



D2.5 – Enhancing Appropriation of Digital Mobility Solutions

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Executive Summary

This report “**How the use of digital mobility solutions can be promoted**” - is deliverable D2.5 from Task 2.3 “Enhancing appropriation of digital mobility services” (hereafter T2.3) in Work Package 2 (WP2) - “Co-creating the INDIMO Inclusive Digital Mobility Toolbox” of the INDIMO project.

In the passing 18 months, by means of multi-stakeholder qualitative research and a co-creation approach, we investigated, analysed, and discussed the drivers and barriers for the development and deployment of **inclusive** and **accessible** digital mobility services from the perspective of users and non-users, developers, operators, and policymakers.

Mobile communication has now reached a new stage that is characterized by the introduction of third-generation mobile smartphone devices and services: now the pertinent question is not “Who uses a mobile phone?” but rather “How do you use it?”.

In the 1990s, when mobile telephone diffusion was an interesting exemplary process that fits well with predictions of diffusion theory (Rogers, 2003), the situation today is far more complex. A mobile app user’s perception of the perceived use experience, in terms of accessibility, privacy and trust, smoothness and therefore efficiency, plays a critical role in whether the person actually downloads and uses the app. Today, thanks to the large number of digital mobility apps available, enhancing appropriation is challenging, and predicting the diffusion process is even more difficult.

In this report, we address the different elements that emerged in several stages of the research conducted so far regarding the process of appropriation of digital mobility and delivery solutions by users.

Appropriation entails more than the similar notion of adoption, i.e., the individual’s process from first hearing about a product to finally using it., since it incorporates the confident use of the adopted functionality and familiarity with its core elements (e.g., Wirth et al., 2007; Stehr et al., 2020).

This report on how the use of digital mobility solutions can be promoted presents the findings and results that enabled us to produce recommendations to more effectively target key elements of appropriations.





Table of Contents

- 1. Introduction9
 - 1.1 About INDIMO.....9
 - 1.2 INDIMO’s Methodology9
 - 1.3 The vision for how the use of digital mobility solutions can be promoted11
- 2. Preliminary Review of the Literature12
 - 2.1 Persuasive Technologies.....12
 - 2.2 Payment Options13
 - 2.3 Internet Connectivity13
 - 2.4 Psychology Perspective13
 - 2.5 Language15
 - 2.6 Security & Safety of Users15
 - 2.7 Social and Educational Strategies16
 - 2.8 Methods and Strategies to Improve Digital Skills17
 - 2.9 Discussion.....18
- 3. Insights on Appropriation from WP1 Data Collection19
 - 3.1 Task 1.2 - Analysis of the requirements of users towards the digital interconnected transport system21
 - 3.2 Task 1.3 - Identification of user capabilities and requirements of a digital transport system on users.....22
 - 3.3 Task 1.4 - Understanding the process of the deployment of digital mobility services ...23
 - 3.4 Discussion.....23
- 4. Community of Practice (CoP) Appropriation Exercise24
 - 4.1 What is CoP?24
 - 4.2 Description of the pilots CoP appropriation exercise25
 - 4.3 Pilots CoP appropriation exercise: main results26
 - 4.4 CoP appropriation exercise discussion31
- 5. Key Recommendations: A Summary32
- 6. Conclusion33
- 7. References34
 - 7.1 INDIMO References34
 - 7.2 Resources on Appropriation34
 - 7.3 Resources on Social and Educational Strategies.....35
 - 7.4 Resources on Methods and Strategies to Improve Digital Skills.....35
 - 7.5 Resources on CoPs36
 - 7.6 Other resources36



List of Figures

Figure 1: Pilot Projects.....	10
Figure 2: D2.3 Makeup.....	11
Figure 3: WP1 Framework.....	20

List of Tables

Table 1. WP1 Tasks.....	20
Table 2: User profiles of the INDIMO pilot projects	20



List of Acronyms

Acronym	Meaning
CoP	Community of Practice
DDS	Digital delivery services
DMS	Digital mobility services
EU	European Union
ICT	Information and Communications Technology
NGO	Non-Governmental Organization
SSI	Semi- structured interviews
UDM	Universal Design Manual
UIL	Universal Interface Language icons
WP	Work package





1. Introduction

1.1 About INDIMO

The INDIMO project aims to enable researchers, operators of digital mobility services and platforms, developers of digital mobility solutions and policy makers to include the user perspective and co-creation approaches in the entire development process of digital mobility solutions. This way, products and services delivered would be tailored to the actual needs of transport users. The project will identify the main characteristics of demands that digitally based mobility solutions place on users, focusing on all types of transport users and in particular on vulnerable-to-exclusion citizens (such as elderly people, children, people with disabilities, low income, low education level). The project will develop the INDIMO Inclusive Digital Mobility Toolbox consisting of the Universal Design Manual, Universal Interface Language for transport services, Guidelines for cybersecurity and personal data protection and a Policy Evaluation Tool. These tools will support policy makers, developers and service operators to develop digital mobility solutions universally accessible to citizens focusing on accessibility and social and spatial inclusivity. The toolbox will be applied and tested on five pilot projects in Madrid (Spain), Antwerp (Belgium), Emilia-Romagna (Italy), Berlin (Germany) and Galilee (Israel). INDIMO has five project objectives, as follows:

- Objective 1: To improve the understanding of the needs of users towards the digital transport system.
- Objective 2: To improve the knowledge about the requirements of a personalised digital transport system towards users.
- Objective 3: To co-create tools that can help engineers, developers, operators and policy makers to develop an inclusive, universally accessible personalised digital transport system.
- Objective 4: To facilitate the concept of universal design throughout the planning design process of digital applications and services both for accessibility and inclusion.
- Objective 5: To navigate future policy by channelling project results into European, regional and local policy making.

1.2 INDIMO's Methodology

Overall, the INDIMO methodology consists of a multi-stakeholder' user-centric approach. The INDIMO Inclusive Digital Mobility Toolbox is being co-designed with local communities of practices (CoPs) in five pilot sites in five countries: Italy, Belgium, Israel, Spain, Germany (Figure 1) and with an international co-creation community including policymakers, user representatives, industry, academia, and developers, during the three years of the project.

Whilst digital mobility solutions are mainly developed for general use according to the assessment of the needs and capabilities of a-priori typical users, INDIMO's main goal is to



expand the use of existing and emerging digital mobility services to populations that are currently excluded due to physical, cognitive, or socio-economic barriers. Aware of the subjective variance of potentially excluded groups, fulfilling this goal requires a holistic standpoint and research that are beyond the scope of the INDIMO project. Nonetheless, INDIMO’s multi-stakeholders’ qualitative investigation of selected various vulnerable-to-exclusion characteristics provides wide-ranging implications for potentially excluded populations in general.

