG 15) would use the information for occasional trips, because the device made it possible for her to take unusual routes she already knew during her most frequent trip;
- Alessandro S. (ex-post FG 6) would use the device to change travel habits (occasional or most frequent one), however, the app should provide information in accordance with his preferences.

Some opinions were not specific to the issue but did not contradict the cluster analysis. Part of participants pointed out that the information delivered did not help them to optimize their trips. Since they changed work places, Marialuisa R. (ex-post FG 8) and Gianluigi G. (ex-post FG 11) also changed travel habits. However, TUeTO did not help them to plan their new trips since they already choose the best alternatives. In the case of Marialuisa R., the most efficient travel was not automatically proposed by TUeTO, and she had to suggest it to the app. Luna M. (ex-post FG 5) and Anna I. (ex-post FG 8) explained the app did not change their travel habits. Although they tried new alternatives, the app never proposed better travel solutions.

According to Anna H. (ex-post FG 12), although the app could be useful in changing travel behaviours and in encouraging people to be more sustainable, public policies should also make more difficult the use of the car. More precisely, public policies should make the use of cars more "wearisome" for those who use them, since they will always prefer to use the car also if "PT were free".

Finally, in total contradiction with results of the cluster analysis Federica G. (ex-post FG 5) would use the device for her most frequent trips if data were reliable. Using PT every day, she "needs" to use real-time information during her trips.

At the end, regarding results of the content analysis, the "intention cluster 3" was partially validated.

5.2.4 Validation of "intention cluster 4"

Cluster 4 is characterized by its highest mean regarding the use of TUeTO in order to change travel habits for the most frequent trip after the test. However, six out of the 13 participants did not express any opinion about this issue during ex-post focus groups because they did not participate or did not share their opinions; and one did not share workable opinion. Furthermore, opinions expressed about the use of TUeTO in order to change travel behaviour are not always in line with the questionnaire results.

The non-use of TUeTO for the most frequent trip in order to change travel behaviour

Some participants expressed relatively positive comments while others are more pessimist about using TUeTO to change travel behaviour.

Among positive comments, Dora B. (ex-post FG 6) explained the app could help her to save money, to be less stressed and to change travel mode, but only if public transport infrastructure were improved. Pasquale B. (ex-post FG 9) would use the app to change travel behaviour only if the suggestions proposed were reliable, while Giovanni B. (ex-post FG 3) said that TUeTO was "useful" to compare alternatives during his travels.

Some participants were not allowed to change of travel behaviour since they did not have transport alternatives. Marco P. (FG 1, ex-post) explained the app would not help him to change travel behaviour even though he thinks it could be

useful thanks to the various travel options proposed. According to him, he could change travel behaviour if the context of his travel changed (such a new O-D). Muriel G. (ex-post FG 9) not having access to PT infrastructure, could not change behaviour towards a more sustainable mode, the car being her only option.

Nadia D. (ex-post FG 3) did not need the device to change of travel behaviour since she already had a sustainable mobility (PT).

According to these comments, the "intention cluster 4" was not validated.

5.2.5 Validation of "intention cluster 5"

Cluster 5 is characterized by the highest score on the intention to use TUeTO before the test and on the enthusiasm towards technology. Another characteristic is the low score on the intention to use TUeTO for occasional trips after the test.

Regarding the variable on the intention to use TUeTO, one out of the 24 participants did not share relevant opinion. Only three participants were in total contradiction with the cluster analysis, while 14 participants were in accordance with the items belonging to the variable.

Qualitative data regarding the strong enthusiasm toward technology were various and difficultly interpretable since only four participants had an enthusiastic attitude toward the issue. However, all participants used technology in their daily life and no negative opinion was expressed.

Regarding the use of TUeTO for occasional trips, results were disappointing since only 15 participants shared their opinions about this issue and that 12 out of the opinions expressed opinions in contradiction with the cluster.

The intention to use TUeTO before the test

Although opinions expressed by participants are diverse and not always in line with the quantitative results, most of the comments expressed on the intention to use TUeTO before the test corroborates quantitative results.

Few participants pointed out the difficulty to change their travel habits. While Claudio L. (ex-ante FG 18) could not improve or differently plan his most frequent trip because he could not change his departure time, Roberta M. (ex-ante

FG 7) and Francesco R. (ex-ante FG 1) pointed out the low frequency of public transport as a limitation to the modal change.

Part of the opinions expressed were totally in line with the items used to form the latent construct related to the intention variable:

- the importance of the reliability of TUeTO was highlighted by some participants. Morena C. (ex-ante FG 11), Yari (ex-ante FG 7), Simone M. (ex-ante FG 7) and Valentina R. (ex-ante FG 22) explained that to be used, the device should be reliable because they would never use an app that is not;
- Valentina O. (ex-ante (FG 21), expected the device would allow her to gain time on her travels (occasional or most frequent trips). Among all the benefits that one could obtain from the use of the app, the gain of time was the most important one since she could not gain money. Carmen F. (ex-ante FG 20) would like to save time, but for occasional trips although she highlighted that trying to save time can be "stressful";
- an important part of participants might use the device to plan better their travels:
    - some (Micaela L., ex-ante FG 23; Bruna C., ex-ante FG 2; Francesco R., ex-ante FG 6; and Davide C., ex-ante FG 4; and Valentina T., ex-ante FG 16) would use the app in case of unpredictable events; the real-time information could help them to know if there were strikes, waiting time or traffic congestion;
    - Vittoria V. (ex-ante FG 4) was also favourable to the use of the app for occasional trips, although she said "maybe" when speaking how to know the "fastest way or the least expensive one";
    - Gianluigi P. (ex-ante FG 10) thought that the device could help him to better plan his business trips and as a consequence, to save time;
    - Gianni B. (ex-ante FG 19) thought the app could help people to find travel alternatives; he would use it to avoid or at least not waiting at bus stop and walking instead of using the bus. Federico S. (ex-ante FG 8) was enthusiast with the idea to change his habits, and Cristian C. (ex-ante FG 15) would use it for both occasional and most frequent trips;
    - Giancarlo S. (ex-ante FG 20) and Elena P. (ex-ante FG 23) considered the app as an opportunity to balance the weaknesses of the transport systems and to feel more secure when using the bike.

> Both would use TUeTO to use safely the bike; they think ATIS would help to know where the bike paths (Giancarlo S.) and the roads with less traffic are (Elena P.).

Finally, Andrea M. (ex-ante FG 11), thought the app could be an opportunity to feel less stressed, especially while waiting for PT, while Andrea B. (ex-ante FG 15), would use it for the "pleasure to open it".

The enthusiasm towards the use of technology

Opinions about the use of technology are quite positive since no one in that group expressed negative comments. Moreover, few comments were really enthusiasts.

Generally, all participants used technologies in their daily life, for work as well as for pleasure. Although they had some negative comments about their use, they also had positive ones. For example, Davide C. (ex-ante FG 4), although he did not like the fact that some people excessively use technology (more specifically the smartphone), admitted being a "victim of the system" but prefers to consider it "as something useful but not essential". Some people, however, had a calmer attitude towards technology. This was the case of Roberta M. (ex-ante FG 7) that although using social networks, made shopping on-line, use WhatsApp, and staid serene if she forgot the smartphone at home.

Some participants were passionate by technologies. Among the most enthusiasts, there was Federico S. (ex-ante FG 8) who explained that he "could not live without it". Or, Gianluigi P. (ex-ante FG 10) that, although enthusiast towards the use of technology ("I'm passionate", "I already owned an e-mail when the web did not exist yet"), interestingly did not own a smartphone.

Moreover, the majority of participants bought goods online, although they were sometimes scared that someone steals their bank details. Morena C. (ex-ante FG 11) usually used a prepaid card to buy online in order to prevent any problem while shopping.

Finally, although as said above, participants positively perceived the technology. Some of them talked about privacy and intrusiveness; however, those aspects did not seem to be a barrier to using technologies. For example, Simone M. (ex-ante FG 7), although he admitted having been "worried", now he did "not pay attention anymore".

The non-intention to use TUeTO to change travel behaviour for occasional trips after the test period

In total, three out of the 24 participants did not share opinions about their use of TUeTO after the test period, and six did not expressed clear opinions. Among all participants who declared something, no one talked negatively of the use of TUeTO for occasional trips.

As already explained, few comments were in line with this last variable. According to Giancarlo S. (ex-post FG 12), the app could not change behaviours since people had the habit to use their car. Claudio L. (ex-post FG 2) did not look like enthusiast by the use of the device since he admitted he did not use it a lot, apart to "test" it by comparing it with other information services. Federico S. (ex-post FG 4) had some difficulties to use it.

In total contradiction with the results of the cluster analysis some participants would use the device to better plan their occasional trips:

- some would use the device to find new travel alternatives. Vittoria V. (ex-post FG 8), as well as Andrea B. (ex-post FG 11), would change of travel mode behaviour for occasional trip in order to discover new alternatives, but not for the most frequent one since people, according to her, do not "look" information for this travel;
- Valentina T. (ex-post FG 2), would use TUeTO to change her occasional trips because the most frequent was already optimized, while Elena P. (ex-post FG 11) for special events (concerti, …) to "feel secure" to arrive on time and "as soon as possible";
- Valentina R. (ex-post FG 10) would use it when she has to wait at bus stop.

Some would use it in case of imponderables. While Micaela L. (ex-post FG 9) would use it in case of problems on her frequent travel, Carmen F. (ex-post FG 5) would use it when she has to take the bus during rainy days.

Although they did not talk about themselves, according to some participants, the app could help people to have a sustainable mobility. According to Bruna C. (ex-post FG 1), the app could help people that "usually use the car" to knew sustainable infrastructure that were not advertised by the public administration. Gianluigi P. (ex-post FG 1) thought that the device could help some people to change their mobility for a more sustainable one, also if it was just few people.

Finally, the transport infrastructure issue was also discussed by some members of this cluster. Francesco R. (ex-post FG 1) could not change of behaviour for the most frequent trip since the public transport infrastructure did not allow him to operate a modal shift from the car to the multimodality (PT + train). Simone M. (ex-post FG 12) also pointed out the weakness of the transport infrastructure service and highlighted the need to improve public transports (trains and PT) or develop the teleworking in order to respectively reduce car use and traffic congestion.

According to Cristian C. (ex-post FG 10), the BS system should be improved, in terms of accessibility but also of bike maintenance, to use the service thanks to the use of TUeTO. While he expected from the use of TUeTO to change of travel behaviour, he was not able to do it due to the bad quality of the service (punctured wheels).

Considering that both variable had a considerable impact on the cluster, it can be concluded that the content analysis allowed to validate partially "intention cluster 5".

5.3 Discussion on the validation of the clusters analysis

This last section aims at discussing the use of qualitative data to confirm the validity of the cluster analysis.

Tables 28 and 29 present, respectively, the results of the content analysis presented above and summarise the various opinions expressed by the participants in relation to the two clusters analysis regarding the benefits expected by using TUeTO and the intention to use TUeTO before the test period. In the aforementioned tables, different colours distinguish the clusters: green identifies the validated clusters; red identifies the non-validated cluster; and blue shows the partially validated clusters. Thus, five clusters were validated using content analysis, two were not and three were partially confirmed. The opinions were classified according to their agreement with the variables and factors characterising each cluster. The opinions in contradiction with the quantitative results were listed in the right column, while the opinions in line with the cluster results were reported on the left side. Since the ecological issue was not included in the focus groups' discussion, the lines related to the opinions about ecological behaviour are coloured in grey.

Looking at Table 28 and 29, we observe that for some factor and variable (e.g. Tech_hedonist and TUeTO_occa of the "intention cluster 5") the opinions expressed by the participants are diversified and difficult to interpret. Regarding Tech_hedonist, the difficulty to interpret this factor comes from the fact that an emotional response was expected, since it would have allowed people to understand if they were or not enthusiast towards the use of technology, while participants generally just described their use of technology. Moreover, the focus group analysis showed that the interpretation of this latent construct cuts across the clusters, not allowing to point out the differences between people showing a strong enthusiasm towards technology and those showing a lower one. On the other side, few participants' opinions of the "intention cluster 5", regarding the variable TUeTO_occa, were easily interpretable as "in contradiction" or "in line" with the quantitative analysis. The reason why could be that while opinions expressed were general, the variable TUeTO_occa was specific.

The content analysis highlighted that some of the groups created thanks to the cluster analysis were not so consistent and that some of the participants might have been assigned to the wrong cluster. While some of the clusters were strongly contradicted by the content analysis ("expectation cluster 3" and "intention cluster 4"), others were partially contradicted ("expectation cluster 4", "intention cluster 3" and "intention cluster 5"). Moreover, it is interesting to observe that clusters that are the most difficult to interpret are the ones allowing to understand the willingness to use TUeTO before and after the test period.

In order to verify if the content analysis effectively pointed out a weakness of the statistical analysis previously performed, the distribution of the variables characterising the partially or non-validated clusters was observed[5], as well as the distributions of the validated clusters:

- regarding the "validated clusters", the analysis of the variables' distribution of the participants belonging to those clusters showed that the content analysis correctly confirmed the clusters;
- the analysis of the distribution of the variables characterising the "partially validated clusters" showed that the method used to validate the quantitative analysis is not always as reliable as expected:
    - regarding "expectation cluster 4":

[5] The tables reporting the distributions of the variables of both clusters analysis can be found in appendix III and appendix IV

        - non-validated variable: the analysis of the distribution of the variable TUeTO_expectation showed that the content analysis failed to confirm the variable: participants effectively did not have expectation towards the use of TUeTO;
        - validated variable: the analysis of the distribution of the variable TUeTO_Fre showed that the content analysis correctly validated the variable;
    - regarding "intention cluster 3":
        - non-validated variable: the analysis of the distribution of the variable TUeTO_intention showed that the content analysis failed in confirming the quantitative results: participants effectively have not the intention to use TUeTO;
        - validated variables: the distribution of the variables TUeTO_occa and Tech_hedonist showed that the content analysis correctly validated the variables;
    - regarding "intention cluster 5":
        - non-validated variable: the content analysis rightly pointed out that some participants were not in line with the variable TUeTO_occa. In fact, the distribution of the variable TUeTO_occa showed that 10 participants were not correctly assigned, and they would use TUeTO to change behaviour for their occasional trips;
        - validated variable: the distribution of the variables TUeTO_intention and Tech_hedonist showed that the content analysis correctly validated the variables;
- the analysis of the variables' distribution for the two non-validated clusters showed that the content analysis is not always a reliable method to validate the clusters created thanks to the cluster analysis:
    - regarding "intention cluster 4", the distribution of the variable TUeTO_Fre confirmed that people were all grouped in the right cluster, according to the statistical analysis, highlighting that the opinions expressed during focus groups were discordant with quantitative results;
    - regarding "expectation cluster 3":
        - non-validated variable: the observation of the distribution confirmed the results of the content analysis, since nine of

the participants were not willing to use TUeTO to change behaviour for the most frequent trip;

- validated variable: the distribution of the variable Tech_hedonist showed that the content analysis correctly validated this variable.

The analysis of the distribution of the variables that were not confirmed by the content analysis points out that the use of qualitative data to confirm quantitative data analysis is not always a reliable method. Thus, although the analysis of the distribution showed that the content analysis correctly validated five clusters ("expectation cluster 1, 2 and 5" and "intention cluster 1 and 2") and correctly non-validated two clusters ("expectation cluster 3" and "intention cluster 5"), the method demonstrated some limits for three clusters ("expectation cluster 4" and "intention cluster 3 and 4").

Regarding the clusters "expectation cluster 3" and "intention cluster 5", if the content analysis rightly pointed out that some participants were not correctly distributed on one variable among the other ones of the cluster, it does not mean that the clusters analysis were not correctly performed and, thus, not correct. Indeed, when performing a cluster analysis, the objects (in our case the participants to the project) are assigned according different variables; if some participants may not have the characteristics of one variable, it does not mean that they are assigned to the wrong cluster, but that they are more characterised by another variable (or variables) belonging to this cluster. Finally, in order to verify the robustness of both clusters, the size of the sample should be increased.