Thus, INDIMO takes into consideration a variety of digital services through an extensive data collection from citizens including end-users and non-users of digital mobility services, software and hardware developers, digital mobility and logistics operators, and transport authorities, municipality and governmental policymakers.

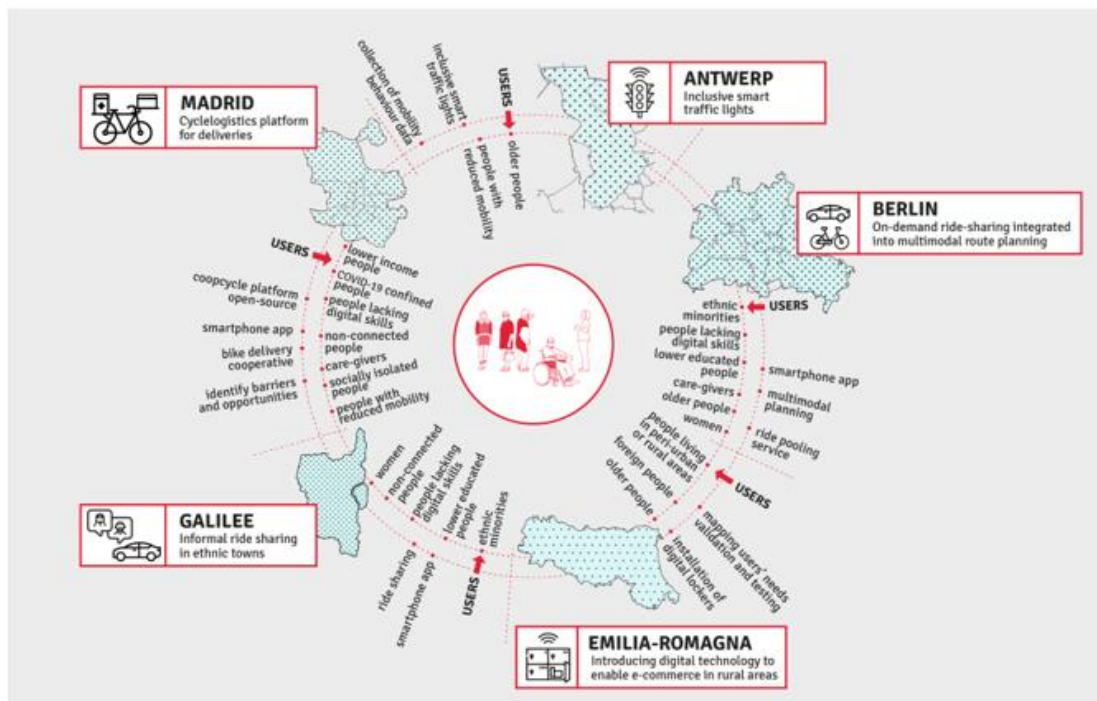


Figure 1: Pilot Projects

The INDIMO co-creation process is designed as a five-stage process, aka work packages (WP).

WP1 was devoted to the identification of user and non-user needs and capabilities, and to the investigation of requirements and concerns of developers, policymakers and operators when introducing digital mobility/delivery services (DMS/DDS).

WP2 concerns the co-designs of the INDIMO Inclusive Digital Mobility Toolbox to bridge the digital mobility gap, on the basis of needs, capabilities, requirements and barriers identified in stage 1. As part of WP2, Task 2.3 and this report concerns with enhancing appropriation of digital mobility solutions.

WP3 looks at the co-implementation of tools from the INDIMO toolbox, their impact and usability tests in the five pilots.

WP4 efforts are focused on co-evaluation, feedback, and redesign. The co-evaluation will be, both, in terms of inclusion and accessibility assessment of the DMS/DDS, and of the INDIMO Toolbox. Pilots will provide feedback in order to improve the INDIMO toolbox.

Finally, WP5 concerns the transferability assessment and the deployment of the INDIMO Toolbox as an online toolkit.

1.3 The vision for how the use of digital mobility solutions can be promoted

INDIMO's task 2.3 "Enhancing appropriation of digital mobility solutions", has the timeframe of M16-M36.

The objective of this task is to develop recommendations on how to influence the take-up of digital mobility services, based on a preliminary review of the literature (see section 2), an analysis of WP1's findings (see section 3), and a discussion of the results of the 5 pilots' Communities of Practices (CoPs) on enhancing appropriation of digital mobility services (see section 4).

In order to provide the recommendations for promoting the adoption of digital mobility solutions, we have incorporated and synthesized the various knowledge sources as depicted in Figure 2

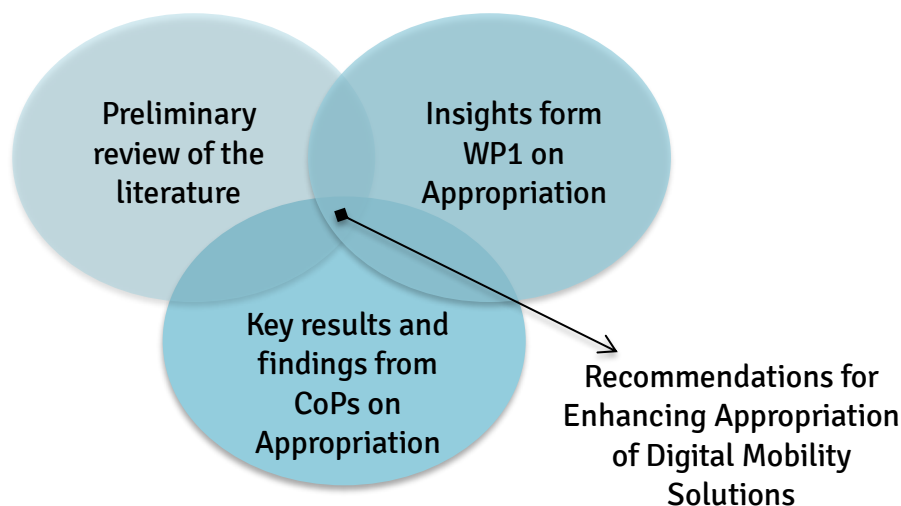


Figure 2: D2.5 Makeup

The recommendations to help improve the adoption of digital mobility solutions are listed in the recommendations section of this report.



The key findings and outcomes of T2.3 and recommendations of this report will be mainly fed into the INDIMO Policy Evaluation Tool compiled in Task 2.5.

This report on **how the use of digital mobility solutions can be promoted**, is structured as follows. Chapter 1 introduces the INDIMO’s multi-stakeholder approach, the INDIMO’s overall project methodology, and T2.3 method. Chapter 2 contains a preliminary review of the literature, which will be extended in the coming months and will be included in the document D2.7 “Recommendations for policy makers and operators for implementing an inclusive digital transport system”, due by M35. In chapter 3, a summary of insights gained on appropriation from WP1 “*Analysis Framework of user needs, capabilities, limitations and constraints of digital mobility services*” is presented. Chapter 4 presents the conclusions and highlights of the key findings from Community of Practices (CoPs) conducted by the project pilots on appropriation. In conclusion, this deliverable last chapter describes the collected recommendations for the promotion of digital mobility services.

2. Preliminary Review of the Literature

Appropriation encompasses more than adoption, that is the process of interacting with a product from the moment they first hear about it to the time when they use it, as it entails the use of its features with confidence and familiarity with its core elements (e.g., Wirth et al., 2007; Stehr et al., 2020).

Appropriation approaches consists of various elements including nudges, social and educational strategies to facilitate the appropriation of digital mobility by different user groups taking into account the needs and characteristics of all societal groups, with particular attention to vulnerable to exclusion citizens. There is a growing focus on methods and strategies to improve digital skills and on the potential of gamification and incentives.

This section contains a preliminary review of the literature, which will be extended in the coming months and will be included in the document D2.7 “Recommendations for policy makers and operators for implementing an inclusive digital transport system”, due by M35.

2.1 Persuasive Technologies

The ability to personalise an application to fit a person’s needs is a key proponent for the majority of mobile phone application users, today. This helps users to have a sense of control over their options while they use the application. Anagnostopoulou et al. (2019) suggest that personalised approaches in applications provide better results as the persuasive strategies applied are specific to the user. This, in turn, would make suitable sustainable route options that are more personalised and more specific to each user. Furthermore, the use of a learning component that dynamically changes based on the user’s previous trips can be utilised to encourage the user to choose more sustainable modes of transport that are similar to their current modes of transport.





Textual messages can be a useful tool to show users a summary of their trips over a given period, as discussed by Anagnostopoulou et al. (2019). For instance, the use of graphs to show e.g., the various modes of transport that one uses, how much money has been spent over a period of time, how many calories one has burnt and the carbon dioxide emissions one has consumed can encourage the person to consider more sustainable modes of travel that are both price and environment friendly.

As much as digital mobility is beneficial to the transportation sector, it is important to remember that users tend to become annoyed by frequent attempts to persuade them to use mobile applications and digital services. For this reason, it would be better, in general, to use low-to-moderate frequency of persuasive messages.

2.2 Payment Options

Accessibility to various financial services is critical for users of digital mobility applications. Since the inception of the provision of digital mobility services, it has been easier for businesses within this sector to offer convenient and secure payment solutions which have mainly been provided by banks that provide credit card facilities. Unfortunately, this has caused a marginalisation against people who lack access to not only credit card facilities but also bank accounts. This situation only gets worse as low income and older community members live in fear of theft or loss of funds through the use of online or smartphone accounts (Golub et al., 2019). In order to bridge the gap on these issues, Golub et al. (2019) and Yan et al. (2021) suggest the **use of cash to pay for the travel fare or to load accounts affiliated with the digital mobility platforms, debit card programs or money orders.**

2.3 Internet Connectivity

Digital mobility platforms are heavily dependent on access to internet connectivity for a person to plan their desired travel route. The majority of low-income earners and the elderly in society either lack access to mobile data plans, internet connectivity in their homes or are unable to keep up with the ever-changing technological developments in the use of smartphones. **To solve the internet connectivity problem, providing Wi-Fi access hotspots at key locations or subsidising the cost of internet or data plans may help in encouraging more people from these backgrounds to use the digital mobility service.** In addition to this, it would also be necessary to have specialised outreach forums for less technology-proficient individuals, to familiarise them with new advancements in digital mobility applications (Golub et al., 2019; Yan et al., 2021).

2.4 Psychology Perspective

Tomaino et al. (2020) investigated the importance of transportation psychology in their research on Mobility as a Service (MaaS). Their key findings are related to perceived control, perceptio of cost, consumer identity and other social factors as described hereafter.





2.4.1 Perceived Control

In as much as digital mobility brings together various modes of public transport, people would like a sense of control over their transit options. **Giving commuters more options to model their preferred mode and route of travel can be quite beneficial in promoting the use of a digital mobility application** as the user will get a sense of affiliation and responsibility for their travel while planning and executing their commute.

2.4.2 Perceived Costs

People tend to become sceptical when a new application seeks a commitment for the provision of a service through a payment. As there is a high possibility that they will compare the application to one already on the market, it is **necessary to prove to potential users that they will receive value for their time and money through the use of a new application** in order to overcome the high level of doubt.

A recent business model for providing free basic-rate digital services to everyone with a data capable phone, living in mobile coverage areas, is called “Freemium”. The term “Freemium” is a portmanteau of the words “free” and “premium”. The Freemium model is a popular business model for digital services, where basic functions are provided for free, but more advanced features can be obtained with a fee (Esselaar et al., 2017). In mobility apps, Freemium business models are predominant, such as WAZE, Moovit, Uber, etc.

From the point of view of a digital mobility application, **a pay-per-use model is likely to be more ideal for a new application** when compared to a subscription-based model. This would allow the users to try out the application and to assess whether the application can meet all their commuting needs when they compare it to other digital mobility applications in the market. In addition to this, the **use of reliable third-party payment solution providers and the provision of services at a discounted rate for first-time users** can also help build a sense of the reliability of the application.

2.4.3 Social Factors & Personalization

The mode of transportation chosen by commuters can be influenced by their sociocultural identities and personal objectives. For instance, a person may opt to travel in an electric vehicle in order to show their environmental consciousness while on the other hand, airline passengers have the choice to choose their preferred seat and class of travel. Commuters are more likely to use an app if it informs them about the impact of their travel choices. As well, it is desirable to make the personalization features within applications stand out through effective and convincing cues.

Different personalities and character traits are used to identify each person individually, in addition to influencing their travel choices. People may find it **beneficial to be able to choose their social environment**, as some may want to travel in a socially connected environment, while others may prefer privacy. Digital mobility's popularity will influence its uptake, and **consumer confidence can be built by using marketing strategies such as social media influencers and support from reputable organizations**.





2.5 Language

Communication is a core component for commuters when planning their travel. The need for the **availability of digital mobility applications in languages other than English** is ever-growing as many people, who speak various languages, are integrated into the digital world each day. This would help to achieve universal access and usability of the application (Golub et al., 2019).