Table 28 Opinions of the participants of the "expectation cluster analysis"

Clusters related to the benefits expected by using TUeTO			
	Clusters characteristics	**Opinions expressed by participants**	
		Opinions that do not contradict	**Opinions that contradict**
Cluster 1 (N=14)	lowest GEB		
	lowest TUeTO_occa	• the app was ineffective in changing behaviour (1) • the proposed alternatives were questioned (2) • the proposed alternatives are not feasible (1) • the improvement of public transport infrastructure would be better than TUeTO in changing behaviour • other factors change the behaviour (1)	• TUeTO can change travel habits (2) ○ but it should be improved (1)
	low TUeTO_Fre		

Cluster 2 (N=16)	highest TUeTO_occa	• TUeTO is useful for occasional trips (3)
		  ○ but it must be reliable (1)
		  ○ business trips (1)
		  ○ new destinations (1)
		• alternatives proposed for the most frequent trip and tried were not the most efficient (3)
		• the quality of TUeTO should be improved to change behaviour (1)
		• to change behaviour, people should have subscriptions to all transport modes (1)
			• TUeTO is useful for the most frequent trip, not for the occasional ones (1)

	lowest Tech_hedonist	• negative attitudes towards the use of technology (3) • nor negative or positive attitude towards the use of technology (6) • high enthusiasm towards the use of technology (4) • use of technology to make shopping online (12) • awareness of privacy issues, but they tolerate the current situation (4)	

Cluster 3 (N=22)	highest TUeTO_Fre	• the app can help to change behaviour related to the most frequent trip (1)
		  ○ to shift mode but it must be reliable (1)
		  ○ but the PT infrastructure should be improved (1)
		• the app can help during travels
		  ○ to save time (1)
		  ○ while using PT (1)
		• the app is useful in case of unexpected events (1)
			• the app cannot help to change since there are not transport alternatives (2)
			• people do not need information for their most frequent trips (1)
			• the app cannot help because the mobility is already sustainable (2)
			• the app is useful for occasional trips (1)

	high Tech_hedonist	• negative attitudes towards the use of technology (2) • nor negative or positive attitude towards the use of technology (8) • high enthusiasm towards the use of technology (9) • use of technology to make shopping online (17) • awareness of privacy issues, but they tolerate the current situation (11)	
Cluster 4 (N=13)	lowest TUeTOExpectation	• the app is not useful for the most frequent trip (1) • the app is more useful for occasional trips (3)	• the app is useful if the information is reliable (3) • the app is useful if transport alternatives are proposed (1)

	lowest TUeTO_Fre	• the app is useful for occasional trips
		  ○ business trips (1)
		  ○ leisure trips (1)
		  ○ new destinations (1)
		• the app is useful in case of unexpected events (1)
		• the app is not useful since the most frequent trip is already optimised (1)
		• the PT infrastructure should be improved to change behaviour (2)	

Cluster 5 (N=11)	highest TUeTOExpectation	• the app could reduce the stress related to the travel
		  ○ by safely biking (3)
		  ○ avoiding traffic (1)
		• the app could allow to save time or arrive on time (2)
		• the app could induce sustainable mobility if reliable (2)
		• the app can be useful to plan occasional trips (1)	

	highest Tech_hedonist	• use of technology to make shopping online (5) • nor negative or positive attitude towards the use of technology (7) • high enthusiasm towards the use of technology (1) • awareness of privacy issues, but they tolerate the current situation (3)	
	highest GEB		

Table 29 Opinions of the participants of the "intention cluster analysis"

Clusters related to the intention to use TUeTO			
	Clusters characteristics	**Opinions expressed by participants**	
		Opinions that do not contradict	**Opinions that contradict**
Cluster 1 (N=11)	lowest GEB		
	low Tech-hedonist	• negative attitudes towards the use of technology (2) • nor negative or positive attitude towards the use of technology (4) • high enthusiasm towards the use of technology (2) • use of technology to make shopping online (7) • awareness of privacy issues, but they tolerate the current situation (5)	
	lowest TUeTO_occa	• the app is not useful since the most frequent trip is already optimised (1) • the PT infrastructure should be improved to change behaviour (1) • the alternatives proposed by the app were not feasible (2) • the alternatives proposed by the app were questioned (2)	• the app can change travel behaviour (2)
	low TUeTO_Fre		

<table>
<tr><td rowspan="2">Cluster 2 (N=17)</td><td>highest TUeTO_occa</td><td rowspan="2">the app is more useful for occasional trips than for the most frequent trip
most frequent trips have tight schedule (2)
no alternatives for the most frequent trip (2)
the device could be useful for multimodal travels (1)
the app is useful for occasional trips
business trips (1)
new destinations (2)
the app is useful in case of unexpected events during the most frequent trip (1)
the test period did not change travel behaviour regarding the most frequent trip (3)</td><td rowspan="2">the device should be reliable to change people habits related to the most frequent trip (2)</td></tr>
<tr><td>low TUeTO_Fre</td></tr>
<tr><td rowspan="2">Cluster 3 (N=11)</td><td>lowest TUeTO_intention</td><td></td><td>the app is useful to better plan
occasional trips (4)
in case of unexpected events during the most frequent trip (1)
on the short term to induce a new behaviour (1)
the most frequent trip (2)</td></tr>
<tr><td>lowest Tech_hedonist</td><td colspan="2">negative attitudes towards the use of technology (4)
nor negative or positive attitude towards the use of technology (3)
high enthusiasm towards the use of technology (2)
use of technology to make shopping online (8)
awareness of privacy issues, but they tolerate the current situation (3)</td></tr>
</table>

	high TUeTO_occa	• the app is useful for occasional trips (3) • alternatives proposed for the most frequent trip and then tried were not the most efficient ones (4) • the app is one of the policy to change travel behaviour (1)	• the app is useful for the most frequent trip (2)

Cluster 4 (N=13)	highest TUeTO_Fre	• the app can help to change most frequent travel behaviour
		  ○ but the PT infrastructure should be improved (1)
		  ○ but the information should be reliable (1)
		• the app can be useful for the most frequent trip (1)
			• the app cannot help because the mobility is already sustainable (1)
			• the app cannot help to change since there are not transport alternatives (2)

Cluster 5 (N=24)	highest TUeTO_intention	• intention to use TUeTO to save time (2)
		• intention to use it to better plan (3)
		  ○ useful in case of unexpected events during the most frequent trip (5)
		  ○ occasional trips (1)
		  ○ business trips (1)
		  ○ to safely travel by bike (2)
		• intention to use TUeTO if reliable (4)
		• intention to use TUeTO to reduce the stress (1)
		• intention to use TUeTO for pleasure (1)
			• it is difficult to change of travel habit (3)

	highest Tech_hedonist	• use of technology to make shopping online (15) • nor negative or positive attitude towards the use of technology (16) • high enthusiasm towards the use of technology (4) • awareness of privacy issues, but they tolerate the current situation (13)	

	low TUeTO_occa	• the app cannot change behaviour (1) • more useful for occasional trips (5) • transport infrastructures should be improved to change travel habits (2) • he did not use a lot TUeTO (1) • difficulty of using TUeTO (1) • the app could help people to have a sustainable mobility (2) • useful in case of unexpected events during the most frequent trip (2) • the app cannot be efficient in changing behaviour if the transport infrastructure is not improved (1)

Discussion

The change of travel behaviour is a widely analysed issue when considering literature related to ATIS. Table 30 classifies the researches available in the literature concerning the ATIS, according to the type of information they provide: traffic information, public transport information and multimodal information systems. The studies marked by coloured cells show that they investigated the behavioural change, where each colour refers to a specific change of behaviour (route change or mode change). Monomodal traffic information systems are deployed to investigate route change, while modal shift is mainly related to the deployment of public transport information systems. The evidence is that the integrated multimodal traveller information systems, potentially able to spur modal shift from car to more sustainable modes (Kenyon and Lyons, 2003), are not much studied; only a few articles proposed to investigate the modal shift through the assessment of multimodal information systems. Among all those studies, only one assessed an ATIS close to the concept described by Kenyon and Lyons (2003). This study, carried out by Pronello et al. (2017), assessed Optymod'Lyon, the first version of TUeTO designed for the city of Lyon in 2012. Unlike the article of Pronello et al. (2017), this thesis proposes a market segmentation to assess the potential change of travel behaviour and to define travellers' profile, using qualitative data to confirm the quantitative analysis and better understand the rationale of decision-making mechanisms.

The TPB posits that people behaviours are reasoned and that the introduction of a new information would change the cognitive foundation of intention, the most relevant predictor of the behaviour. Instead, in addition to the intention, the variable "performance expectancy" and "hedonic motivation" would be the best constructs affecting the adoption of a technology, according to acceptance models. The use of psychosocial constructs, asking for expectations and intentions before and after the test of the application, allowed: a) defining the users' characteristics at different stages of the use; b) verifying which individuals were willing to use the application before and after the test. However, the results of the "intention cluster analysis" were not in accordance with the TPB assumption since no cluster presented high scores on the intention to use TUeTO both before and after the test. Such results could be due to the non-compatibility of measures of the intention before and after the test of the app. While the intention before the test

period refers to the use of the device in case of hypothetical benefits, the intention after the test is specific to the real travel behaviour (both changed and unchanged).

On the other side, the psychosocial determinants of using a technology ("performance expectancy") in the UTAUT2 theory were somehow more relevant in predicting the intention to use TUeTO in order to change travel behaviour or, more precisely, the non-intention to use the device to change travel behaviour. Thus, while before the test, people from cluster 4 (related to the "expectation cluster analysis") were not expecting benefits from the use of the app, they were also not willing to use the device after the test period. However, the fact that people from cluster 5 were not willing to use the app after the test to change travel behaviour while they had the highest expectation level before the test, could be partly due to their negative experience with the device. In fact, although it has been clearly said to not consider technical problems occurred during the test when thinking about future use of the app, they might somehow have been influenced by its malfunctioning.

Social psychology explains that the effects of the information on behaviour may be limited by the force of habit. In the case of the mode change, the introduction of multimodal real-time information should challenge travel habits of users. The cluster analysis allowed defining different groups of people willing to change behaviour before and after the test of the device. While some articles in literature (Yi et al., 2010; Memon et al., 2017; Pronello et al., 2017) showed that people interested in using information system were mainly car users, the analysis of our clusters showed that it was not an evidence. On one side, the clusters defined through the latent constructs related to the benefits expected by using TUeTO showed that the use of the car for the most frequent trip was not specific to a single cluster. On the other side, the cluster 1 derived by the latent construct related to the intention to use TUeTO was characterised by the highest percentage of people using the car for their most frequent trip while they never had the intention to use the app. On the contrary, people having the highest intention to use the app before the test ("intention cluster 5") declared they often use PT (83,3%) and, notably, for their most frequent trip (41,7%).

Table 30 Review of the ATIS in literature

Technology assessed in the study	Method used in the study	Authors	Research goal
Traffic Information Systems			
EXISTING ATIS			
ARTIMIS: a Telephone Information System providing traffic information	Survey conducted on users of the service	Clemons, et al. (1999)	Investigate benefits of using information
Variable Message Signs		Gan and Sun (2006)	Present VMS and evaluate their effects
Dynamic route guidance system providing real-time traffic information	Laboratory simulations, field tests, and a survey	Schofer et al. (1997)	Users attitude towards the information
Real-time information available on internet	Surveys and field test	Alexandri et al. (2015)	Investigate potential change of route
HYPOTHESISED SERVICES GIVEN BY POTENTIAL ATIS			
Vehicle travel times in real-time for public transport	Simulations of a corridor of the Massachusetts Bay Transportation Authority (MBTA) in Boston	Hickman and Wilson (1995)	Investigate time saving and time variability benefits
Real-time traffic information	Behavioural survey of drivers of a congested commuting corridor in Brisbane	Dia (2002)	Investigate users' profile and the development of a dynamic driver model to evaluate the impacts of different ATIS
ATIS providing on-route information	Stated choice experiment	Yannis et al. (2008)	Classify the attributes of the information that influences the behaviour

Traffic information	Simulation of traffic by using an interactive dynamic multiuser, computer-based simulator	Chen et al. (1999)	Investigate the compliance according to the attributes of the information
Real-time traffic information	Simulation of a traffic corridor using a dynamic interactive travel simulator	Mahmassani and Liu (1999)	Investigate how the information influence route choice
Real-time traffic information	Interactive microcomputer simulation	Adler and McNally (1994)	Investigate users' profile
Real-time traffic information	Simulation	Levinson (2003)	Benefits of real-time information on traffic flow
VMS providing delay information (Time and causes)	Stated preference survey	Wardman et al. (1997)	Impact of information on drivers according to different levels of service quality
Real-time traffic image app	Opinion survey based on traffic images	Koo and Asitha (2016)	Investigate the effect of the service on modal choice
Traffic information	Route-choice experimentation	Ben-Elia et al. (2013)	Investigate the impact of information accuracy on route change
Public Transport Information Systems			
EXISTING ATIS			
Dynamic at-stop real-time information displays	Observation of people entering in subway stations of the city of Stockholm	Dziekan and Kottenhoff (2007)	Investigate use of displays and their effects
Dynamic at-stop real-time information displays	Survey conducted before and after the implementation of the system	Dziekan and Vermeulen (2006)	Investigate use of displays and their effects
Bus Arrival real-time information accessible at-stop, on internet and by telephones	Survey conducted before and after the implementation of the system	Zhang et al. (2008)	Investigate the increase of PT use by PT users and benefits by using the service
Advanced Bus Passenger Real Time Information System at-stop	Survey conducted on regular and circumstantial PT users	Politis et al. (2010)	Investigate the increase of PT use by PT users and the satisfaction of using the service
Real-time passenger information	Ex-ante survey and in-itinere survey	Monzon et al. (2013)	Investigate the improvement of the

at bus stop and in vehicle			quality of the service after deployment in two different cities
Busview: a transit information system available in internet providing real-time transit vehicle location	Statistics of use of the service	Maclean and Dailey (2002)	Investigate the use of the service
Bus Tracker: real-time information through internet	Estimation of ridership increase using route data, monthly and average weekday ridership	Tang and Thakuriah (2012a)	Investigate transit ridership increase
Real-time transit information	Stated preference survey on commuters	Tang and Thakuriah (2012b)	Investigate the roles of psychological factors during the behavioural change process
Web-enabled and mobile devices on public transit ridership	Estimation of ridership increase using average weekday route-level unlinked trips	Brakewood et al. (2015)	Investigate transit ridership increase
OneBusAway: providing arrival real-time transit information via smartphone and web-enabled devices	Behavioural experiment with a before–after control group in which RTI is only provided to the experimental group Web-based surveys are used to measure behaviour	Brakewood et al. (2014)	Investigate benefits and behavioural change after using the service
	Surveys on OneBusAway users	Ferris et al. (2010)	Investigate the increase of PT use by PT users, the benefits and the satisfaction by using the service
	Survey and interviews of bus rider	Watkins et al. (2011)	Investigate benefits of using the service
HYPOTHESISED SERVICES GIVEN BY POTENTIAL ATIS			
Advance transit information	Stated-preference on PT users and non-PT users	Abdel-Aty et al. (1996)	Investigate desired information and potential impact on non-PT users
Travel time under five different types and level of ATIS	Realistic travel simulator	Abdalla and Abedl-Aty (2006)	Benefits of using information

Web-enabled public transport information services	Stated choice experiment	Molin and Timmermans (2006)	Investigate the WTP and traveller expectations towards the service
Real-time public transit stop information	Stated Preference survey on bus and rail users	Caufield and O'Mahony (2009)	Potential benefits provided by the deployment of the system
Real-time information for PT	Two surveys (to transit users and to transit agencies)	Harmony and Gayah (2017)	Investigate the information most valued by passengers and information provided by PT agencies
HYPOTHESISED SERVICES GIVEN BY POTENTIAL ATIS AND EXISTING ATIS			
Traffic route guidance	Survey on drivers equipped with route guidance (LISB) Interactive route guidance simulator (IGOR)	Bonsall and Joint (1991)	Investigate the use and travel change
REVIEW			
Real-time bus arrival information systems	Review	Schweiger (2003)	Investigate benefits, reliability and marketing issues of such services
Multimodal Information Systems			
EXISTING ATIS			
TravInfo: advanced traveller information system providing real-time updates on freeway traffic conditions, static information on public transit and ridesharing, as well as information on other	Survey on service users	Ygnace et al. (2000)	Investigate users' profile and changes in travel behaviour
	Survey conducted on users of the service	Mehndiratta et al. (2000)	Investigate profiles of ATIS users and expected improvements of the service

transport options, such as bicycle routes and airport transport services			
BayernInfo: a supra-regional multimodal traffic information system provided through a portable mobility planner for transits and drivers	Guideline-interviews with experts, focus group discussions, email survey, online-surveys among BAYERNINFO homepage visitors and a field trial with end users	Neuherz et al. (2000)	Investigate the market penetration of the system
Transbasel.com: a multimodal information web site offering compared travel times for car, bike and PT	Survey	Rapp (2003)	Investigate the utility, the credibility and the change of behaviour
AnachB.at: multimodal route-planner providing information about car, PT, bicycle and foot	A group of experts participated to interviews and compiled two surveys Testers of the service participated to focus groups and compiled a questionnaire. They were also mapped before, during and after the test phase	Götzenbrucker and Köhl (2012)	Investigate the profile of people willing to change according to the group of experts and the users' experience as well as the impact on their mobility
Traveline Scotland: a SMS, telephone and website multimodal planner	Qualitative (focus groups) and quantitative (questionnaire) survey	Hope and King (2006)	Investigate users' profile and behavioural change
Co-modal travel planner providing private and public modes of transport (bike, PT, walk) and information on estimated travel times, greenhouse gas emissions and monthly travel costs for each combination.	Survey before and after the use of the device (9 months' period)	Skoglund and Karlsson (2012)	Investigate benefits and behavioural change after using the service
Optymod'Lyon: a multimodal real-time information navigator for smartphone	Quantitative ex-ante and ex-post survey	Pronello et al. (2017)	Investigate the effects of the service on users

HYPOTHESISED SERVICES GIVEN BY POTENTIAL ATIS			
WISETRIP: international multimodal journey planner providing information on routes for specific segments of the trip	Laboratory simulation in order to develop the service	Zografos et al. (2012)	Investigate profiles according to their perception of time saving by using ATIS
Smartphone multimodal information system providing information about car and park-and-ride as well as car delay, cause of delay, park-and-ride cost and comfort level of rail transit	Stated preference survey	Gan (2014)	Investigate factors influencing mode choice
Integrated multimodal traveller information	Stated preference survey	Memon et al. (2017)	Investigate profiles and factors influencing mode change
Multimodal smartphone real-time information system providing also information about carbon emissions'	Stated preference survey	Brazil and Caufield (2013)	Investigate which information affects users

Study investigating the effects of mono-modal information systems on mode change

Study investigating the effects of multimodal information systems on mode change

Study investigating the effects of mono-modal information systems on route change

Study investigating the effects of multimodal information systems on route change

Other psychosocial constructs, such as the attitude towards the technology, were investigated in the cluster analysis. According the UTAUT2, the enthusiasm towards technology is a central element for using a technology, as also Pronello et al. (2017) confirmed concerning the use of a real-time multimodal information system. Instead, partly in contradiction with Pronello et al. (2017), the intention to use TUeTO may not be always correlated with the familiarity with technology. Thus, cluster 3 ("intention cluster analysis") and cluster 2 ("expectation cluster analysis") showed that a low enthusiasm towards technology can be correlated with the intention to use TUeTO for occasional trips. However, groups having the highest intention to use TUeTO for the most frequent trip ("expectation cluster 3" and "intention cluster 4") are always characterised by a relatively high level of enthusiasm towards technology, notably "expectation cluster 3".