2.6 Security & Safety of Users

A large body of transportation research focuses on security and safety of users of the transport system (e.g., Acheampong, 2021; Yan et al., 2021). Obviously, the safety of passengers while travelling is a major priority for organisations that are already involved in the transportation sector. To ensure passenger safety, several measures have already been put in place, including extensive training for drivers and requiring them to possess certificates of good conduct in their respective countries. Unfortunately, there have been recent cases in the media that report the use of internet ride-hailing services to conduct criminal activities, impersonation, and dishonesty among some ride-hailing drivers (e.g., <https://www.nbcboston.com/news/local/19-charged-in-ride-hailing-fake-driver-account-scheme/2375154/>). This instils fear in the travellers as they have little information about who they are travelling with. **More information about the driver can be beneficial to passengers** since it will help them feel more at ease with the driver they have been assigned to, but it can also expose the driver to possible theft or impersonation risks. In light of this, there is a critical need for more transparent and effective policies and procedures that would reexamine the scope of documents that are necessary to build a more trusting relationship between drivers and passengers with regards to the provision of digital mobility services.

The ability to share one's location while travelling has been a game-changer in the transportation industry. Travellers can share their trips with their loved ones and, in the event that something goes wrong along the trip, it would be easy to track the traveller. Even though these developments have had a positive contribution mainly to encourage people to use internet ride-hailing applications, there are still cases of sexual harassment reported by mainly female travellers. In the end, it's really up to the individual's feelings: while some people enjoy sharing their locations, some feel unsafe doing so. Therefore, **one of the essential features of digital mobility applications is the provision of personalized security assurances**. In order to improve safety in vehicles, **ensuring a larger gap between seats, installing security cameras and ensuring adequate driver training** can be helpful (Yan et al., 2021). Furthermore, **giving female users the option to have the option to travel in a designated vehicle for only women can be beneficial**. A similar option can also be extended to families that wish to have a conducive environment to travel with their children.





2.7 Social and Educational Strategies

The following presents social and educational strategies for enhancing appropriation of digital mobility solutions by target-groups of users such as people with reduced vision and mobility, older people, peri-urban and rural areas inhabitants, foreigners, ethnic minorities, women, socially isolated, non-connected, COVID-19 confined, low-income and caregivers. More on these strategies and insights can be found in D1.3 in which the capabilities, limitations, and requirements of the identified target-groups of users are highlighted (Di Ciommo et al., 2021. Section 1).

The literature shows that the spread and social value of Information and Communication Technology (ICT) and the digital domain have given rise to new forms of exclusion and new problems of accessibility, which add up to those already existing in the physical pre-digitalized world. The digital divide is thus defined as the gap between those who have high access to digital tools and those who have low or no access at all, either because of not having access to the equipment, to Internet connection, not having the adequate skills and capabilities, or not feeling appealed by technology for doing everyday tasks in a different way (Saha, 2014).

While digital literacy has broadly been classified as skills and knowledge of diverse nature (e.g., Vanwynsberghe et al., 2011; Van Deursen and Van Dijk 2010), the most advanced research has shaped it through the notion of self-efficacy (e.g., Helsper and Eynon 2013). Self-efficacy is defined as ‘the belief in one’s capability to organise and execute the courses of action required to manage prospective situations’ (Bandura 2010, 2).

Along with the problem of digital appropriation, there is a growing concern on the consequences of transport poverty on inequality (EU 2020). This is the effect of the inaccessibility to mobility services in certain regions or for certain groups. The availability, accessibility and affordability of transport have a major impact on people’s ability to find and retain employment, to take advantage of opportunities for education, to access healthcare and to buy food and other needs (Frye, 2011). The lack of, or inability to use, mobility services is shown to be a factor sustaining poverty, unemployment, and other socioeconomic inequalities since it blocks access to these very same crucial opportunities (Lucas et al., 2012; Delbosc and Currie, 2011, Lucas et al., 2019).

2.7.1 Recommendations from social and educational strategies literature review:

Based on this specific literature and the last UNESCO (2020) and UNFCCC (2021) on Action for technological educational empowerment, the educational and social strategies of Digital Mobility Services (DMS) and Digital Delivery Services (DDS) by target-group users include the following recommendations.

Technologies educational strategies implementation is recommended at all levels of education (primary, secondary and tertiary) as a cross-cutting element of educational curricula and policies in areas such as technological and social studies; thus, teachers, university educators and faculty members need to build and integrate digital technology into their curricula.





Training local communities and authorities from different NGOs and administrations at different levels can enhance institutional and technical capacity. Moreover, training decision-makers, including government officials, can enhance understanding how mobility issues and transport poverty relates specifically to their area of work; learning good practices, recognized by their governments, for working together with vulnerable communities; understanding why and how gender equality and intercultural principles are relevant to take-up the DMS and DDS; and design skills development programmes for decreasing transport poverty issues specially for vulnerable-to-exclusion groups.

Public awareness can be enhanced by producing local campaigns to inform the public and specially target groups on DMS/DDS and how these solutions could cover their vulnerabilities, among other things (e.g. through social media, email, billboards and mobility empowering actions, festivals or by partnering with cities and rural locations); creating communities of practice (CoP) knowledge and learning that's available and accessible to a wide range of stakeholders including women, children and youth, the elderly and people with disabilities. Deliverable D3.2 elaborates on the scope of the CoP's (Di Ciommo et al., 2021) showing how these spaces can become a tool for empowering users and end-users in the adoption of digital mobility services. By sharing information, we build new ideas and familiarize with new behaviours. This dialogue is led and encouraged by specialists on the topics, which provide their own valuable inputs. The appropriation and the take-up of DMS/DDS by users vulnerable to exclusion mainly go through these CoP's coordinated by cambiaMO. Specifically, the appropriation exercise goal carried out in the T2.3 was to identify social norms and behaviours that facilitate the use of DMS and DDS (section 4 in D3.2).

Public access to information by providing accurate information on digitalization, apps, and government websites, as well as making scientific information on DMS/DDS freely available; making DMS/DDS available in local languages for vulnerable communities, including people with special needs; considering the global impact of transportation and commute choices on global warming and ecology, it is important to improve public access to climate change information at the national and local level using a variety of methods and tools; and taking into account possible differentiated digitalization on particular communities, groups and individuals, including women, children and youth.

Public participation can be achieved by holding frequent, inclusive civil society consultations, including follow-up processes with specific outcomes such as feedback surveys allowing participants to express how they feel that their input was used; and by developing guidelines for enhancing public participation, including participation of children and young people.

2.8 Methods and Strategies to Improve Digital Skills

Recent research has demonstrated emotions are key determinants in product adoption. When using a technology for the first time, final user emotions and perceptions have a great influence in the evaluation of its usefulness (Charles Lamontagne, 2021). **A positive training experience in the first interaction with a new technology has a great impact in motivate the user to use the applications** (S. Gupta, 2014). In order to guarantee a good adoption by the final user, it is





important to provide a pleasurable and comprehensible learning environment (M.G. Morris, 2010).

Until recent years, in-person training was the most common way of disseminating knowledge about a new technology. Face-to-face training have the advantage of providing immediate feedback and increase user engagement (Grieve, 2014). Today, due to the number of applications and software available in the market, and the continuous release of updates, trainers are having difficulties to stay up to date (Charles Lamontagne, 2021). Moreover, new restrictions given by the COVID-19, have made in person training not possible. These factors have contributed to the growth of **video tutorials as a primary source of learning new technology**. Given the lack of immediate feedback and engagement, and the need of keeping a pleasurable learning experience, it is recommended to apply two techniques to optimize video tutorials: first, to **divide the instructions into smaller segments** to reduce the complexity; second, to **conduct user testing on the online training material** (Charles Lamontagne, 2021) .

Another relevant aspect, also identified by all the INDIMO pilots, is the **need for human assistance and support**. Different studies support the correlation between technology adoption and availability of assistance and support services (Pratyush Bharati, 2006). Still, Software development companies and service providers often cannot afford these services, making them an out-of-reach cost.

Among the external factors that can influence digital inclusion it is important to mention the role of family and friends and the role of communication strategies and influencers. **Family and friends play a key role in providing social support for technology adoption**.

In the last years, **social media influencers have been playing a key role in increasing the adoption intentions and trust in applications**. A social media influencer, by endorsing a new technology, increases the perceived usefulness in the final user (Hu, 2019). Marketing communication strategies also have an important role in technology adoption. When they target people that feel discomfort about the usage of a new technology, marketing strategies focus on simplicity and promoting only the core functions. **Especially after adoption, communication strategies are extended beyond the product promotion by showing new features and demonstrating the use of the product in different context** (Minhee Son, 2016).

In conclusion, the literature supports the importance of **training, assistance and support and external factors in adopting new technology and improving digital skills**. These findings complement the recommendations of the project pilots described in D1.2 “*User needs and requirements on a digital transport system*” (Vanobberghen et al., 2021), and in D1.5 “*Opportunities, Limitations & Constraints of Digital Mobility Services*” (Specktor et al., 2021).

2.9 Discussion

In order to meet the target of sustainable urban mobility, it is necessary to take into account the needs of different users and to offer transportation that is accessible and inclusive to all groups equally.





Digital mobility solutions are mainly developed for general use according to the assessment of the needs and capabilities of a-priori typical users. However, to be effective, strategies and plans relating to urban mobility and delivery must be target-group sensitive. Recent travel research findings suggest that there appears to be a distinct gender bias in the support and adoption of mobility solutions, which may be due to women's increasing awareness of their mobility needs. Therefore, women are more likely to support and accept appropriation of mobility solutions than men.

INDIMO's main goal is to expand the use of existing and emerging digital mobility and delivery services to populations that are currently excluded due to physical, cognitive, or socio-economic barriers. Given the subjective variance of target-groups potentially excluded, INDIMO can't fully accomplish its goal. However, the INDIMO multi-stakeholders' user-centric approach qualitatively investigates selected various vulnerable-to-exclusion characteristics in five pilots, providing wide-ranging implications on appropriation of digital mobility for potentially excluded populations in general.

The need to adhere to a target-group sensitive vision of digital mobility and delivery services has emerged as a daunting and impending task for urban mobility policymakers and planners. As noted in the literature review, current knowledge is limited when it comes to how digital mobility services are intended to target different target groups; this is where INDIMO contributes to fill the knowledge gap. Among the key issues to be addressed are the idea of promoting the participation of various target groups in decision-making, improving access to mobility solutions, as well as the planning of transportation services that meet the needs of all users.

3. Insights on Appropriation from WP1 Data Collection

During the first phase of the INDIMO project in Work Package 1 (WP1) "Analysis of barriers and opportunities for tapping the full potential of the digital interconnected transport system" a comprehensive framework (Figure 1) was established for the work plan of WP1 tasks (Table 1).

In general, the WP1 analysis framework of qualitative data collection included definitions of users' characteristics in the five pilots (Table 2) and opportunities for information collection. Each pilot site addressed specific user profiles and characteristics and focused on certain digital mobility or delivery services that will be tested and re-designed during the project to be improved from the accessibility and inclusiveness perspectives.

Although enhancing appropriation of digital mobility solutions was not an objective of WP1, during the tasks T1.2, T1.3 and T1.4 different aspects of appropriation, mainly the user's requirements to gain proximity with apps, were explored and feedback from different stakeholders were collected.

Here we present the main findings and insights from WP1 data collection process that were found relevant to this stage of the research process.





Figure 3: WP1 Framework

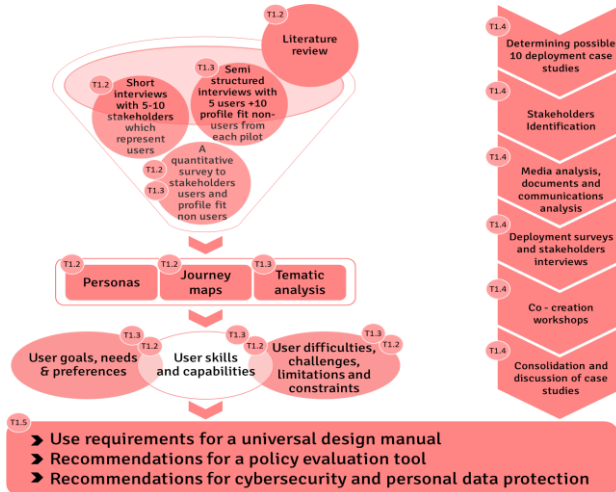


Table 1. WP1 Tasks

Task ID	Task Title	Leader & Contributing Partners
T1.1	Framework for analysis of user needs, capabilities, limitations & constraints of a digital transport system	Technion VUB, VDI/VDE-IT, IMEC, CambiaMO, MBE
T1.2	Analysis of the requirements of users towards the digital interconnected transport system	IMEC VUB, CambiaMO, DBL, MBE, Technion, ZLC, EPF, Door2Door, VIC, CoopCycle, ITL, PI
T1.3	Identification of user capabilities and requirements of a digital transport system on users	CambiaMO Technion, IMEC, EPF, DBL, MBE Door2Door, VIC, CoopCycle, ITL, PI
T1.4	Understanding the process of the deployment of digital mobility services	MOBI – VUB VDI/VDE-IT, ZLC, polis
T1.5	Opportunities, limitations and constraints for the use of an inclusive digital transport system	Technion VUB, IMEC, CambiaMO