About the attitude towards the ecology, Gaborieau (2016) found out, in his Ph.D. thesis, that people willing to use ATIS were characterised by a high mean value of GEB. The results of the cluster analysis were somewhat different and highlighted that the intention to use real-time information system was not correlated with a high score of GEB, but with the variable related to the benefit expected by using the service ("expectation cluster 5"). Nevertheless, this research is quite in line with the results of Gaborieau (2016), since "expectation cluster 1" and "intention cluster 1" showed that a low attitude towards the ecology is associated with a low intention to use ATIS in order to change travel behaviour for both occasional and most frequent trips.

The cluster analysis allowed to create two groups of people willing to change behaviour regarding the most frequent trip ("expectation cluster 3" and "intention cluster 4"), considered as the trip with the strongest habit. The first group is the largest one (N=22) and it is characterised by the enthusiasm towards technology. The second group, although smaller (N=13), is the most representative of those willing to use ATIS for their most frequent trip, since up to 13 participants ("intention cluster 4") would have the intention to shift mode by using real-time multimodal information system. The individuals willing to use TUeTO to change travel behaviour for the most frequent trip are males, low educated and could use an alternative mode for their most frequent trip. However, the impact of this group of people in terms of sustainability is low; although they represent 17.1% of the participants, only 38.5% of them use the car for the most frequent trip.

More generally, coherently with previous researches (Pronello and Camusso, 2011), the results of the thesis showed that no socio-economic variables and only

one travel habit ("BS subscription" for "intention cluster analysis") are significantly different among the clusters and only in the case of cluster analysis using the variable "intention".

Never used in literature to characterise population willing to use ATIS, the two variables related to the existence of potential travel alternatives for the most frequent trip showed interesting insights:

- regarding the cluster analysis using the latent constructs related to the intention to use TUeTO:
  - members of cluster 1 – characterised by the lowest score on the *intention* to use TUeTO for the most frequent trip – could use an alternative transport mode for their most frequent trip;
  - members of cluster 4 – characterised by the highest score on the intention to use TUeTO for the most frequent trip – do not have an alternative route;
- concerning the cluster analysis using the latent construct related to the *expectation* regarding the use of TUeTO, the statistical analysis reveals that members of cluster 4 – characterised by the lowest expectation regarding the use of TUeTO before the test – did not have alternative route and mode for their most frequent trip.

The distance travelled for their most frequent trip is another variable never used in the literature related to ATIS. The results of the "expectation cluster analysis" highlighted that people belonging to the cluster with the lowest average value of the intention to use TUeTO for the most frequent trip (cluster 1) travelled the longest distance for such trip. Instead, people belonging to the cluster with the highest expectation of benefits using TUeTO before the test (cluster 5) travelled the shortest distance for the above trip.

Both clusters where the intention to use TUeTO for the most frequent trip was high ("expectation cluster 3" and "intention cluster4") presented a low educational level, while literature showed they should be highly educated (Pronello et al., 2017, Götzenbrucker and Köhl, 2012). However, participants belonging to the "intention cluster 2" were in line with the literature since their intention to use TUeTO for occasional trips was associated to a high educational level.

Concerning the gender, the literature offers conflicting views. While some authors showed that women were more willing to use ATIS (Hope and King, 2006) and to change behaviour thanks to them (Götzenbrucker and Köhl, 2012), another author highlighted that men were more willing to change behaviour

thanks to ATIS (Memon et al., 2017). In our research, people from “intention cluster 3” are mainly women, while people from “intention cluster 4” are mainly males. However, such results should be carefully considered since other clusters with high intention to use TUeTO to change travel behaviour were not significantly different in terms of gender.

The combined use of qualitative and quantitative methods aimed at validating the clusters and at going in depth into the use of real-time multimodal information systems to change travel behaviour. However, the comparison of the clusters with the content analysis showed that the use of qualitative data to validate clusters may not be as reliable as expected. While six clusters were confirmed by the content analysis, that pointed out that the distributions of one variable of two clusters were not homogenous, the cross check failed for three clusters. Different factors may have affected the success of content analysis in validating quantitative data.

Some variables were more difficult to interpret, notably the variables extracted from the EFA (Tech_hedonist, TUeTO_intention and TUeTO_Expectation). The difficulty to analyse TUeTO_intention and TUeTO_Expectation, thanks to the use of the qualitative data, comes from the structure of latent constructs, made of specific questions related to the use of ATIS; instead, questions addressed during focus groups were more general. The focus group analysis showed that the interpretation of the latent construct Tech_hedonist cuts across the clusters, not allowing pointing out the differences between people showing a strong enthusiasm towards technology and those showing a lower one. In addition, the variable TUeTO_occa of the “intention cluster 5” was too specific compared to the general opinions expressed during focus groups discussions too be correctly interpreted.

Although focus groups discussions can provide reliable data as regards the use of ATIS to change travel behaviour, some participants may have expressed opinions that were not in line with their experience of the real-time information system. When gathering data, the annoyance and tiredness effects can affect database quality and reliability, as well as low response rates and missing data often compromise the sample representativeness. Although participants to the project generally expressed sincere opinions about the discussed topics, it is evident that some participants were influenced by the “social desirability bias” and might not have been honest regarding the use of TUeTO in order to be viewed favourably by others.

However, despite the low success of the use of qualitative data in validating the cluster analysis, the content analysis allowed to deepen the understanding about the reasons behind the use or not of real-time information systems, as well as about the change of travel behaviour by using them. In line with Bonsall and Joint (1995) and Pronello et al. (2017), participants belonging to the clusters having positives attitudes towards the use of TUeTO for occasional trips (after the test of the app) confirmed their view during the focus groups and explained that the device could be helpful during both their occasional trips to reach the destination where they never used to go before and for business trips.

Furthermore, focus groups discussions allowed defining more precisely what people mean as "occasional trips". While people generally referred to unfamiliar destinations, others would also use TUeTO occasionally during the most frequent trip when they are facing an unexpected event. Thus, people belonging to clusters 2 and 3 from the "intention cluster analysis" and cluster 2 from the "expectation cluster analysis" would prefer to use TUeTO in case of unexpected events and traffic disruption during their most frequent trip. Two of those clusters ("intention cluster 2" and "expectation cluster 3") are characterised by high scores of the intention to use TUeTO for occasional trips and by the lowest score of the attitude towards technology (after the test). Some individuals belonging to cluster 1 of both clusters analyses – characterised by low scores on the intention to use TUeTO – did not trust the travel solutions proposed by the app (after the test), issue largely dealt with in the literature.

In line with the literature, some participants belonging to the clusters having the highest level of expectation and the highest intention to use TUeTO before the test period explained that the device should be reliable to be used. Unlike Ferris et al. (2010), who highlighted that ATIS could be useful to increase safety at bus stop, some participants considered the safety issue from another point of view. In fact, before the test of the app, some participants belonging to the clusters with the highest intention to use TUeTO and with the highest level of expectation towards TUeTO would use the device to safely bike in the city.

The content analysis also allowed to discover issues never investigated in the literature regarding factors affecting the use of TUeTO to change travel behaviour. Thus, among the participants with a low willingness to use TUeTO to change travel behaviour, a few emphasised the non-feasibility of the proposed alternatives. Another opinion cutting among clusters pointed out the need to

develop public transport infrastructure before to deploy ATIS, in order to change travel behaviour.

Conclusions

Multimodal traveller information systems are a recent concept and nowadays are spread all over Europe, therefore there is a real need for the assessment of their impacts because many funds are being addressed towards this development, without a real knowledge on their effectiveness. The strategic goal of the thesis was to assess the effect on the travel behaviour of a real-time multimodal information system (TUeTO). To reach this objective, a market segmentation has been carried out to individuate a set of traveller's typologies using psychosocial constructs. To this end, an EFA was conducted on the data collected through the two questionnaires (one designed for the ex-ante phase of the Opticities project and the second ad hoc designed within the thesis work) in order to define the psychosocial constructs related to the sample of travellers recruited within the Opticities project. Then, a cluster analysis was carried out to define different categories of people according to their willingness to use real-time multimodal information system for changing travel behaviour and, notably, the travel mode. To this end, different psychosocial variables were used; some of them were latent constructs built thanks to EFA (TUeTOExpectation, TUeTO_intention, Tech_hedonist) and Rasch model (GEB questionnaire of Gaborieau (2016) in addition to new items designed for this Ph.D. thesis), while other variables were those related to questions designed for the ad hoc questionnaire (TUeTO_occa, TUeTO_Fre).

The innovative design of this thesis using both qualitative and quantitative data aimed at validating, determining and characterising the clusters created thanks to the cluster analysis method. While the cluster analysis allowed to define categories of people willing to use ATIS to change travel behaviour after the test period, the use of qualitative data was successful in deepening the understandings of such issue, but not in validating the two clusters analyses. Thus, the comparison of both types of data showed that:

- despite the success of the method in confirming part of the clusters and highlighting the weakness of other clusters, three clusters were not validated, demonstrating that qualitative data may not always be a reliable tool to confirm clusters analysis;

- the aim of using qualitative data was to verify the accuracy of clusters as well as to deepen the understanding of the variables; however:
    - the analysis of the attitude towards the ecology (GEB) was not possible since this issue was not investigated during the focus groups;
    - the latent constructs were more difficult to interpret because of the structure of those variables, composed of variables investigating different aspects of a specific issues;
    - the analysis of the latent construct on the attitude towards technology (Tech_hedonist) did not allow to understand why a person would be more enthusiastic by using technology than another one;
    - some participants might have answered to be viewed favourably by other participants regarding the use of TUeTO;
    - the analysis of the use of TUeTO to change travel behaviour was more successful and allowed deepening the knowledge on the use of ATIS.

As mentioned above, the use of qualitative data to confirm the clusters analysis was not efficient as expected in validating clusters obtained through the clusters analysis. However, the research method allowed to point out some suggestions which could be helpful when designing focus groups useful to check the clusters. It would be preferable (when possible) to design focus groups outline after the quantitative analysis in order to define questions fully in line with the variables obtained by the cluster analysis. In addition, the issues investigated during the discussions should be compatible with the quantitative variables in order to ease the comparison of clusters characteristics with the content analysis.

The use of psychosocial constructs measured before and after the test of TUeTO allowed better understanding the impact of the device on travel behaviour. The segmentation showed that:

- the EFA allowed creating two sets of latent constructs highlighting different psychosocial constructs: *intention*, relevant variable of the TPB, and *performance expectancy*, relevant variable of the UTAUT2;
- in contradiction with literature, the statistical analysis showed that people having the intention to use TUeTO before the test, were not willing to change behaviour after the test. The psychosocial construct *performance expectancy* might be a better predictor of the future behaviour since

people having low expectation regarding the use of the app before the test, are still not willing to use it to change travel behaviour after the test;
- a low attitude towards the ecology is associated with a low intention to use ATIS in order to change travel behaviour for both occasional and most frequent trips;
- other psychosocial variables were not as relevant as expected:
    - in contradiction with previous articles, people having the intention to use TUeTO were not car users, but rather PT users;
    - partly in contradiction with literature, the enthusiasm towards technology was not always positively correlated with the use of TUeTO. Moreover, the results of the "intention cluster analysis" showed that a high intention before the test can be related to a low attitude towards the use of technology;

As shown in chapter 2, the development of ATIS towards multimodal real-time information systems has been carried out with the idea that previous technologies were not enough efficient to create the expected change of behaviour. More precisely, the literature on ATIS puts forward the idea that people always make rational choices according to the available information and that the information provided by ATIS should challenge people habits. On the other side, according to the TPB, people are rational in the sense that they follow "*reasonably and consistently from their beliefs no matter how these beliefs were formed*" (Ajzen, 2015). In other words, the information provided by ATIS should be enough persuasive to change the behavioural, normative and control beliefs – predictors of the intention – to change behaviour.

Regarding the most frequent trip, despite 17.1% ("intention cluster 4", N=13) would shift mode using real-time multimodal information systems, few participants belonging to this cluster use a car for such trip (38.5%). Furthermore, before the test, people having the intention to use TUeTO were mainly PT users. Those results question policies aiming at deploying ATIS in order to induce a more sustainable mobility. In fact, since the objective of deploying ATIS is to divert people from car to more sustainable transport alternatives, our results show a low impact in terms of green mobility and, however, not as important as expected.

Regarding opinions of people willing to change mode for the most frequent trip, the content analysis did not allow better understanding such issue. However, focus groups have shown to be an opportunity to deepen the understanding of the

willingness to use ATIS and to change travel behaviour and some opinions are worthy to be considered before deploying ATIS. Before launching ATIS, policy makers should carefully consider the quality of the proposed service. Using ATIS, people expect an improvement of the quality of their travels (reduce the stress, increase the reliability, etc.) and, notably, of the most frequent one; thus, the reliability of the information is a prerequisite of ATIS use in the short-term, but also in a long-term perspective. Then, while cities try to divert people from car towards a more sustainable mobility, thanks to the use of real-time information, an information of low quality could affect the users who will abandon the device or who will not trust an information proposing a radical change of behaviour.

Focus groups highlighted the need to develop transport infrastructures in addition to the deployment of ATIS. According to this point of view, the success of ATIS in changing travel behaviour is dependent on the transport infrastructures, notably public transport systems (accessibility to stops, frequency, etc.) and bike infrastructures (BS accessibility and safety routes).

Finally, the usefulness of real-time information systems should be carefully questioned by policy makers; in fact, some opinions expressed during the focus groups highlighted that citizens might not need using such systems since they consider their choice as the best one, or since their accessibility to transport alternatives is limited. More precisely, ATIS should be considered as one of the solutions amongst the other ones to change travel behaviour, but not like “the” solution that will solve mobility issues. Instead, investment in transport-related services and infrastructures should be increased, in order to improve the accessibility to all urban areas, and large campaigns should be designed to educate people to sustainable mobility.

To conclude, although the control of the factors potentially limiting the outcomes of this research has been performed, the generalization of the results should be carefully made. This is mainly due to the relatively small size of the sample that is not representative of the population. However, despite the above limitations, the research can give a valid contribution to the knowledge about the effects of ATIS on travel behaviour and may be seen as a relevant reference also due to its wide literature review.

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Appendix I – Quotes used to validate clusters related to the benefits expected by using TUeTO

Quotes used to validate cluster 1

Io penso di sì. Penso di sì perché concatena, non so, anche tuo bus, treno a piedi e tutta una serie di cose messe assieme, può cambiarmi lo spostamento in modo intelligente. Può anche farci, farmi risparmiare del tempo molto probabilmente. Perché ci sono dei mezzi che io non conosco, se lui me li proponesse io li userei.

Piera C. - ex-post FG 3

Ma io anche se i dati del ToBike fossero più certi, siccome stanno aprendo un sacco di postazioni in più e si avvicinano sempre di più alle mie zone quello mi cambierebbe in realtà parecchio.

Valentina O. – ex-post FG 5

Domenico: E quindi… se questa app che comunque é multimodale, ma avesse la possibilità di con i bottoncini io scelgo due o tre tipi di mezzi…

Moderatrice: Facciamo mono e multi…

Domenico: mi eviterebbe di dover installare che so il TomTom piuttosto che Maps o Moovit

Domenico A. – ex-post FG 11

Sì io ho scoperto ad esempio un pullman della Fiat a una certa ora del mattino alle 7.05, solo quello, però facendocela vado in piazza Caio Mario, arriva molto diretto diciamo. Non lo sapevo, però una volta poi…

Marcello M. - ex-post FG 4

[…]l'idea è quella già esposta e la proposta delle alternative sicuramente dovrebbe essere rafforzata per permettere alle persone di poter cambiare le proprie abitudini e penso più da un punto di vista della pianificazione che non del tempo reale, nel senso probabilmente le abitudini le cambi se ho la

possibilità di pianificare e quindi se domani voglio andare in bicicletta perché ho deciso che magari mi fa bene, magari cambio e allora se posso pianificare il mio tragitto, avere le alternative e capire che strada fare, allora magari sono più propensa.

Alice - ex-post FG 9

Ho fatto critiche a iosa, non ho cambiato abitudini, ho contestato molte informazioni che dava e basta.

Riccardo G. – ex-post FG 2

Io che conosco la città so che per andare là dovevo fare un certo tragitto ma lui me ne faceva fare un altro.

Claudia P. – ex-post FG 10

Vincenzo: Sì. Cos'è cambiato dal punto di vista delle abitudini di movimento? Mah diciamo che l'app non mi ha aiutato molto.

Moderatrice: Non avevo dubbi. Lo intuivo.

Vincenzo: Rispetto alla mia abitudine di movimento, per cui non è cambiato sostanzialmente nulla.

Vincenzo M. - ex-post FG 9

Ma a parte che a me la bici, cioè a me ha suggerito vai fino alla metro, Sali in metro con la bici, che è vietato e poi continui in bici. Cioè non è fattibile.

Ilaria S. - ex-post FG 7

Se dovessi venire da Sud ci vuole poi mezzora per attraversare la città. Ci vorrebbe qualcosa che mi migliora…. Non c'ho treni da Poirino, c'ho solo il mezzo pubbli… il pullman, però gli orari sono uno ogni ora e dovrei trovare la coincidenza alla stazione per prendere il treno, oppure a Chieri prendere l'altra… per adesso io…

Francesco P. - ex-post FG 1

L'unica cosa è che lavorando nello stesso posto in città metropolitana, ci sono sempre meno soldi per la benzina per cui usiamo molto più i mezzi anche per i servizi esterni. Quindi prendo, che ho l'abbonamento prendo molti più pullman quando vado in giro per la città…

Claudio L. - ex-post FG 2

Quotes used to validate cluster 2

[...] nel mio lavoro o sono tappato in studio e non mi muovo oppure sono in giro e quindi devo improvvisare. […] a me interessa che mi dica: la fermata è a 300 metri arriva tale numero tra cinque minuti, piglialo. E quello sì funzione e a me mi ha fatto risparmiare dei giri.

Stefano F. - ex-post FG 4

Logicamente non per casa-lavoro perché i tempi sono risicati. [...] mentalmente userei la macchina e invece l'app ti dice: guarda che io ti consiglio il pullman perché i parcheggi sono tutti pieni, c'è un traffico della malora in quella zona là, io sarei più agevolato a a seguirla e ad attuare questo cambiamento.

Daniele S. - ex-post FG 9

Moderatrice: Ma nella scelta, per esempio, dei percorsi in bicicletta è una scelta che fai più tu individualmente oppure talvolta ti affidi all'applicazione per magari individuare la strada migliore?

Floriana: Ma più per curiosità alla fine perché anch'io ho i miei percorsi quindi ormai faccio quelli, però magari cercavo di vedere…

Moderatrice: Forse più sugli spostamenti occasionali?

Floriana: Sì, sì, sì, magari quelli in università no perché si va un po' di fretta, però mi capitava altri percorsi che comunque conoscevo altre vie, altre… magari si allungava un po' di più però alla fine mi ha permesso di conoscere un po' più la città.

Floriana D. - ex-post FG 15

Cambiare le abitudini personalmente io sono una molto statica, molto abitudinaria, per cui difficilmente, anche se per gioco ogni tanto mi sono messa a vedere.

Anna L. - ex-post FG 6

Non le ho cambiate, sono quelle, vado liscia, liscia… al massimo per [***] un'altra però… sono sempre due strade che più o meno faccio e non trovo traffico, mi trovo bene e quindi continuo a usare quella. L'app non mi ha modificato la vita.

Luana M. - ex-post FG 5

Anna: Ho provato a sperimentare un percorso alternativo che mi era stato suggerito però l'ho trovato più lungo e alla fine ho continuato sempre così con quello solito.

Moderatrice: Quindi non è cambiato come situazione.

Anna: Non è cambiato niente anche perché l'auto la uso poco, ecco, proprio così per la necessità di arrivare lì alle 8 di mattina, è complicato con i mezzi pubblici.

Anna I. - ex-post FG 8

[...] ho provato anche a vedere se fosse possibile appunto con mezzi pubblici ma effettivamente non era proprio fattibile, ho provato qualche diciamo percorso alternativo che dava l'applicazione usando la macchina necessariamente per cui questo è

Gianluigi G. - ex-post FG 11

Forse per quanto riguarda il mio, la mia idea sì perché non conoscendo Torino alla fine mi lascio un po' guidare dall'applicazione, magari cambio il percorso faccio nuove… cioè una sperimentazione più mia per conoscere la città. Magari chi già è di Torino fa quel percorso, conosce quello e quindi va.

Floriana D. - ex-post FG 15

Moderatrice: Ma nella scelta, per esempio, dei percorsi in bicicletta è una scelta che fai più tu individualmente oppure talvolta ti affidi all'applicazione per magari individuare la strada migliore?

Floriana: Ma più per curiosità alla fine perché anch'io ho i miei percorsi quindi ormai faccio quelli, però magari cercavo di vedere… Moderatrice: Forse più sugli spostamenti occasionali?

Floriana: Sì, sì, sì, magari quelli in università no perché si va un po' di fretta, però mi capitava altri percorsi che comunque conoscevo altre vie, altre… magari si allungava un po' di più però alla fine mi ha permesso di conoscere un po' più la città.

Floriana D. - ex-post FG 15

Ma anche se in realtà comunque anche se funzionassero, in realtà se ci fossero i dati esatti, io ogni santissimo giorno guardo l'applicazione GTT, perché comunque ho bisogno di sapere, o almeno vado alla palina a fare… perché ho bisogno di sapere tra quanto arriva, per cui non lo userei in maniera occasionale se i dati fossero corretti.

Federica G. - ex-post FG 5

Ma poi riaggancio un attimo a quello che si diceva prima, la scelta tra le varie modalità di trasporto può avvenire però è anche abbastanza vincolata, cioè se io ho un abbonamento al mezzo pubblico, dovrei anche avere in tasca anche l'abbonamento al bike sharing, l'abbonamento al car sharing, la disponibilità della macchina, però è una cosa che non tutti hanno, quindi alla fine già il ventaglio si restringe.

Paolo . - ex-post FG 5

Quando uno parte da fuori e arriva in città inizia a sclerare, perché non sa dove mettere la macchina, quindi secondo me se avesse un qualche cosa che funziona efficiente, secondo me lo usi.

Elena C. - ex-post FG 4

Ma diciamo che se funziona bene probabilmente in termini di tempo potrebbe essere utile. Cambiare le abitudini personalmente io sono una molto statica, molto abitudinaria, per cui difficilmente, anche se per gioco ogni tanto mi sono messa a vedere, vediamo se voglio andare da qui a lì, da casa mia a casa di Beppe, ci ha fatto un percorso veramente assurdo, ho detto guarda non ti vengo a trovare perché Tu&To mi ha detto che devo andare prima a nuoto a Palermo e poi dopo arrivo a casa tua, per cui non…

Anna L. - ex-post FG 6

Ho sempre viaggiato per più di trent'anni in macchina per cui dal mese di marzo, fine marzo, ho iniziato a viaggiare con treno e metro, quindi l'utilizzo di questa applicazione, cioè l'ho usata anche se mi dà dei percorsi che non ho mai fatto, perché a mio... provando, sperimentando, col treno mi fa andare fino al Lingotto e poi tornare indietro, che in realtà io scendo a Susa e prendo la metro… quindi l'opzione metro è difficilmente utilizzata, cioè la dà se tu metti la stazione Spezia, ti dà la metro altrimenti non la dà… anche il mio giudizio non è tanto positivo, l'ho usato anche come percorso automobilistici, anche volte solo così per fare delle ipotesi di trasferimento ecc. su percorsi che magari conosco. Utilizza in alcune fasce orarie dei percorsi lunghissimi, no non sono sempre i più brevi, a discrezione probabilmente sua di non so quale calcolo, in base magari al traffico, sicuramente, però l'abitudine a fare un certo tipo di itinerario per me è vincolante, è qualcosa… se no faccio il giro dell'oca, aspetto due semafori, cioè… e quindi non ha modificato alcune abitudini di spostamento. Diverso è per percorsi nuovi dove non conosco e quindi l'ho usato senza andare a

calcolare che poteva essere magari le strade un po' più lunga un po' meno lunga eccetera.

Marialuisa R. - ex-post FG 6

Io sono disponibile a cambiare, sono disponibile a cambiare qualsiasi abitudine, ovviamente tenendo conto dei miei interessi, degli interessi.

Alessandro S. - ex-post FG 6

The non-enthusiasm towards technology

Anna: Io sono poco tecnologica, preferisco comunque tutti i vecchi sistemi anche se comunque ormai in tante cose sei dipendente dalle varie funzioni. Che comunque non utilizzo loro ampia gamma dell'offerta che c'è, proprio perché, ripeto, non piace più di tanto, cioè se posso fare un pagamento non col telefono, piuttosto lo faccio dal computer, ma dal telefono non so, c'è qualcosa che mi blocca ora di più, sarà che o non lo uso da molto comunque, che poi alla fine uguale… ma è un po' così.

Anna L. - ex-ante FG 5

Anna: [...] peccato che diventa un pochino troppo invasiva, perché trovo che ci passo troppo tempo io con lo smartphone oppure con il computer. Anche nel tempo libero, per esempio, tu torni a casa e fatte le cose, governato la casa, hai ancora lì dei compiti da correggere, però devi sistemare tutte le mail che cominciano ad arrivarti, perché da noi poi è diventato così… non è vero che torni e finisce il tuo lavoro, a casa devi ancora rispondere a tutte le e-mail e questa cosa non ti dà più il tempo libero che avevi una volta cioè tu lavori, lavori sempre, lavori di domenica, lavori a tutte le ore, ho lo chiudi e lo metti via, però poi ti viene in mente di dire ma poi mi scade quella cosa lì, io devo comunicare quella data a… devo ricordarmi.

Anna I. - ex-ante FG 6

Federica: sì, devo avere una reperibilità, se segui i progetti devi stargli dietro… appunto per me è un lavoro perché io lavoro con il web, cioè sto sul web per lavoro, paradossalmente io ho facebook sempre aperto, per controllare se le applicazioni funzionino, ma non leggo un messaggio, ho una vita su facebook pari a zero, e lo uso solo per vedere se le cose che abbiamo fatto funzionino e lo uso nei weekend…

Moderatore: scusa non ho capito, lo usi? Federica: lo uso solo nei weekend praticamente

Federica: cioè per quello per cui è stato fatto, però a me la tecnologia piace, mi piace vedere come viene, non so, sviluppi un'applicazione quindi vedere come vengono utilizzate

Federica G. - ex-ante FG 8

Federica: non lo so… nel senso sì obiettivamente che ci sono una serie di aspetti pericolosi però a me piace vedere di più il lato positivo e funzionale per cui appunto è vero i giovani sicuramente i bimbi che adesso hanno i tablet giocano con i tablet, sono una cosa che ti lascia perplesso, però forse non è la cosa più rischiosa a cui genitori magari gli espongono.

Federica G. - ex-ante FG 8

Simone: Purché non diventi una, faccio riferimento soprattutto al telefono, non diventi una dipendenza nel senso che, penso che il rischio potenzialmente potrebbe diventare troppo invasiva, ovviamente dipende dalla vita di chi lo usa lo strumento, mi piace, ho fiducia nella tecnologia finchè rimane uno strumento che si usa consapevolmente, mi piace cercare di limitarlo a quella funzione lì.

Simone D. - ex-ante FG 5

Luigi: io per adesso per acquisti pagamenti non ne faccio uso, compro biglietti ma non le faccio mai i pagamenti dallo smartphone, li faccio dal pc; per il momento si, ho ancora qualche dubbio, ma non so se è differente usare un pc oppure usare uno smartphone, più il timore di perderlo che me lo rubino, allora che possono utilizzare quello che…

Luigi G. - ex-ante FG 9

Daniele: Io sono appassionato di tecnologia, la uso da tempo, faccio acquisti on-line direttamente con la carta di credito con paypall. A parte il lato il navigatore per me rimane molto utile perché io amministro un blog, un gruppo di acquisto solidale, quindi iscrizione , gestione dei calendari condivisi, quindi io faccio tutto dallo smartphone.

Daniele S. - ex-ante FG 7

Alessandro: Ne faccio un uso abbondante, lo trovo molto comodo e utile per un'infinità di cose. Guardo la posta elettronica perché… guardo anche le notizie, libri, economia e lo uso anche per spostarmi.

Alessandro S. - ex-ante FG 13

Daniele: Io sono appassionato di tecnologia, la uso da tempo, faccio acquisti on-line direttamente con la carta di credito con paypall.

Daniele S. - ex-ante FG 7

Federica: francamente con tutti tracciamenti che ci sono, non fa la differenza…non è magari l'ultimo dei problemi magari l'ultimo dei tracciamenti…

Federica G. - ex-ante FG 8

Quotes used to validate cluster 3

The use of TUeTO for the most frequent trip in order to change travel behaviour

Moderatrice: Quindi il cambiamento è più facile, insomma basato sulla fiducia il cambiamento ci sta, l'abitudine non è così forte mi dite.

Pasquale: No sono abituato a cercare sempre alternative la mattina, quindi se c'è qualcuno che me lo dice meglio.

Pasquale B. - ex-post FG 9

Moderatrice: Quindi la potenzialità di cambiamento c'è.

Luisa: […] con informazioni veramente precise ecco, sui mezzi pubblici, perché se poi io mi trovo alle fermate e il pullman non passa sono fregata.

Luisa M. - ex-post FG 8

Arrivando da fuori Torino, da Lanzo io credo che per me sarebbe più comodo a livello economico, perché è una bella spesa arrivare con la macchina dalle valli di Lanzo a qua, per cui se ci fosse un buon servizio con i mezzi pubblici sicuramente risparmierei di soldi e anche di nervosismo insomma, perché il traffico porta sempre un minimo di stress.

Dora B. - ex-post FG 6

[…] purtroppo la mia vita è monotona, quindi non è che devo andare chissà dove, però io sì. Ma mettiamo il caso che io debba andare un sabato pomeriggio che ne so, da una parte che non è quella, anche avere un paio di scelte in cui posso inter… che ne so… mi dice prendi il pullman fino a lì che tanto hai là vicino Enjoy, a me è utile. A me sarebbe davvero utile, non è una cosa così…

Andrea B. - ex-post FG 11

Io con tutti i se se se se… sarei assolutamente disponibile a cambiare le abitudini con una piccola variante, farei una piccola modifica che è questa, io sono anche di memoria corta, quindi mi desse la possibilità di attivare o non attivare la notifica o le notifiche, dove mi dice oggi c'è lo sciopero quindi puoi, pensa di poter fare… domani è San Giovanni, il traffico è limitato, gli orari sono questi.

Micaela L. - ex-post FG 9

Chiara: […] Quella è stata una stupidaggine, ma comunque io quel mezzo non l'avevo mai visto e mi portava comunque vicino al Lingotto che… io penso che se fosse tutto concatenato bene potrebbe servire.

Davide: Sì, anche io credo che stessa, stesso discorso… anzi magari si potrebbe ancora di più enfatizzare la questione dell'effettivo risparmio in termini temporali o anche di costo del carburante che viene cio…

Davide C. - ex-post FG 3

Sì, io ho trovato ad esempio che, per esempio anche il confronto tra servizio ferroviario metropolitano e GTT può essere utile, certe volte col servizio [ferroviario] metropolitano si arriva molto più rapidamente che con il pullman, quindi l'ho trovato utile ecco anche in quel senso.

Giovanni B. - ex-post FG 3

No per me far cambiare metodo di spostamento non credo. Però sarebbe utile perché avrei, cioè se funzionasse bene, ci fosse tutto al completo, quindi car sharing, bike sharing, tutto completo, avrei un'unica app da poter utilizzare anziché averne più di una. Quindi la comodità dal mio punto di vista sarebbe quella, però da qui ad arrivare a cambiare comportamenti forse dovrei cambiare io il… il mio attuale stile di vita o i miei attuali movimenti. Allora in quel caso sarebbe utile, ma attualmente no.

Marco P. - ex-post FG 1

[…]quindi da Druento mi sposto per fare quei 10/12 km. Il modo di trasporto utilizzato normalmente è l'automobile, perché a volte mi serve anche per spostamenti intermedi e anche abbastanza rapidi e poi comunque per arrivare a Druento abbiamo un solo pullman e appunto poche stazioni della bicicletta.

Marco P. - ex-post FG 1

Uso la macchina perché coi mezzi pubblici ci va un'ora e un quarto, devo cambiare tre pullman, cioè nonostante sia tre chilometri da casa però fanno un giro assurdo, quindi l'ho usato come navigatore, e poi nel tempo libero, con lei perché chiaramente ci muoviamo insieme, nei mezzi pubblici che tra l'altro ultimamente li sto prendendo anche di più, soprattutto per andare in centro. Se posso evitare la macchina la evito.