Table 2: User profiles of the INDIMO pilot projects

#	Pilot owner	Pilot name	User profile(s)	User characteristics/Target groups included (all or most) in the profile
P1	Emilia Romagna	Introducing digital technology to enable e-commerce in rural areas	<p>1st user profile: Older people who receive/send parcels</p> <p>2nd user profile: Migrants or foreign people who receive/send parcels</p>	<ul style="list-style-type: none"> • Age: older • Lack of digital knowledge • Residing in peripheral locations • Lack of digital services • Lack of dedicated network infrastructure • Limited access to transport services and commercial delivery services • Low economic conditions (assuming migrant from out of Europe) • Low level of education (assuming migrant from out of Europe) • Language barrier • Lack of digital knowledge • Residing in peripheral locations • Lack of digital services • Lack of dedicated network infrastructure • Limited access to transport services and commercial delivery services
P2	Antwerp	Inclusive traffic lights	Vulnerable pedestrians	<ul style="list-style-type: none"> • Age: older (over 60) • Permanently impaired or with disabilities: visual disability, wheelchair mobility
P3	Galilee	Informal ride sharing in ethnic towns	Informal ride sharing users	<ul style="list-style-type: none"> • Ethnic minority man/women • Residing in the periphery • Insufficient public transport services • Language barrier





#	Pilot owner	Pilot name	User profile(s)	User characteristics/Target groups included (all or most) in the profile
P4	Madrid	Cycle logistics platform for delivery	Healthy food delivery users	<ul style="list-style-type: none"> • Lack of digital skills • People with reduced mobility • People with reduced vision • Socially isolated (unwanted loneliness) • Not-connected people (e.g., Low digital skills, lower technology availability) • Low income • COVID-19 isolated with none or reduced number of daily trips allowed
P5	Berlin	On-demand ride-sharing integrated into multimodal route planning	On demand ride sharing users	<ul style="list-style-type: none"> • Caregivers of children/ impaired/ elders • Gender: women • Lack of services (reduced mobility) • Lack of digital skills • Residing in peripheral locations

In total, 70 semi structured interviews (SSIs) with digital mobility services’ users and non-users and 95 interviews with stakeholders representing users have been carried out.

3.1 Task 1. - Analysis of the requirements of users towards the digital interconnected transport system

Through the journey map and persona exercise a number of elements were identified with regards to the first approach and contact with the app and the related service. We are going to observe those which are more relevant for each pilot.

For Emilia Romagna, the first contact with the service is highly dependent on the human assistance. The target audience tends not to feel comfortable with an advanced use of digital apps and the first approach probably is associated with the available service agents in place. It is required for the older group that service agents are present during the first weeks of the deployment to help with the first usage and train local associations volunteers working with foreigners and elderly people in the use of the new digital service. And probably a continuous human presence at the digital locker point is further needed. Additionally, with regards to the appropriation, it is required to design a communication plan and campaign that enables to fight back the common fear to technology. For the adoption phase, it is also suggested online or offline tutorials, teaching sessions by volunteers and toll-free number for further assistance.

In the case of Antwerp, a mass-media communication campaign directed to the target audience is suggested for appropriation. One of the requirements is to communicate via well-known channels about the presence of the smart lights (e.g., TV, radio, papers). Introductory videos and experimental individual mobility walks to the target audience are also suggested.

In the case of Galilee, in Task 1.2 it was mentioned that the informal ride-sharing service take-up should include introductory videos explaining the step-by-step procedure to use the digital tool and a helpdesk support for the setting-up of the app, which is sensitive in the context of this pilot. A communication campaign is needed to convince Arab women about the benefits of





the app and the advantages of reserving this service on the mobile phone. Addressing Arab women in Arabic and caring for gender aspects is also important for appropriation.

For Madrid, the findings of Task 1.2 about appropriation have to do with the use of older people as characters in the introductory tutorials in YouTube, in order to favour identification. Training sessions and other opportunities for familiarization before adoption should be identified. In this pilot, social campaigns also appear, mainly via opinion leaders and social organizations around the target audience, with the aim of fostering knowledge about the existence of the app and stimulate recommendations.

Finally, in Berlin, Task 1.2 identifies, for the appropriation of the on-demand ride-sharing integrated into multimodal route planning service, the integration of the service in the public transport networks which facilitates its recognition as alternative, and favours trust-building. The service should be promoted in public accessible spaces where caregivers tend to be present. A communication campaign will be needed to overcome the imaginary that divorces ride sharing/ ride hailing as a transport mode for mothers and caregivers in general.

3.2 Task 1.3 - Identification of user capabilities and requirements of a digital transport system on users

During Task 1.3, a path of capabilities, limitations, and requirements was identified for the different target audiences of the pilots. A list of around 80 requirements was created, from which there was an additional selection that enable to have a more manageable number of requirements to assess together with the participants of the Communities of Practice. From this total list of requirements, many items directly related to the appropriation of the pilots' DMS/ DDS. Here we highlight the most important:

- Include introductory tutorials. Introductory audio and/or video tutorials for downloading, initially configuring, and using the apps were noted as essential. This can assist first-time users, and help facilitating app adoption by people with low digital skills, and people who feel afraid about technology. This could enhance the experience for new users, and make users feel accompanied by the service provider.
- Support service introduction through social media and community groups. It is of importance especially in traditional family environments or other rigid contexts that are more sensitive and may hinder the introduction to digital tools. These schooling environments are many times an unexplored space to build a first familiarity and approximation away from households and its cultural mandates.
- Allow registration through social networks (such as Facebook). This is a way of shortcoming a step and making the adoption closer to the user. It is also a way of generating the feeling of integration among different networks where the user has created an identity.
- Involve influencers and local peer volunteers as trusted communicators. This was especially highlighted in the Emilia Romagna pilot, where local and proximity ties were very important to provide legitimacy to the new-coming service.





- Create a positive attitude through communication. This implies that communication should be based in positive images and, overall, images of empowerment.
- Highlight the environmental and social values behind the service. It is an important motivation for the first contact and adoption, mainly in the case of Madrid and Berlin. For Berlin, the interest is in finding alternatives to the private car, with complete awareness of their negative impact in the city. Accordingly, another requirement is not to communicate the ride-sharing as a replacement of bikes or public transport but as a complement. In the case of Madrid, the contrast between big commercial delivery apps and cooperative projects with good labour conditions clearly appear as a motivator of the first trial of the service. This is the willingness to support cooperatives who contribute to a better commercial environment.
- Promote the services offline via events and flyers. This implies not only relying on the online communication but also on the traditional channels of spread.