Muriel G. - ex-post FG 9

[...]però diciamo che al 90% uso i mezzi pubblici e la metro che quindi per certi versi… nel senso dell'applicazione non… mi è stata…

Nadia D. - ex-post FG3

Moderatrice: Funziona solo di fatto su Torino dove c'è veramente la multimodalità. Questo, questo è evidente. Chi non mi ha ancora risposto? Voi due più o meno sul cambiamento comportamentale? Vi cambia la vita?

Francesco P.: Ma io muovendomi sia in macchina, sia con i mezzi pubblici sia con la bici, devo cambiare ancora di più? Non so come poter cambiare…

Francesco P. - ex-post FG 1

E magari forse per chi ha degli spostamenti proprio abitudinari funziona meno, ma non guarda neanche altre app, per degli spostamenti che fai tutti i giorni non guardi nessuna applicazione della mobilità.

Vittoria V. - ex-ante FG8

The non-enthusiasm towards the use of technology

Sono poco tecnologica ma la tecnologia che uso la uso perché mi serve.

Muriel G. - ex-ante FG 12

Lo uso come telefono, non pago le chiamate, per contenere i costi perché non sono un granché tecnologico, perché a casa moglie e figli ce lo hanno tutti, poi abbiamo Internet e quant'altro, diciamo che ce l'ho da tre anni, però lo utilizzo come telefono.

Franco M. - ex-ante FG 17

[...]dunque io ho tutti i social network possibili e immaginabili, adoro la tecnologia, secondo me ha una potenzialità enorme [...]

Andrea B. - ex-ante FG 15

No, mi fa paura, sono terrorizzato già dai servizi televisivi che fanno vedere che sono dipendenti, però cioè è una cosa che adesso viene trasportata anche sugli smartphone, quindi se prima si vedevano quelli lì che giocavano tutto il giorno, adesso uno gioca a casa e rimane pure nascosto, quindi è una via…

Giovanni B. - ex-ante FG 15

Talvolta è invasivo, come dice lui, in maniera passiva. Per me non è invasiva, perché io sono qua magari a bere una birra con lei e ci sono tre miei amici "tididi-tididi" quindi cioè invade il mio spazio sociale nel senso esci a prendere una birra...

Valentina T. - ex-ante FG 16

[...] poi per quanto riguarda la privacy sto attento a non dire cose troppo importanti, cioè se attacco nel telefono la tessera del supermercato il supermercato sa che ho comprato il latte non me ne importa molto, cerco anche tramite i social network di non andare a dire troppe cose private.

Francesco P. - ex-ante FG 16

Non so quanto determinate applicazioni riescano a carpire dei tuoi gusti o dei tuoi consumi ecco su questo non sono ferrata, appunto quanto il supermercato possa capire quanto e come consumo. Però non mi sento tanto in pericolo ecco. Secondo me, il giusto bilancio tra cosa voglio far sapere al mondo...

Valentina T. - ex-ante FG 16

Quotes used to validate cluster 4

<u>The benefits expected by using TUeTO before the test</u>

[...]io lo trovo un po' difficile sullo spostamento quotidiano, nel senso che è già ottimizzato, è molto più facile che questa valenza ce la abbia sugli spostamenti sporadici, perché allora li devo pianificare, devo capire, come fare, quanto tempo ci metto, ma questo nel mio caso perché io ho uno spostamento quotidiano un po' limitato, immagino, che per tutti non sia così, però per quanto riguarda me io lo vedrei molto più utile per gli spostamenti sporadici

Daniela C. - ex-ante FG 10

Cioè lui ha detto io lo userei per quando non so dove andare. Quindi vuol dire che per gli spostamenti quotidiani…

Luis S. - ex-ante FG20

Sono abbastanza d'accordo sul fatto che comunque uno lo può utilizzare ovviamente non sul percorso che fa tutti i giorni, che magari sa già, però nel momento in cui si ritrova in quel momento senza macchina o nel caso in cui uno deve fare una commissione particolare quindi in questa occasione è assolutamente utilissimo, anche nel tempo libero, nel programmarsi il tempo libero. Quindi oggi ho deciso di, almeno parlo di me ovviamente, andare in bicicletta in centro magari ci sono le piste ciclabili in questa zona qua dove mi è più agevole, piuttosto che oggi voglio prendere la metro e quindi conviene fare questo percorso qua piuttosto che quest'altro. E poi anche a maggior ragione in un posto che non conosco.

Silvia - ex-ante FG 5

Sì, ma con un margine d'inventario nel senso testerei prima il prodotto per capire veramente se è affidabile perché proprio ciecamente no, non mi fiderei.

Morena C. - ex-ante FG 11

Anche se cambio al lingotto è sempre l'incognita perché poi bisogna prendere dei treni regionali che arrivano da Genova o da Cuneo, da qualche parte… per cui, le App che danno queste informazioni per fare questo genere di cambi sono benvenute, allora vediamo questa come si comporterà

Bruna C. - ex-ante FG 2

Innanzitutto sarei meno stressato, credo, ad aspettare mezz'ora un pullman, però credo che forse sia più sensato che chi lavora, chi è adulto perché effettivamente noi giovani vabbè non è che abbiamo sempre magari a volte usciamo per andare dall'amico, però per chi lavora immagino già esce stanco da lavoro magari si vuole evitare quella coda di 20 minuti di traffico quindi…

Andrea M. - ex-ante FG 11

Cioè posto che nel mio caso non c'è un'alternativa al treno. L'alternativa è la macchina, non c'è un pullman che in alternativa mi porta a Torino, non esiste, quindi io sono vincolata. Ma pure se ci fossero le alternative […]

Francesca S. - ex-ante FG 18

The use of TUeTO for the most frequent trip in order to change travel behaviour after its test

Quello che è cambiato è che ho fatto l'abbonamento al ToBike apposta anche per poterlo utilizzare con l'applicazione, con scarso entusiasmo, ma non per colpa dell'applicazione, ma per il servizio di ToBike che sulla mia tratta, […]… arrivi lì e le biciclette le trovi rotte e quindi… ho provato solo questo tratto qua e un po' mi è dispiaciuto perché anche se magari l'app ti diceva più o meno azzeccando quante bici c'erano, quanti posti c'erano però arrivavi e le biciclette erano inutilizzabili, quindi non per colpa dell'app, ma per colpa del servizio. E quindi spero che uno che amplino un po' le postazioni bike sharing, e poi fare un pochino più attenzione anche, che si attrezzino per… perché è veramente [***] e diversamente non è cambiato, a parte questo non è cambiato altro.

Christian C. - ex-post FG 10

Ammettendo che funzioni tutto bene, al meglio possibile, secondo me per cambiare la cultura bisognerebbe avere anche i servizi di base che funzionino bene, nel mio caso pensando per andare da Piossasco a Caselle si parla da anni di fare una linea ferroviaria che va da Pinerolo a Caselle. Se non c'è… se ci fosse quella io andrei con la macchina ad Airasca, e il mio problema è risolto. Ma se in generale i mezzi pubblici non sono ottimizzati,

Luis S. - ex-post FG 9

[…] il mio utilizzo è stato prevalentemente con, per l'automobile, non è cambiato assolutamente nulla e quindi il mio utilizzo è stato costante per tutta la sperimentazione.

Claudio R. - ex-post FG 7

Bruna: Ma infatti è quando, cioè se tu sai che non puoi fare una cosa, però ti dà le informazioni sulle alternative in tempo reale è utile anche per gli abitudinari eh.

Moderatrice: È pensato anche per quello: c'è lo sciopero, c'è un guasto, c'è un incidente, dovrebbe darti un alert dicendo guarda che…

Bruna C. - ex-post FG1

[…] però in effetti io cambierei le mie abitudini, soprattutto nel week end.

Silvia - ex-post FG 9

No su quello no perché appunto facendo una strada fuori Torino, adesso non dovendo più andare in Torino a recuperare i ragazzi, però magari alla sera o quando esco con le amiche o vado in centro, oppure nel weekend la userei se mi potessi fidare

Silvia - ex-post FG 9

E l'ho utilizzata soprattutto quando cambiavo, cioè dovevo andare da qualche parte che non vi era… dove non c'era un tragitto che mi era comune, quindi provavo a vedere che cosa mi suggeriva e ho trovato alcune difficoltà che alla fine dicevo vabbè andiamo.

Daniela G. - ex-post FG 5

Nel mio caso io la macchina già non la uso, cioè la uso per un pezzetto di strada alla mattina per arrivare al treno poi dopodiché diciamo mi muovo già con i mezzi pubblici e se funzionasse potrei sfruttarli meglio, insomma, avere un'idea migliore… poi vabbè i treni mancano quindi non dipende dalla app e quindi quello mi rassegno, non ci sono… però quando poi arrivo a Torino effettivamente, non tanto per gli spostamenti, per lo spostamento quotidiano che è quello avviene a piedi, però più che altro per gli altri spostamenti di lavoro che appunto non essendo io di Torino non conosco, non so dove è quel posto, non so dov'è quell'altro, effettivamente cercare tutto in un luogo, potrebbe costituire un risparmio di tempo, e adesso invece chiedo a TueTo poi chiedo ai colleghi, loro lo sanno. E mi fanno… E li stresso un po'… sì questo a me farebbe comodo, se funzionasse insomma sicuramente.

Francesca S. - ex-post FG 6

Devo dire che già sinceramente sul percorso abituale come dicevamo prima, tendenzialmente non lo consulterei perché io la consulto vabbè a scopo della sperimentazione, quindi è chiaro che l'ho fatto ad hoc, però la consulto solo, soprattutto se sono in attesa alla fermata o se sono su un mezzo, cioè è proprio lì che ne approfitto per fare dei test. Non la vedo come un qualcosa che mi permetta di risparmiare tempo.

Valentina R. - ex-post FG 10

Quotes used to validate cluster 5

<u>The benefits expected by using TUeTO before its test</u>

Ma io lo utilizzerei soprattutto quando vado verso il centro di Torino, che la considero la zona più a rischio per il traffico e anche per quanto riguarda le piste ciclabili, tornando alle biciclette, perché a Torino la nostra realtà è molto carente. Quindi è un po' un deterrente per usare la bicicletta. Il problema è che non la prendo perché ho paura di rischiare di finire male. Magari prendo qualcos'altro e lascio a casa la bicicletta.

Giancarlo S. - ex-ante FG 5

Elena: Sì sicuramente, soprattutto per le strade, sapere se c'è la pista ciclabile soprattutto in relazione agli orari può essere utile, perché…

Giovanni: In che senso rispetto agli orari scusi?

Elena: Perché di notte magari se c'è una pista ciclabile allora lo faccio, o magari tendenzialmente poi quello che uno fa è non lo so cambia percorso e fa delle vie meno trafficate, evita di andare su…

Elena P. - ex-ante FG 23

Elena: Non solo di tempo percorso, ma anche di tempo di consultazione. Ad esempio per venire qua ho dovuto scegliere se prendere la macchina o prendere il pullman. Allora sono andata sul sito della Gtt, sono andata sul sito di Via Michelin, poi mi sono dovuta fare il conto del parcheggio a pagamento invece se…

Intervistatrice: Fosse integrato…

Elena: Eh, se ci fosse una cosa che fa tutte queste cose insieme non bisognerebbe collegarsi su mille siti.

Elena S. - ex-ante FG 11

Sì, ma anche perché il treno parte a una determinata ora e da lì fondamentalmente uno si… non si scappa. Quindi le possibilità sono due: o vai a piedi e sai che ci metti tot minuti o aspetti il pullman, sperando che non sia già passato. Quindi tu puoi aspettare il pullman finché non guardi l'orologio e non dici: e adesso cosa faccio? Sì, vado a piedi se riesci e quindi… questa applicazione potrebbe essere veramente utile nel dire: guarda che tu hai queste possibilità per arrivare a quest'ora in questo posto e tu scegli.

Gianni B. - ex-ante FG 19

Secondo me, secondo me l'utilità sta proprio in quello, cioè prima di partire, prima di uscire da casa io devo fare una verifica e se il mio percorso abituale, che magari normalmente è il primo della lista c'ha qualcosa di

strano ho la possibilità di utilizzare gli altri, cioè secondo me l'utilità potrebbe essere questa, quella che io vedo più quotidiana diciamo, […]

Amerigo S. - ex-ante FG 22

Moderatore: invece tu Federico pensi che potresti cambiare le tue abitudini?

Federico: Ho sempre fatto quelle strade con meno traffico, quindi volentieri…

Moderatore: però per quanto riguarda accompagnare la bambina?

Federico: è ancora piccola, se devo accompagnarla lì, che poi tra l'altro da una parte il tragitto è talmente breve che pensi di non utilizzarlo nemmeno perché per 2 km, 2 km neanche in linea d'aria ma percorsi… è quella strada, quella faccio, non c'è traffico non c'è nessuno non ci sono semafori…

Moderatore: cioè per accompagnarla dai nonni…

Federico: si per accompagnarla da loro, da una parte potrebbe anche servire, perché come al solito io dove trovo verde giro e dove vedo traffico devi, potrebbe tornarmi utile poi la mattina che non la porto dai nonni e che mia moglie …

Moderatore: però non in un'ottica di versione modale, quindi di cambiamento del mezzo, il fatto di dover accompagnare la bambina è un vincolo per la scelta modale, è così?

Federico: Sì, so che si può vivere benissimo senza e potrei andare… la accompagno in pullman poi riprendo il pullman però …

Moderatore: si però considerando la tua vita reale …

Federico: Si poi sarebbe fattibile … non ho voglia, è comoda… ho il parcheggio, la ZTL, capisco i problemi di inquinamento, il traffico, però è comoda.

Federico S. - ex-ante FG 8

Sì, poi diciamo che potrebbe essere efficace in alcune circostanze, ma non come abitudine per quanto mi riguarda. Se appunto capita la domenica in cui decido di andare in montagna in treno, allora, lo vedo più dal punto di vista dell'utilità che del risparmio di tempo, quindi ho bisogno di sapere che la domenica alle 5.40 del mattino, alle 6 del mattino, che pullman arriva per permettermi di arrivare in stazione e prendere il mio treno. Sì, non tanto dal punto di vista del risparmio di tempo perché la vedrei proprio come un, cioè come un'alienazione, un applicativo alienante…

Carmen F. - ex-ante FG 20

Moderatore: Potrebbe farvi cambiare abitudini di viaggio soprattutto cambiare il mezzo di trasporto abituale, potrebbe, indurvi a cambiare il proprio le abitudini attuali? Le abitudini sono molto influenti per molte persone, proprio perché la mancanza di informazioni inducono a fare preferire quello che già si conosce, il fatto che con questa applicazione vediamo una panoramica sulle alternative possibili, pensate, che possa farvi cambiare un po' abitudini, ad esempio chi è automobilista che sa che ci mette 12 minuti con quella strada lì e non sa quando arriva il pullman, e allora non lo prendo…Cosa ne pensate?

Yari: dipende dall'affidabilità

Simone: anche secondo me.

Yari - ex-ante FG 7
Simone M. - ex-ante FG 7

The enthusiasm towards technology

No no io la uso, io l'ho introdotta e non essendo più neanche giovanissimo ho eliminato bollette, non vado più in banca, insomma dovunque ho individuato l'opportunità di semplificazione l'ho usata, sì.

Amerigo S. - ex-ante FG 22

Sì, io lo smartphone lo uso come sostituto del computer perché non sono mai a casa quindi la mail… io gestisco tutto dallo smartphone. Non ho tante applicazioni e sono abbastanza assuefatta ai social network, sono sempre abbastanza collegata.

Elena S. - ex-ante FG 11

Uso moderato dei social nel senso che nello smartphone non attivo le notifiche, Cioè non ho il programma LinkedIn del programma facebook , quando ci vado io vedo quello che è successo, ma non voglio che mi vibri perché ho messo la foto due anni fa è qualcuno mi dice che le piace …cioè non ci manca solo quello!

Yari - ex-ante FG 7

Quindi dal mio punto di vista c'è un'utilità, è sicuramente utile, ma sento il peso di questa cosa, sia dal punto di vista della privacy che sicuramente non esiste più, perché io scrivo una mail e c'è un termine particolare e subito dopo pubblicità…E questo mi ha inquietato all'inizio, poi dopo non ci fai più caso, però effettivamente la privacy non esiste […]

Simone M. - ex-ante FG 7

Appendix II - Quotes used to validate clusters related to the intention to use TUeTO

Quotes used to validate cluster 1

The non-intention to use TUeTO to change travel behaviour for occasional and most frequent trip

Ho fatto critiche a iosa, non ho cambiato abitudini, ho contestato molte informazioni che dava e basta.

Riccardo G. - ex-post FG 2

[…]a volte dà dei percorsi per cui il fatto del mezzo minuto sembrano non plausibili, ecco se uno ha questa impressione di non plausibilità si fida poco.

Vincenzo M. - ex-post FG 9

Sì io ho scoperto ad esempio un pullman della Fiat a una certa ora del mattino alle 7.05, solo quello, però facendocela vado in piazza Caio Mario, arriva molto diretto diciamo. Non lo sapevo, però una volta poi…

Marcello P. - ex-post FG 4

Ma a parte che a me la bici, cioè a me ha suggerito vai fino alla metro, Sali in metro con la bici, che è vietato e poi continui in bici. Cioè non è fattibile.

Ilaria S. - ex-post FG 7

Sulla multimodalità non vedo questa grande utilità perché, almeno per l'uso che ne faccio io ho percorsi abbastanza standard, quindi già conosciuti, mi interessa più l'orario della situazione contingente diciamo, penso che quando arriva, quale mi conviene prendere… però dire prendo un pezzo di bici, poi faccio un pezzo di un'altra cosa, non la vedo molto praticabile ecco.

Marcello P. - ex-post FG 4

[…]l'idea è quella già esposta e la proposta delle alternative sicuramente dovrebbe essere rafforzata per permettere alle persone di poter cambiare le proprie abitudini e penso più da un punto di vista della pianificazione che non del tempo reale, nel senso probabilmente le abitudini le cambi se ho la possibilità di pianificare e quindi so domani voglio andare in bicicletta perché ho deciso che magari mi fa bene, magari cambio e allora se posso pianificare il mio tragitto, avere le alternative e capire che strada fare, allora magari sono più propensa.

Alice - ex-post FG 9

Sì, poi comunque sarebbe interessante perché comunque accumulerebbe GTT, Trenitalia, il parcheggio, cioè ToBike il car sharing, voglio dire è un intreccio di cose molto interessante perché potrebbe farti risparmiare del tempo, però è chiaro che se non funziona.

Chiara P. - ex-post FG 3

<u>The non-enthusiasm towards technology</u>

Ma, secondo me, serve a poco lo smartphone, infatti non ce l'ho. Uso il suo giusto in quelle occasioni, non so, sei in montagna devi sapere qualcosa su Internet. Poi in montagna prende poco, prende quali niente. Se non fosse… principalmente le applicazioni sono o dei giochi o WhatsApp che van bene per i giovani, per chattare, però onestamente non vedo questa grossissima utilità.

Marcello P. - ex-ante FG 11

Ricordiamoci che loro sono nati con il computer e noi invece lo abbiamo imparato, una cosina grossa così della casio, sarà stato il 1990 era, adesso lo uso tutti i santi giorni. Della tecnologia bisogna non essere schiavi. Bisogna che tutta la tecnologia, con il mondo informatico, sia al nostro servizio, non che noi dobbiamo essere al servizio degli altri per cui dobbiamo andare a comperare attraverso Internet.

Franco F. - ex-ante FG 2

Piera: Io da 2-3 anni. Lo utilizzo tutti i giorni direi, lo utilizzo molto

Piera C. - ex-ante FG 10

Piera: Io lo trovo indispensabile oramai, per gli acquisti come biglietti del treno, spettacoli, varie applicazioni, c'è ad esempio radio rai, c'è per la

musica, ce ne sono ormai molteplici, le uso tutte, dalla lettura del quotidiano, adesso non mi vengono in mente tutte, ma comunque lo trovo sicuramente indispensabile, quindi lo apprezzo tantissimo e mi piace proprio. Mi piace avere sempre tutto a portata di mano, sotto mano.

Piera C. - ex-ante FG 10

Simona: ma io ho un computer, un tablet e uno smartphone. In realtà li ho perché mi piacciono e li utilizzo tantissimo fin quando non li ho conosciuti a fondo e poi vanno un po' nel dimenticatoio. Nel senso che il tablet sono un po' di mesi che non lo uso più. Lo smartphone ce l'ho sempre dietro per cui se sono in giro in qualsiasi momento le mail posso leggerle. Il computer lo utilizzo o per leggere i quotidiani o per tenermi informata oppure se non ho molto tempo per leggere le mail di giorno, durante la sera accendo il computer.

Simona B. - ex-ante FG 12

Forse con lo smartphone no, ho pagato qualche applicazione, se devo fare degli acquisti per l'e-commerce preferisco il tablet, per questione di comodità, per vedere prodotti meglio, o il computer. Sì diciamo che ne faccio un uso assiduo

Vincenzo M. - ex-ante FG 7

Marcello: Con lo smartphone non mi fido.
Moderatrice: Col computer, tablet?
Marcello: Col computer sì.

Marcello P. - ex-ante FG 11

Sì, è invasiva, molto, devo essere sincera, mi dà molto fastidio, del tipo che se vai su qualsiasi sito a ricercare il costo di un qualsiasi oggetto, tipo su amazon, tu il giorno dopo quando apri la videata hai la pubblicità di amazon che ti propone quell'oggetto o magari non quello, ma quello simile con la lista di fianco, oppure se vai a cercare su booking, sicuramente poi il giorno dopo hai tutta la ghiera degli alberghi della stessa zona, ma certo che dà fastidio, però lo sopporto mi va bene.

Piera C. - ex-ante FG 10

Alice: fa anche parte del gioco… Sono tutte informazioni tracciabili di conseguenza penso che sia, cioè fa parte di tutto quello che è, la facilità, il fatto di semplificare il tutto, spesso viene anche dal fatto che tracciano tutte le

nostre visite o tutto quello che facciamo, tutto quello che scriviamo, diciamo spesso derivano cose che precisamente ti interessano. Non più solo, cioè io faccio sempre l'esempio del volantino in buca, che ti arriva comunque anche se non hai mai comprato niente, se non hai mai comprato in un certo un supermercato, mentre su Internet in realtà quello che ti arriva è perché tu hai visitato, scritto, ho detto quella cosa… quindi, forse un pochino più mirato, però può spaventare. Comunque spesso è quasi immediato, basta scrivere una parola e nel giro di tre secondi ti compaiono le offerte su quel prodotto, quindi può spaventare la mancanza di privacy.

Alice - ex-ante FG 6

Quotes used to validate cluster 2

Per il lavoro no anche per me ma perché oggettivamente non è possibile fare niente, però per il tempo libero sì.

Mauro M. - ex-post FG 5

Logicamente non per casa-lavoro perché i tempi sono risicati. [...] mentalmente userei la macchina e invece l'app ti dice: guarda che io ti consiglio il pullman perché i parcheggi sono tutti pieni, c'è un traffico della malora in quella zona là, io sarei più agevolato a seguirla e ad attuare questo cambiamento.

Daniele S. - ex-post FG 9

Però in effetti io cambierei le mie abitudini, soprattutto nel week end. […] No su quello no perché appunto facendo una strada fuori Torino, adesso non dovendo più andare in Torino a recuperare i ragazzi, però magari alla sera o quando esco con le amiche o vado in centro, oppure nel weekend la userei se mi potessi fidare.

Silvia - ex-post FG 9

Daniele: Allora diciamo che io sono mentalmente predisposto alle alternative, infatti mi è piaciuta fare questa sperimentazione proprio perché ho detto magari riesco a trovare l'aggancio per cambiare il mio metodo di spostarmi. Logicamente non per casa-lavoro perché i tempi sono risicati.

Daniele S. - ex-post FG 9

Elena: Secondo me sì può servire, a me sì è servito, tranne che per i due spostamenti che faccio abitualmente, negli altri spostamenti spesso ho

preferito prendere i mezzi pubblici, andare a piedi o in bici grazie all'applicazione. Sì.

Moderatrice: Quindi le ha dato questo, quest'idea diciamo?

Elena: Sì sì, prima prendevo la macchina.

Elena S. - ex-post FG 14

Moderatrice: l'abitudine, che poi tutti siamo un po' abituati a fare certe cose, a muoverci in un certo modo, l'abitudine consolidata, e aprire nuove possibilità di spostamento oppure proprio per nulla?

Elena: Se funzionasse sì.

Elena C. - ex-post FG 4

Luisa: [...]ho i figli da prendere e da portare, tra poco più di un anno mio figlio prende la patente e si piglierà lui la macchina e mi farà molto comodo avere gli orari dei mezzi pubblici, per cui sì se funzionasse, s emi desse fiducia sarebbe una cosa utilizzabile, sicuramente.

Moderatrice: Quindi la potenzialità di cambiamento c'è.

Luisa: [***] con informazioni veramente precise ecco, sui mezzi pubblici, perché se poi io mi trovo alle fermate e il pullman non passa sono fregata.

Luisa M. - ex-post FG 8

Però anche già così, nel mio… nel mio lavoro o sono tappato in studio e non mi muovo oppure sono in giro e quindi devo improvvisare. E se sono in città con i pullman, io non seguo il percorso della mappa col pullman o che, non ha senso, a me interessa che mi dica: la fermata è a 300 metri arriva tale numero tra cinque minuti, piglialo. E quello sì funzione e a me mi ha fatto risparmiare dei giri.

Stefano F. - ex-post FG 4

[…]non tanto per gli spostamenti, per lo spostamento quotidiano che è quello avviene a piedi, però più che altro per gli altri spostamenti di lavoro che appunto non essendo io di Torino non conosco, non so dove è quel posto, non so dov'è quell'altro, effettivamente cercare tutto in un luogo, potrebbe costituire un risparmio di tempo[…]

Francesca S. - ex-post FG 6

E l'ho utilizzata soprattutto quando cambiavo, cioè dovevo andare da qualche parte che non vi era…

Daniela G. - ex-post FG 5

Però potrebbe essere utile sapere se questo percorso funziona regolarmente cioè se il tragitto che io compio mentre devo andare a lavoro è regolare, cioè se il 13 passa, se è bloccato per un incidente, se devo cambiare percorso. Allora io vedrei molto utile, per esempio, memorizzare un percorso, salvare un percorso quotidiano casa-lavoro che io uso tutti i giorni.

Amerigo - ex-post FG 15

Il mio utilizzo è stato prevalentemente con, per l'automobile, non è cambiato assolutamente nulla e quindi il mio utilizzo è stato costante per tutta la sperimentazione.

Claudio R. - ex-post FG 7

Ma diciamo che se funziona bene probabilmente in termini di tempo potrebbe essere utile. Cambiare le abitudini personalmente io sono una molto statica, molto abitudinaria, per cui difficilmente […]

Anna L. - ex-post FG 6

Quotes used to validate cluster 3

<u>The non-intention to use TUeTO before the test</u>

Per me pure per l'abituale oltre che per l'occasionale perché prendendo i treni che arrivano da Bardonecchia che sono in ritardo comunque li sopprimono e uno lo scopre quando arriva in stazione. Se lo sapessi un po' prima posso regolarmi andare ad esempio a prendere la metropolitana o altre scelte e poi […].

Andrea B. - ex-ante FG 16

Questa è una soluzione che va bene per percorsi fissi, prestabiliti. Per cose occasionali credo che sia molto difficile da combinare, magari decidi un po' all'ultimo minuto. Quindi non riesco ancora ad immaginare questa soluzione, se non per percorsi fissi, quotidiani, sul lavoro e così via.

Alessandro S. - ex-ante FG 13

Quindi se mi chiudono la strada solita che devo fare per tornare a casa, e nell'ultimo pezzo non posso più passare di lì, alle volte ci sono le chiusure improvvise, inizio girare, vado fino a Porta Nuova, poi devo tornare da corso vinsaglio e cercare strade alternative che non sono molto….Magari in una situazione simile, che non si torna a casa potrebbe essere…

Wanda - ex-ante FG 6

Floriana: Forse più per le occasioni però, cioè più per gli spostamenti magari che non fai quotidianamente perché magari automaticamente come dicevo poco fa, tipo io casa-Valentino, faccio sempre la stessa sostanzialmente.

Floriana D. - ex-ante FG 15

Moderatore: Cioè la flessibilità della macchina…

Luana: La flessibilità questo per quanto riguarda il lavoro, per quanto riguarda il girare invece secondo me il mezzo pubblico non è neanche …anzi è anche carina come idea, però se uno non si dovesse preoccupare di dove scendere a che ora passa a che ora non passa …

Moderatore: quindi diciamo che per i tuoi spostamenti occasionali potrebbe fare la differenza?

Luana: sì, lo trovo anche comodo…

Luana M. - ex-ante FG 6

Io lo userei molto, "molto" cioè, sicuramente lo userei di più, per andare Random cioè se ci dobbiamo spostare per altre cose, dove comunque non hai bene idea della strada, il percorso quale è meglio, quindi quello, sicuramente sì.

Marialuisa R.- ex-ante FG 1

Se ci penso, fino adesso non mi è mai venuto di andare a cercare un mezzo alternativo all'auto per questo raggio, per queste distanze qua. Quindi effettivamente potrebbe essere una soluzione quando scegli dove andare sabato mattina puoi avere anche quello come criterio di scelta.

Anna H. - ex-ante FG 13

Secondo me può essere utile per lo spostamento, non parlo del mio caso, nello spostamento quotidiano ma in un ambito di pianificazione, nel senso che magari non nel momento in cui uno compie lo spostamento ma a monte può aiutarlo sul riflettere se effettivamente l'idea che si era fatto del proprio spostamento era poi quella migliore possibile oppure aveva dei preconcetti che lo facevano pendere più verso una soluzione piuttosto che un altra, quando invece visto magari da un altra posizione non è proprio la soluzione più ottimale.

Paolo - ex-ante FG 5

The non-enthusiasm towards the use of technology

Allora, io ho lo smartphone da due anni e mezzo, tre. Ne faccio un uso abbondante, lo trovo molto comodo e utile per un'infinità di cose. Guardo la posta elettronica perché… guardo anche le notizie, libri, economia e lo uso anche per spostarmi.

Alessandro S. - ex-ante FG 13

Cioè rivolta a noi se mi spaventa, va bene, spero di avere la capacità di riuscire un po' a filtrare il tutto, però invece oggettivamente non credo che le condizioni siano così per tutti; per cui spaventa proprio. Cioè io ho delle occasioni, lavorando con i ragazzini, vedendo l'uso che ne fanno i ragazzini e ….Signori succedono delle cose terribili che poi coinvolgono i genitori, famiglie, di tutto succede. Quindi è invasiva ripeto.

Anna I. - ex-ante FG 10

secondo me l'invasività si è notata proprio negli ultimi anni quando c'è stato il ribaltamento, tutto sommato secondo me adesso Internet è diventato Facebook piuttosto che Twitter piuttosto che un altro. cioè, una volta si andava su Internet a cercare le cose, adesso le cose vengono a cercare te e quindi da quel lato li è molto più inquietante come l'utilizzo sia molto più attivo di una volta forse ai tempi blog eccetera, però in realtà è molto più passivo, si subisce molto di più…

Paolo - ex-ante FG 5

[…]per me è invasiva nel senso che in ogni momento devo rispondere all'e-mail dei clienti, questa per me la vera invasione…

Moderatore: cioè oltre all'orario di lavoro tu devi essere pronta …

Federica: sì, devo avere una reperibilità, se segui i progetti devi stargli dietro…

Federica G. - ex-ante FG 8

Dal mio punto di vista se ci tengo abbastanza a queste cose tipo della privacy e altro ritengo che se utilizzassi lo smarthphone con il pieno delle sue potenzialità forse sarebbe troppo invasivo, perdendo persin fin troppo tempo. Da un lato mi piace anche un pochettino avere una specie di distacco, usarlo solo per quello, usare tipo il tablet solo per quello che serve evitando di legarmi troppo.

Andrea B. - ex-ante FG 16

Dal mio punto di vista personale invece io non trovo che sia invasivo, anzi semplifica, Puoi rispondere immediatamente, sta a te dover decidere se è il caso di, se non è il caso di collegarsi. Anzi ritengo che sia molto più facile dare una risposta, di prenotare una visita, tramite smartphone o tramite computer, io non trovo invasiva la tecnologia anzi credo che ci aiuti parecchio, meno carta in giro anche.

Luana M. - ex-ante FG 6

loriana: Allora per quanto riguarda l'utilizzo sì, tutti i giorni sia per comunicare con i miei famigliari giù, quindi Skype o anche Facebook con gli amici.

Floriana D. - ex-ante FG 15

The intention to use TUeTO to change travel behaviour after the test period

Marialuisa: Marialuisa Rapalino, lavoro al CTO, è cambiato invece per me che all'inizio della sperimentazione lavoravo da un'altra parte e andavo a lavoro in macchina. Io abito fuori Torino a Settimo. Ho sempre viaggiato per più di trent'anni in macchina per cui dal mese di marzo, fine marzo, ho iniziato a viaggiare con treno e metro, quindi l'utilizzo di questa applicazione, cioè l'ho usata anche se mi dà dei percorsi che non ho mai fatto, perché a mio... provando, sperimentando, col treno mi fa andare fino al Lingotto e poi tornare indietro, che in realtà io scendo a Susa e prendo la metro… quindi l'opzione metro è difficilmente utilizzata, cioè la dà se tu metti la stazione Spezia, ti dà la metro altrimenti non la dà… anche il mio giudizio non è tanto positivo, l'ho usato anche come percorso automobilistici, anche volte solo così per fare delle ipotesi di trasferimento ecc. su percorsi che magari conosco.

Marialuisa R. - ex-post FG 8

Ho usato l'applicazione per provare alternative per lo spostamento necessaria l'automobile… ho provato anche a vedere se fosse possibile appunto con mezzi pubblici ma effettivamente non era proprio fattibile, ho provato qualche diciamo percorso alternativo che dava l'applicazione usando la macchina necessariamente per cui questo è. Nucleo famigliare sempre lo stesso per il momento, tutto così.