3.3 Task 1.4 - Understanding the process of the deployment of digital mobility services

In the Task 1.4 barriers for the design, planning, deployment, and operation of services were identified. Working in workshops and interviews with experts and developers, some drivers of usage which are directly related to the adoption and appropriation of the service were identified:

- Call centres provide easy access.
- Relatively low initial subscription cost.
- Personal approach to customer service.
- No need for credit card.
- Personal handling of complaints.

In the strategies to overcome barriers, there are two that directly address the appropriation of the app/service:

- Promote the service locally to residents, give information, offer phone support in the beginning, partner with local organizations, educate.
- Experience has shown that with time, the need of call-centre support is reduced.

3.4 Discussion

In the appropriation phase, a lot of attention should be paid to the setting of implementation and the characteristics of the target audience. Based on the findings and recommendations from the pilots described in previous WP1 deliverables (D1.2, D1.3 and D1.5) we identified three main categories: training, assistance and support, and external factors (family, friends, and influencers) as major factors in enhancing appropriation of digital mobility solutions, in





addition to obtaining the end user trust. There is also a shared understanding of education and communication campaigns as vehicles for reaching the target audiences.

It is also common among the different pilots that human presence is very important, not just in the first contact and interaction with the service, but also at any given time when an issue arises while using the app. Observations in the five pilots have shown that human contact is a game-breaker. Mainly, but not only users with limited digital skills expressed their requirement to have a contact person, contact points, and service support available to resolve their issues rather than dealing with related technology on their own.

Both users and non-users stated that text and audio tutorials, as well as introductory videos, are essential to explain registration and how to use the app. It was found that traditional and digital campaigns, and social media influencers have a direct and indirect influence on appropriation of digital mobility solutions. An additional key component in this domain is education, which was identified to have significant impact on enhancing appropriation of the digital transport system.

4. Community of Practice (CoP) Appropriation Exercise

4.1 What is CoP?

According to Wenger Trayner¹, communities of practice consist of individuals who engage in common interests and learn how to do it better through regular interaction.

The beginning of knowledge is the recognition that it is not an object that can be stored and transferred. Knowledge is also not an idea of the world already constructed that is transmitted from an instructor to a student.

In order to build knowledge, social interaction is essential. It involves sharing and exchanging ideas with others, and a setting that promotes such exchange. We all know some things and we ignore some others. By exchanging information, we create new ideas and behaviours.

Experts in the fields contribute their own valuable insights and facilitate the dialogue.

¹ Wenger-Trayner <https://wenger-trayner.com>



4.2 Description of the pilots CoP appropriation exercise

The CoP exercise on appropriation had the same format for all pilots. CoP agenda and exercise slides are presented below.



Agenda:

- I. Introduction to appropriation on digital mobility (5 min)
- II. Exercise 1. Slido - poll about notifications (10 min)
- III. Exercise 2. Role play pro-con for downloading apps (30 min)
- IV. Exercise 3. Slido - selecting 3 app for your phone (10 min)
- V. Debate and closing remarks (5 min)

Role Play:
Why, when and how would you download an application?



Group 1
 PRO: Please collect arguments for downloading apps

- It's super easy and fast
- Have you heard of this new application?
- This app has great ratings

Group 2
 CON: Please collect arguments for NOT downloading apps

- I don't have space on my phone anymore
- I can't stand more newsletters sent to my email
- I don't want to share my personal data

For the pro-con role play exercise on “why, when and how would you download an application?” participants were split into two breakout rooms.

This project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement No. 875533

slido

If an app keeps notifying you with information you think is not useful. What do you usually do?

Start presenting to display the poll results on this slide.

Options:

1. You delete them right away without even reading them.
2. You ignore them and leave them there.
3. You read them, wondering so what?
4. You read them and try to find a way to prevent them from happening again.



slido

Imagine you have a completely empty mobile phone and you can only install 3 of the following apps? Which ones would you choose?

Start presenting to display the poll results on this slide.

Options:

1. Access to public services (e.g., Library)
2. Saving data on the cloud (e.g., Dropbox)
3. Travel / Holidays (e.g., Boooking.com,)
4. Chat (e.g., Whatsapp, Telegram)
5. Amazon (online shopping)
6. Social networks (e.g. Twitter/Facebook)
7. Music (e.g., Spotify)
8. Maps, maps (e.g., Google maps)
9. Home banking
10. Teleconference (e.g., Zoom/Teams)
11. Health App (Calorie Counting, Fitness)
12. Calendar
13. Mobile browser (Chrome, Firefox)
14. Text processing (e.g., Word/Excel/PDF)
15. E-Mail
16. Games
17. App for food delivery (e.g., Deliveroo)

4.3 Pilots CoP appropriation exercise: main results

The following highlight the main results of the pilots’ Communities of Practice, hereafter CoP. Further detail can be found in the INDIMO deliverable on CoP, D3.2 (Di Ciommo et al, 2021).

4.3.1 P1 - Emilia Romagna: e-commerce in rural areas

Most of participants don’t like notifications. In 83% of cases, they are deleted without even being read. 17 % ignore them and don’t do anything about it.

Pros and Cons for downloading apps:

PRO arguments:

- Apps make life easier.
- Apps reduce time of service and can be used at times when it deems most appropriate.
- Apps always keep you updated.
- With an App information can be accessed 24 hours a day and on the move.

CON arguments:

- It’s difficult to justify downloading a new App if you have too many already downloaded.
- Apps do not help, the risk of digital scams is high, and there are many limitations related to the basic functions of the App.
- Referring specifically to the Poste App participants say that it could generate anxiety because it is possible for someone to distract you while collecting a package.
- A learning period after downloading the app can help you understand what the advantages are and how the App can be used effectively.





- The role of social norms: “How important is the social context? Is it relevant if someone recommends you to download an App?”. Participants answered that if someone recommends an App, it’s consider safer and that is certainly an advantage.
- Some of the participants believe that some applications are useful at a certain time but that often you prefer not to delete them to avoid having to redo all the steps and communicate the data in case you want to reinstall them at a later time.
- For citizen of Monghidoro, word of mouth influences a lot because it allows you to download an App and try it.