Gianluigi G.- ex-post FG 11

cioè lo spostamento casa-lavoro con il mezzo pubblico, con il treno, con la macchina eccetera una scelta abbastanza fatta già a monte indipendentemente dall'atto, nel senso che bene o male lo spostamento è quello, uno sa benissimo che se va a lavorare con i mezzi ci mette quello, magari come nel mio caso venerdì mi vizio e ci vado in macchina, quindi esco dopo ma lo faccio già a priori, metto la sveglia la sera prima a priori perché so che andrò in macchina, so che ci metterò di meno, so che arr… cioè negli spostamenti magari più inconsueti quindi chi per o per lavoro deve spostarsi in posti diversi o per tempo libero allora sì.

Paolo - ex-post FG 5

Federica: Ma anche se in realtà comunque anche se funzionassero, in realtà se ci fossero i dati esatti, io ogni santissimo giorno guardo l'applicazione GTT, perché comunque ho bisogno di sapere, o almeno vado alla palina a fare… perché ho bisogno di sapere tra quanto arriva, per cui non lo userei i maniera occasionale se i dati fossero corretti.

Federica G. - ex-post FG 5

Io sono disponibile a cambiare, sono disponibile a cambiare qualsiasi abitudine, ovviamente tenendo conto dei miei interessi, degli interessi.

Alessandro S. - ex-post FG 6

Moderatrice: Forse più sugli spostamenti occasionali?

Floriana: Sì, sì, sì, magari quelli in università no perché si va un po' di fretta, però mi capitava altri percorsi che comunque conoscevo altre vie, altre… magari si allungava un po' di più però alla fine mi ha permesso di conoscere un po' più la città.

Floriana D. - ex-post FG 15

Non le ho cambiate, sono quelle, vado liscia, liscia… al massimo per [***] un'altra però… sono sempre due strade che più o meno faccio e non trovo traffico, mi trovo bene e quindi continuo a usare quella. L'app non mi ha modificato la vita.

Luna M. - ex-post FG 5

Anna: [...]Ho provato a sperimentare un percorso alternativo che mi era stato suggerito però l'ho trovato più lungo e alla fine ho continuato sempre così con quello solito.

Moderatrice: Quindi non è cambiato come situazione.

Anna: Non è cambiato niente anche perché l'auto la uso poco, ecco, proprio così per la necessità di arrivare lì alle 8 di mattina, è complicato con i mezzi pubblici. Diversamente se posso io ho una mia bici e gli spostamenti se posso io li faccio sempre con la mia bici. Non è cambiato molto devo dire.

Anna I. - ex-post FG 8

Anna: Sì diciamo che potrebbe essere utile l'applicazione nel momento in cui la città fa interventi per rendere più o meno comodo l'utilizzo dell'auto, se spingi le politiche per incentivare, modificando le strade Cristina: Non so, agevolare gli abbonamenti…

Anna H. - ex-post FG 12

Anna: deve diventare più difficoltoso muoversi in auto, perché gli incentivi non bastano, devi rendere faticoso usare l'auto, devi fare in modo che…

Anna H. - ex-post FG 12

Anna: Ma c'è gente che poi non usa i mezzi pubblici e usa l'auto a prescindere, anche se fossero gratuiti userebbe l'auto

Anna H. - ex-post FG 12

Quotes used to validate cluster 4

Arrivando da fuori Torino, da Lanzo io credo che per me sarebbe più comodo a livello economico, perché è una bella spesa arrivare con la macchina dalle valli di Lanzo a qua, per cui se ci fosse un buon servizio con i mezzi pubblici sicuramente risparmierei di soldi e anche di nervosismo insomma, perché il traffico porta sempre un minimo di stress.

Dora B. - ex-post FG 6

[...]Siamo sempre tirati con questi orari, quindi mi dice sì fai questa strada e risparmi… avendo un feedback positivo lo farei tranquillamente.

Moderatrice: Quindi il cambiamento è più facile, insomma basato sulla fiducia il cambiamento ci sta, l'abitudine non è così forte mi dite.

Pasquale: No sono abituato a cercare sempre alternative la mattina, quindi se c'è qualcuno che me lo dice meglio.

Pasquale B. - ex-post FG 9

Sì, io ho trovato ad esempio che, per esempio anche il confronto tra servizio ferroviario metropolitano e GTT può essere utile, certe volte col servizio [ferroviario] metropolitano si arriva molto più rapidamente che con il pullman, quindi l'ho trovato utile ecco anche in quel senso.

Giovanni B. - ex-post FG 3

Però sarebbe utile perché avrei, cioè se funzionasse bene, ci fosse tutto al completo, quindi car sharing, bike sharing, tutto completo, avrei un'unica app da poter utilizzare anziché averne più di una. Quindi la comodità dal mio punto di vista sarebbe quella, però da qui ad arrivare a cambiare comportamenti forse dovrei cambiare io il… il mio attuale stile di vita o i miei attuali movimenti. Allora in quel caso sarebbe utile, ma attualmente no.

Marco P. - ex-post FG 1

Però diciamo che al 90% uso i mezzi pubblici e la metro che quindi per certi versi… nel senso dell'applicazione non… mi è stata

Nadia D. - ex-post FG 3

Per quanto mi riguarda nel mio quotidiano non sarebbe possibile, perché non ho il servizio dei mezzi pubblici nel senso che io casa-lavoro ci metto circa otto minuti in macchina, e un'ora e un quarto in pullman.

Muriel G. - ex-post FG 9

Quotes used to validate cluster 5

<u>The intention to use TUeTO before the test</u>

E alle volte però diventa difficile cambiare l'orario di partenza la matitina, perché io per dire per portare i bimbi al nido ho un orario decente per poi poter uscire a un orario decente per andarli a recuperare, io devo uscire di casa sempre… ho dieci minuti di gioco… quindi sono due… a quell'ora del mattino sono due mezzi che mi ballano…

Claudio L. - ex-ante FG 18

Sì sì, perché sono contenta che passa poi in orario però se passa una volta ogni 40 minuti, devo partire 2 ore prima dal lavoro, quando in macchina ci metto 15 minuti

Roberta M. - ex-ante FG 7

Francesco R : Se dovrei venire da Sud ci vuole poi mezzora per attraversare la città. Ci vorrebbe qualcosa che mi migliora…. Non c'ho treni da Poirino, c'ho solo il mezzo pubbli… il pullman, però gli orari sono uno ogni ora e dovrei trovare la coincidenza alla stazione per prendere il treno, oppure a Chieri prendere l'altra… per adesso io…

Other participant: Ci vorrebbe un posto a metà.

Francesco R.: Esatto. Mi conviene più venire in macchina che prendere…

Francesco R. - ex-post FG 1

Moderatrice: E invece adesso torniamo a quello che vi stavo chiedendo un attimo fa. Quindi per voi sarebbe utile, la utilizzereste per spostamenti abituali, quindi quelli che compite ogni giorno oppure più per quelli occasionali o per entrambi, insomma per cosa vedete l'utilità dell'applicazione?

[...]

Cristian: Entrambi.

Cristian C. - ex-ante FG 15

Valentina: Secondo me in ambito urbano potrebbe essere implementato con le informazioni sulle deviazioni temporanee dei pullman e dei tram, perché io all'inizio… Io uso prevalentemente la metro e ho notato che in metro non ci sono quei fogli gialli in cui ci sono le deviazioni temporanee dei mezzi di superficie.

Valentina T. - ex-ante FG 16

Ma io lo utilizzerei soprattutto quando vado verso il centro di Torino, che la considero la zona più a rischio per il traffico e anche per quanto riguarda le piste ciclabili, tornando alle biciclette, perché a Torino la nostra realtà è molto carente. Quindi è un po' un deterrente per usare la bicicletta. Il problema è che non la prendo perché ho paura di rischiare di finire male.

Giancarlo S. - ex-ante FG 20

Sì sicuramente, soprattutto per le strade, sapere se c'è la pista ciclabile soprattutto in relazione agli rari può essere utile, perché… [...] Perché di notte magari se c'è una pista ciclabile allora lo faccio, o magari tendenzialmente poi quello che uno fa è non lo so cambia percorso e fa delle vie meno trafficate, evita di andare su…

Elena P. - ex-ante FG 23

Quindi le possibilità sono due: o vai a piedi e sai che ci metti tot minuti o aspetti il pullman, sperando che non sia già passato. Quindi tu puoi aspettare il pullman finché non guardi l'orologio e non dici: e adesso cosa faccio? Sì, vado a piedi se riesci e quindi… questa applicazione potrebbe essere veramente utile nel dire: guarda che tu hai queste possibilità per arrivare a quest'ora in questo posto e tu scegli.

Gianni B. - ex-ante FG 9

E uno può scegliere di salvare che ne so un percorso preferito che fa spesso. Perché per esempio a me mi interesserebbe sapere quando la linea che prendo solitamente è deviata perché ci sono manifestazioni piuttosto che incidenti, e spesso magari ci sono i cartelli ma sono solo…

Micaela L. - ex-ante FG 23

Certo a me mi servirebbe molto. Se tu sai tempo reale se un treno ritarda, se nel punto di cambio hai la coincidenza oppure no eccetera. …

Bruna C. - ex-ante FG 2

Potrebbe essere anche nel caso di manifestazioni, che ti chiudono la strada, in caso di eventi vari…

Francesco R. - ex-ante FG 6

Sì, diciamo che il risparmio dei tredici minuti forse ha come contropartita la, come dire, uno stress maggiore, perché poi di fatto cambiare per risparmiare tempo a quel punto mi tengo i miei tredici minuti, ma arrivo con calma. [...] Sì, poi diciamo che potrebbe essere efficace in alcune circostanze, ma non come abitudine per quanto mi riguarda. Se appunto capita la domenica in cui decido di andare in montagna in treno, allora, lo vedo più dal punto di vista dell'utilità che del risparmio di tempo [...]

Carmen F. - ex-ante FG 20

Anche io forse più che per gli spostamenti non abituali lo utilizzerei magari per quelli occasionali, o quando non so dove devo andare, quando ho particolare fretta e mi serve capire quale è la situazione più veloce o meno costosa per arrivare in un posto.

Vittoria V. - ex-ante FG 4

Sì, ma con un margine d'inventario nel senso testerei prima il prodotto per capire veramente se è affidabile perché proprio ciecamente no, non mi fiderei.

Morena C. - ex-ante FG 11

Andrea: Innanzitutto sarei meno stressato, credo, ad aspettare mezz'ora un pullman [...]

Andrea M. - ex-ante FG 11

Moderatrice: [...] Quindi per qualsiasi spostamento e anche tutti i giorni. Quindi non lo dedichereste solo a: devo andare in un posto che non conosco? No.

Valentina: No, se riesco ad arrivare prima nello stesso posto è ancora meglio.

Valentina O. - ex-ante FG 21

Valentina: No, io dico soprattutto il risparmio di tempo. Ma anche solo quei cinque minuti a spostamento per me a fine mese sono… sono un sacco di ore libere, un sacco di tempo in più. Quindi in realtà io me lo aspetto. Adesso pensavo anche ai costi, ma in realtà io ho gli abbonamenti annuali sia ai mezzi pubblici che alla bici, quindi a me a livello di costi non cambia niente. È solo un fatto di risparmio di tempo.

Valentina O. - ex-ante FG 21

Moderatrice: [...] Quindi per voi sarebbe utile, la utilizzereste per spostamenti abituali, quindi quelli che compite ogni giorno oppure più per quelli occasionali o per entrambi, insomma per cosa vedete l'utilità dell'applicazione?

Giovanni: Per me sempre.

Andrea: Sono d'accordo, anche solo per il gusto di aprirla. Vabbè io sono fatto così.

Andrea B. - ex-ante FG 15

Davide: Di certo più per gli spostamenti occasionali che per quelli fisici. Si potrà vedere dalle prime volte se effettivamente quello che ritengo io e quello che effettivamente è più conveniente, sennò per gli spostamenti occasionali l'utilità può essere quella di vedere se c'è stato un incidente che blocca tutto.

Davide - ex-ante FG 4

Gianluigi: anche per me. Più o meno lo spostamento casa lavoro e già un pò per tutti ideale, diversamente per quanto riguarda l'occasionale no e in effetti può essere veramente molto utile anche perché io per esempio quando vengo a torino in macchina per questioni occasionali, anche io ho la tendenza di, per esempio so che quella strada lì la faccio sempre e magari sto completamente sbagliando strada.

Gianluigi P. - ex-ante FG 10

Moderatore: Potrebbe farvi cambiare abitudini di viaggio soprattutto cambiare il mezzo di trasporto abituale, potrebbe, indurvi a cambiare il proprio le abitudini attuali?

[...]

Yari: dipende dall'affidabilità

Simone: anche secondo me

Yari - ex-ante FG 7

Simone M.- ex-ante FG 7

Valentina: Per me anche è una questione di affidabilità, cioè ora però sapere, cioè io sinceramente le volte che piove, che devo prendere i benedetti autobus, se ho voglia e se… insomma, talvolta interrogo prima di uscire di casa per capire se passa prima il 58 o il 56 e poi vorrei che sia davvero affidabile l'informazione che ricevo se no io vado al 56 e poi [...]

Valentina R. - ex-ante FG 10

Moderatore: invece tu Federico pensi che potresti cambiare tue abitudini?

Federico: Ho sempre fatto quelle strade con meno traffico, quindi volentieri…

Federico - ex-ante FG 8

The enthusiasm towards the use of technology

Davide: Non posso pensare di non fare qualcosa al computer, piuttosto che altre cose….credo anche che siamo arrivati, un po', all'eccessività. Perché uscire il sabato sera, e trovarsi a parlare di fronte a uno con un I-phon, a un certo punto…cioè, ma cosa siamo usciti a fare? Certo è utile è comoda, bisogna saper dire basta quando diventa superflua ecco.

Moderatrice: Quando quasi evita di far vivere la vita reale ecco.

Davide: Si poi noi abbiamo telefono, tablet in famiglia quindi… Sono vittima del sistema. M: Ti consideri un po' vittima o… cioè ti piace? Davide: Si non mi entusiasma. non è che quando esce il nuovo i-phon sono li che "ohh che bello"…

Moderatrice: Fa parte della vita?

Davide: Si lo vedo come una cosa utile ma non essenziale. Non devo essere sempre lì pronto a capire la nuova novità e il nuovo aggiornamento eccetera…

Davide C. - ex-ante FG 4

Roberta: Io utilizzo tanto, compro on-line, ciatto con 10.000 gruppi whatsapp, è piacevole. Non scrivo gli appuntamenti alle note sul cellulare, quindi ho un'agenda cartacea perché mi ricordo di più, e se dimentico a casa il telefono pazienza, il problema è perché non porto l'orologio ma chiedo a primo che passa e ho risolto il tutto…e se arrivo tardi a qualche appuntamento mi aspetteranno.

Roberta M. - ex-ante FG 7

Roberta: Io Facebook e istagram …Poi ci sto pochissimo metto un mi piace ogni tanto ma non sono schiava dei social.

Roberta M. - ex-ante FG 7

Lo utilizzo molto, lo apprezzo, probabilmente non riuscirei a vivere senza anche al lavoro, perché per qualsiasi cosa sento parlare, ma no è così, no è cosò, vedo discorsi che vanno avanti mezz'ora prendo il telefono, anche in riunione…no, si fa così punto…perché trovi già subito la risposta, la soluzione è molto comodo

Federico S. - ex-ante FG 8

Io utilizzo la tecnologia tanto, anche perché sono un appassionato, sia per lavoro ma anche personalmente, sono sempre stato un appassionato di informatica eccetera…. praticamente avevo internet prima del web di fatto avevo l'indirizzo e-mail ma non c'era ancora il web, quindi ho vissuto tutta questa grandissima fase di sviluppo, però comunque lo utilizzo praticamente dalla mattina fino alla sera, sono davanti a uno schermo del computer, non ho lo smartphone, apprezzo anche io avere una tastiera e lo schermo più grosso, per lavorare. Per i social sono su Twitter.

Gianluigi P. - ex-ante FG 10

Per fare acquisti online preferisco computer o il tablet, [...] Se posso aggiungere una cosa a proposito degli acquisti online io, ad esempio, uso una prepagata, nel senso mi fido, ma non mi fido nel senso che è una prepagata nel senso che se deve succedere qualcosa non è caricata con chissà cosa. Cioè a proposito della fiducia o meno nelle tecnologie sì ma no...

Morena C. - ex-ante FG 11

Quindi dal mio punto di vista c'è un'utilità, è sicuramente utile, ma sento il peso di questa cosa, sia dal punto di vista della privacy che sicuramente non esiste più, perché io scrivo una mail e c'è un termine particolare e subito dopo pubblicità…E questo mi ha inquietato all'inizio, poi dopo non ci fai più caso,[...]

Simone M. - ex-ante FG 7

Secondo me, come dicevo a lui, la tecnologia è invasiva per certe cose dico appunto, mi sta bene che al supermercato compro il latte, ma sta anche a noi, cioè se io ogni 3 secondi su Facebook dico sono qui, sono là, faccio questo, faccio l'altro, ovvio che il mondo sa cosa faccio, ma sono io che lo dico al mondo. Non so quanto determinate applicazioni riescano a carpire dei tuoi gusti o dei tuoi consumi ecco su questo non sono ferrata, appunto quanto il supermercato possa capire quanto e come consumo. Però non mi sento tanto in pericolo ecco. Secondo me, il giusto bilancio tra cosa voglio far sapere al mondo...

Valentina T. - ex-post FG 16

<u>The non-intention to use TUeTO to change travel behaviour for occasional trips after the test period</u>

Federico: l'applicazione l'ho usata prevalentemente in macchina e l'ho provata anche sui mezzi pubblici, avendo qualche grossa difficoltà.

Federico S. - ex-post FG 4

Giancarlo: Secondo me è dura. Perché ormai le persone sono abituate ad avere l'automobile sempre a disposizione.

Giancarlo S. - ex-post FG 12

Claudio: Quindi, non l'ho usata tantissimo per i mezzi pubblici. Qualche tentativo anche sulla macchina per fare dei tratti extrametropolitani, essendo in due che eravamo tutti e due si riusciva anche a lavorare… no, si

mettevano. Anzi eravamo quasi in tre perché io e poi avevo anche un altro collega che riuscivamo a fare [***] per cui tante volte con un servizio esterno lo facevamo partire insieme per vedere se ci dava lo stesso percorso, se ci proponeva le stesse soluzioni, quindi lo abbiamo anche testato da quel punto di vista. Lo abbiamo un po', come si dice, strizzato.

Claudio L. - ex-post FG 2

Vittoria: da quell'applicazione in più in questo caso mi darebbe anche delle alternative che magari non ho pensato, se vedo che ne so che a piedi ci metto trenta minuti e in macchina ce ne metti venticinque viene in automatico. Magari non mi ero posta il problema, lo vedo scritto lì e chiarò che a questo punto vado a piedi, è un risparmio di soldi, magari anche di chili, quindi… quindi sì quando te lo vedi lì, devi avere ovviamente un'applicazione di cui ti fidi e che funzioni bene. E magari forse per chi ha degli spostamenti proprio abitudinari funziona meno, ma non guarda neanche altre app, per degli spostamenti che fai tutti i giorni non guardi nessuna applicazione della mobilità.

Vittoria V. - ex-post FG 8

Valentina: Secondo me l'applicazione è utile non per gli spostamenti abituali, io parlo per me, io vado dalle Molinette a praticamente Porta Nuova, c'è la metro, quella è. Se sono pigra da re Umberto prendo il 64 faccio due fermate. Invece se devo andare, che ne so, nel week end in centro, magari in una zona che più meno conosco, ma così per curiosità dico io ho sempre fatto questa strada, magari visto che è un pullman che non prendo da sei mesi ha cambiato percorso o c'è una altro pullman, è utile diciamo per queste, io parlo per me, per questi spostamenti. Non saltuari ma non proprio quotidiani.

Valentina T. - ex-post FG 2

Andrea B.: Ma mettiamo il caso che io debba andare un sabato pomeriggio che ne so, da una parte che non è quella, anche avere un paio di scelte in cui posso inter… che ne so… mi dice prendi il pullman fino a lì che tanto hai là vicino Enjoy, a me è utile.

Andrea B. - ex-post FG 11

<u>Elena:</u> Per cui se mi devo muovere di sera, magari, non lo so per una questione di sicurezza o anche solo sono stanco e voglio arrivare a casa il prima possibile, poter privilegiare la machina, quando devo andare a un

concerto, o al Salone del Libro dire no aspetta non voglio passare un'ora a cercare parcheggio, voglio andarci in bici o… e sulla questione della bici bisognerebbe sicuramente cercare di farsi valorizzare di più anche non solo il bike sharing, ma anche il fatto che uno possa utilizzarlo normalmente. So che non è facilissimo perché ci sono un sacco di app che ci stanno provando, però... quello sicuramente sarebbe ancora più interessante.

Moderatrice: Quindi come motivatore di cambiamento di abitudini ha delle potenzialità?

Elena: Ma secondo me sì, poi dipende da… io per esempio non la penso come lui…. Per me arrivare il prima possibile non è strettamente necessario, ovviamente se lo so per tempo, se sono in ritardo diventa… impossibile. Il tutto con dei limiti, è vero anche io preferisco piuttosto non cambiare mezzo, perché non mi fido così tanto di quelli che… cioè l'attesa tra un mezzo e l'altro è una cosa che un po' tesa According to Valentina O. (FG 5, ex-post), if the data provided by TUeTO were reliable regarding bike sharing services, she would be willing to change of behaviour.

Elena P. - ex-post FG 11

Valentina: Ma io anche se i dati del ToBike fossero più certi, siccome stanno aprendo un sacco di postazioni in più e si avvicinano sempre di più alle mie zone quello mi cambierebbe in realtà parecchio. E in automatico è molto difficile pensare prendo la macchina fino a lì, poi prendo la bici, quindi lì questo doppio abbinamento sicuramente a me potrebbe cambiare. Neanche due minuti che sono arrivata…

Valentina O. - ex-post FG 5

Michela: Io con tutti i se se se se… sarei assolutamente disponibile a cambiare le abitudini con una piccola variante, farei una piccola modifica che è questa, io sono anche di memoria corta, quindi mi desse la possibilità di attivare o non attivare la notifica o le notifiche, dove mi dice oggi c'è lo sciopero quindi puoi, pensa di poter fare… domani è San Giovanni, il traffico è limitato, gli orari sono questi. Quelle piccole, dei piccoli notifiche che mi ricordano questa cosa, mi ricordano di usarla, non mi dispiacerebbe questo sì.

Micaela L. - ex-post FG 9

Devo dire che già sinceramente sul percorso abituale come dicevamo prima, tendenzialmente non lo consulterei perché io la consulto vabbè a scopo della sperimentazione, quindi è chiaro che l'ho fatto ad hoc, però la

consulto solo, soprattutto se sono in attesa alla fermata o se sono su un mezzo, cioè è proprio lì che ne approfitto per fare dei test. Non la vedo come un qualcosa che mi permetta di risparmiare tempo.

Valentina R. - ex-post FG10

l'applicazione diciamo che ho cambiato un po' il metodo di spostamento nel senso che a volte quando pioveva e, prendevo il pullman e quindi usavo l'applicazione soprattutto per appunto controllare gli orari dei passaggi dei bus.

Carmen F. - ex-post FG 5

Francesco: io c'ho una macchina GPL, quindici euro di GPL ci faccio una settimana andata e ritorno. Perciò… noi lavoriamo io in piazza San Giovanni, mia moglie in via Bologna, facendo il traforo arrivo sul lato opposto. Se dovrei venire da Sud ci vuole poi mezzora per attraversare la città. Ci vorrebbe qualcosa che mi migliora…. Non c'ho treni da Poirino, c'ho solo il mezzo pubbli… il pullman, però gli orari sono uno ogni ora e dovrei trovare la coincidenza alla stazione per prendere il treno, oppure a Chieri prendere l'altra… per adesso io…

Francesco R. - ex-post FG 1

Simone: Sì sì sì per carità, però è anche vero. [***] usare un applicativo come leva per cambiare certe abitudini. Lo vedo molto difficile, lo vedo come un ottimo ausilio per chi già ha queste abitudini, ma non per chi per cambiare le abitudini bisogna sicuramente un po' cambiare la mentalità e avere dei mezzi che siano più puntuali, che siano più…

Simone M. - ex-post FG 12

Simone: L'offerta deve essere migliore certo. Perché io vedo soprattutto le ferrovie, la Torino-Pienorolo che è una ferrovia che ha veramente sei stazioni, tutti i giorni è in ritardo, allora se uno va a lavorare e non ha un orario flessibile, arrivare sempre in ritardo è un problema, perché poi ci rimette e allora capisco anche che alcuni non lo vogliano usare il mezzo pubblico, ci sta tutto questo.

Simone M. - ex-post FG 12

Simone: Adesso lo sforzo che stanno facendo tutte le aziende è quello di andare sul telelavoro, quindi quello è secondo me la cosa che porterà a una diminuzione del traffico.

Simone M. - ex-post FG 12

Cristian: [..] arrivi lì e le biciclette le trovi rotte e quindi… ho provato solo questo tratto qua e un po' mi è dispiaciuto perché anche se magari l'app ti diceva più o meno azzeccando quante bici c'erano, quanti posti c'erano però arrivavi e le biciclette erano inutilizzabili, quindi non per colpa dell'app, ma per colpa del servizio. E quindi spero che uno che amplino un po' le postazioni bike sharing, e poi fare un pochino più attenzione anche, che si attrezzino per… perché è veramente [***] e diversamente non è cambiato, a parte questo non è cambiato altro.

Cristian C. - ex-post FG 10

Bruna: No però se se si affermasse come navigatore può dare delle informazioni sull'esistenza di alternative di trasporto pubblico che uno che è abituato a usare l'automobile non conosce.

[…]

Bruna: Perché poi io incontro ma spesso gente che ad esempio dalle mie parti che il servizio ferroviario metropolitano ma manco sa cosa sia eh. E lì effettivamente essendo così ben impostato il servizio… infatti cioè io lo dico sempre anche all'agenzia che se facessero un po' più di pubblicità, non tanto a Torino forse, lungo le direttrici perché…

Bruna C. - ex-post FG 1

Gianluigi: Sì ma il discorso che dicevo prima, cioè nel senso che se l'app mi permette di spostare anche solo una sola persona, perché grazie all'app si rende conto che magari prendendo il trasporto pubblico ci mette di meno, è più conveniente per lui sotto il profilo, conveniente sotto il profilo dell'auto, io ho spostato una persona su una modalità più sostenibile. Fosse anche una, no? L'app… è una persona in meno che prende la macchina… quindi sarà marginale ma c'è. Per quello dicevo il discorso che facevo prima, il discorso Google piuttosto che Tu&To piuttosto che Moovit ecc., cioè se tutta questa offerta di applicativi per, no, diciamo, per favorire il trasporto pubblico, no, fa fare ai cittadini delle scelte più sostenibili per me va bene, cioè se io riesco grazie a tutte ste cose a portare 1,2,3 persone a lasciare la macchina per un mezzo pubblico è già da leccarsi le dita, mettiamola così, dal punto di vista della sostenibilità per cui va bene, va bene comunque.

Gianluigi P. - ex-post FG 1

Appendix III - Variables distributions of the participants belonging to the "expectation cluster analysis"

Numero cluster del caso * TUeTO_Fre Crosstabulation

Count

		TUeTO_Fre				
		1,00	2,00	3,00	4,00	Total
Numero cluster del caso	1	11	3	0	0	14
	2	8	8	0	0	16
	3	0	9	10	3	22
	4	11	2	0	0	13
	5	3	8	0	0	11
Total		33	30	10	3	76

Numero cluster del caso * TUeTO_occa Crosstabulation

Count

		TUeTO_occa				
		1,00	2,00	3,00	4,00	Total
Numero cluster del caso	1	6	6	2	0	14
	2	0	1	3	12	16
	3	0	2	13	7	22
	4	0	7	2	4	13
	5	1	3	3	4	11
Total		7	19	23	27	76

Numero cluster del caso * Zscore(TUeTOExpectation) Crosstabulation

Count

		Zscore(TUeTOExpectation)											Total
		-2,43551	-2,03915	-1,64279	-1,24644	-,85008	-,45372	-,05737	,33899	,73535	1,13170	1,52806	
Numero cluster del caso	1	0	1	1	0	1	1	1	2	2	2	3	14
	2	0	0	1	2	2	3	3	3	2	0	0	16
	3	0	0	0	1	5	1	3	7	2	1	2	22
	4	1	1	1	1	4	4	1	0	0	0	0	13
	5	0	0	0	0	0	0	0	4	0	1	6	11
Total		1	2	3	4	12	9	8	16	6	4	11	76

Numero cluster del caso * Zscore(Tech_hedonist) Crosstabulation

Count

		Zscore(Tech_hedonist)																			Total
		-2,67865	-2,30614	-2,11988	-1,93363	-1,56112	-1,37486	-1,18860	-1,00235	-,81609	-,62984	-,44358	-,25733	-,07107	,11518	,30144	,48770	,67395	,86021	1,04646	
Numero cluster del caso	1	1	0	1	0	0	0	1	0	0	1	3	1	0	0	0	1	1	3	1	14
	2	0	1	2	2	2	1	1	2	1	0	2	1	1	0	0	0	0	0	0	16
	3	0	0	0	0	0	0	0	0	0	1	0	1	2	2	2	3	1	3	7	22
	4	0	0	0	0	0	0	0	0	0	2	0	0	1	0	1	2	5	0	2	13
	5	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	2	1	2	3	11
Total		1	1	3	2	2	1	2	2	1	5	5	3	4	3	4	8	8	8	13	76

Numero cluster del caso * Zscore(GEB) Crosstabulation

Count

		Zscore(GEB)																				
		-2,31173	-1,71414	-1,51494	-1,31574	-1,11655	-,91735	-,71816	-,51896	-,31976	-,12057	,07863	,27783	,47702	,67622	,87542	1,07461	1,27381	1,47301	1,87140	2,07059	2,26979	Total
Numero cluster del caso	1	1	1	2	0	2	1	3	1	1	0	0	1	0	1	0	0	0	0	0	0	0	14
	2	0	1	0	1	1	0	0	1	1	2	2	2	1	3	1	0	0	0	0	0	0	16
	3	0	1	1	1	1	2	2	2	4	4	0	0	1	2	0	0	0	0	0	0	1	22
	4	0	0	0	0	0	0	0	0	2	2	1	0	2	2	1	2	1	0	0	0	0	13
	5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	1	3	2	1	0	11
Total		1	3	3	2	4	3	5	4	8	8	3	3	4	9	3	4	2	3	2	1	1	76

Appendix IV - Variables distributions of the participants belonging to the "intention cluster analysis"

Numero cluster del caso * TUeTO_Fre Crosstabulation

Count

		TUeTO_Fre				
		1,00	2,00	3,00	4,00	Total
Numero cluster del caso	1	9	2	0	0	11
	2	11	6	0	0	17
	3	5	6	0	0	11
	4	0	0	10	3	13
	5	8	16	0	0	24
Total		33	30	10	3	76

Numero cluster del caso * TUeTO_occa Crosstabulation

Count

		TUeTO_occa				
		1,00	2,00	3,00	4,00	Total
Numero cluster del caso	1	5	4	2	0	11
	2	0	0	3	14	17
	3	0	1	3	7	11
	4	0	2	5	6	13
	5	2	12	10	0	24
Total		7	19	23	27	76

Numero cluster del caso * Zscore(GEB) Crosstabulation

Count

		Zscore(GEB)																				
		-2,31173	-1,71414	-1,51494	-1,31574	-1,11655	-,91735	-,71816	-,51896	-,31976	-,12057	,07863	,27783	,47702	,67622	,87542	1,07461	1,27381	1,47301	1,87140	2,07059	2,26979	Total
Numero cluster del caso	1	1	2	2	0	1	1	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	11
	2	0	0	0	1	1	0	0	1	2	3	1	1	1	1	0	2	2	0	1	0	0	17
	3	0	1	0	0	1	0	0	1	1	0	2	1	0	3	1	0	0	0	0	0	0	11
	4	0	0	0	1	0	1	1	0	3	3	0	0	1	2	0	0	0	0	0	0	1	13
	5	0	0	1	0	1	1	3	2	2	2	0	0	1	2	2	2	0	3	1	1	0	24
Total		1	3	3	2	4	3	5	4	8	8	3	3	4	9	3	4	2	3	2	1	1	76

Numero cluster del caso * Zscore(Tech_hedonist) Crosstabulation

Count

		Zscore(Tech_hedonist)																			
		-2,67865	-2,30614	-2,11988	-1,93363	-1,56112	-1,37486	-1,18860	-1,00235	-,81609	-,62984	-,44358	-,25733	-,07107	,11518	,30144	,48770	,67395	,86021	1,04646	Total
Numero cluster del caso	1	1	0	1	0	0	0	1	0	0	2	3	1	0	0	0	1	0	1	0	11
	2	0	0	0	1	0	0	1	0	0	1	1	1	2	0	0	2	4	0	4	17
	3	0	1	2	1	2	1	0	2	1	0	1	0	0	0	0	0	0	0	0	11
	4	0	0	0	0	0	0	0	0	0	1	0	0	2	2	1	1	0	2	4	13
	5	0	0	0	0	0	0	0	0	0	1	0	1	0	1	3	4	4	5	5	24
Total		1	1	3	2	2	1	2	2	1	5	5	3	4	3	4	8	8	8	13	76

Numero cluster del caso * Zscore(TUeTO_intention) Crosstabulation

Count

		Zscore(TUeTO_intention)									
		-3,69491	-2,81599	-1,93708	-1,49762	-1,05817	-,61871	-,17925	,26020	,69966	Total
Numero cluster del caso	1	0	0	1	1	1	1	2	1	4	11
	2	0	0	1	0	1	1	4	2	8	17
	3	1	1	2	2	4	1	0	0	0	11
	4	0	0	0	0	2	0	1	2	8	13
	5	0	0	0	0	0	1	0	1	22	24
Total		1	1	4	3	8	4	7	6	42	76