The last instant poll includes: "Imagine you have a completely" empty "mobile phone, what applications would you insert? (maximum 3 answers). Each participant had 17 options available (as listed above). This test result was as follows:

1. Chat.
2. Email.
3. Home banking.
4. Access to public services.

4.3.2 P2 – Antwerp: Inclusive traffic lights

There was an equal divide between 33% who ignore notifications and leave them, 33% who delete them right away without reading them, and 33% who delete them and try to find a way to prevent them from happening again. None just read them, wondering so what.

Pros and Cons for downloading apps:

PRO arguments:

- Useful: the app should be useful for me and in my daily life.
- Participants trust the opinion/experience of family and friends on whether an app is useful for them or not. “If someone tells me if something is good, I download the app”.
- The app user-friendliness for visually impaired, blind people: If other visually impaired, industry employees recommend it, it triggers us (blind people) to install an app.
- Good Reviews: I choose the best app according to the reviews in the App Store.
- Feature-rich Apps including directions/ guided-navigation offline are desired.
- Accessible: aspects such as speech output/voice and visibility are important. It is difficult to make accessible what it has been designed as inaccessible. It requires attention from the design stage, e.g., Good colour contrast.
- Privacy preserving app, participants prefer not to give personal information. Some users trust applications like CoronaApp: this app preserves the privacy of the users.
- Enable mobile payments of parking, public transport (e.g. DeLijn, Nmbs, where you can search for a train and buy the tickets). Payments will only be used if the organisation is trusted.

CON arguments:

- App takes a lot of battery.





- App has bad reviews.
 - App is not user friendly for visual impaired, blind people.
 - Storage: the app does not consume a lot of space, sometimes participants don't download the app if their phone is full.
 - The App doesn't work offline.
 - Low data consumption: prepaid data is expensive, before acquiring a subscription one of the participants used the app only when connected to WiFi.
 - Unclear apps, apps that offer many features and it is not clear what is its main function: for example an app that offers banking and shopping.
 - Participants know people who experience issues with the app's Cyber-security. Messages are spread between them via social media or groups, especially for visually impaired people.
 - App requires sharing personal data such location without any clear scope.
 - App requires personal data but the developer is not always trusted, it needs to come from a known and trusted source.
 - Payments: kids can buy things when using the app (games), whenever possible, this should be prevented.
 - Payments: the owner of the app is not trusted, the app is new and/or not widely used.
 - Payments: some prefer to pay only via computer.
-
- Top 2 apps were: Google search, Google maps, and thirdly travel related apps, music apps, and email.
 - Participants do not like notifications but, depending on the type (usefulness) of app, they are willing to tolerate them.
 - Participants rely a on feedback from family and friends (social norms) when downloading, paying or sharing personal information with an app.
 - Other factors such as the reviews, number of downloads, purpose of the usage of their personal data, trusted developer among other, have also an influence on the decision of downloading an app. Aspects related to battery, Internet, space consumption was also mentioned as important.
 - The results of the most used apps are related to the age of participants and on the presence of some degree of visual impairment. We recommend to the other CoPs to make an open question rather than suggesting a predefined list of apps.
 - It is recommended for workshops on app usage to directly engage with people from the target group, and not with their representatives. Direct feedback will be in this case more insightful. Moreover, it is recommended to send the questions in advance and later evaluate if an online session is required.

4.3.3 P3 – Galilée: Informal ride sharing in ethnic towns

There was an equal divide between 50% who ignore notifications and leave them, and 50% who delete them right away without reading them.

Pro and con arguments for downloading Apps:





PRO arguments:

- Only if practical and helps me in life.
- It has lots of functionality. More features in one app the better the chances.
- If app got good reviews and rating.
- Based on recommendations and others experiences of people we trust.
- Depending on how reliable the app is, what info we get/use and how accurate it is.
- It must be simple to download and friendly to use.

CON arguments:

- For sharing personal data, we need to have an added value.
- Too many letters.
- Having too many apps.
- Because of the price.
- Service is not appropriate for me.
- Having cyber security concerns when App provider is not trusted.
- Phone storage limitation.
- Lengthy process for downloading with a low performance phone and/or Internet connection.
- Battery consuming.
- The use of apps should be avoided to prevent addiction to them.
- Consolidation or not of various functionalities in a single app.
- Sometimes an app is downloaded, but then never used and deleted.
- The complexity of the app.
- Open to download and app is assessed and deleted if not needed or too complex.

Top 3 apps by far than others were: travel related (probably because all participants have transportation planning backgrounds and interests), music, and mapping.

4.3.4 P4 – Madrid: Cycle logistics platform for delivery

17 % delete notifications right away without even reading them. 33% ignore them and leave them there. 17 % read them, wondering so what? And 33% read them and try to find a way to prevent them from happening again.

Pro and con arguments for downloading Apps:

PRO arguments:

- Ease of use.
- Useful and practical (e.g. when you need to do something such as scanning, some people look for an app and some other look for a physical place where you can scan)
- Easy to download.
- App is free.
- App takes up little space.
- App has no advertising.





- App is of interest to others too.
- App responds to a specific need.
- Influenced by social norms and environment.
- Impact of Influencers.
- Incentives app gives when you install it (social security).
- Curiosity for the marketing or advertising of large applications (Instagram).
- Notifications and alerts.

CON Arguments:

- Data collection and what they do with this data (if they sell it).
- Obsolete and outdate application developments.
- Advertising and ads.
- Lack of transparency and opacity, for profit or not.
- Amount of storage required and downloads.
- Number of permissions the app asks for (location, contacts, photos...)
- Inertia and "conservatism". Critical mass.
- Battery usage.
- Type of operating system the app asks for.
- Already installed applications that cover several functionalities.
- App asks to create a username, password, ID, driving licence (too much info asked).
- Request for credit card.
- Rejection by the marketing or advertising of big apps.

Apps are part of the current human daily-life and, in general, are well accepted when channelled through the non-invasive and subtle advertising (such as advertising on Instagram, which some participants value as very relevant and on some occasions have followed with great interest).

The CoP debate confirms that social norms and environment play an important role in downloading apps and, therefore, satisfy users' needs through the digital services.

Telegram/WhatsApp/chat are the most popular apps. Journeys maps apps are the second selected "essential" typology of app. This means that digital mobility apps are considered as essential and their appropriation is a matter of being accessible, inclusive and well "channelled". Third came web navigator apps.

4.3.5 P5 – Berlin: On-demand ride-sharing integrated into multimodal route planning

- 50% ignore notifications and leave them, 25% delete them right away without reading them, and 25% read them and try to find how to prevent it from happening again.
- Pro and con arguments for downloading Apps:

PRO arguments:

- Usefulness of the app is the biggest reason.





- The ability to check information on the way, support in the daily life.
- It has to be not only easy and useful, but also fun.
- For social networks we work with. But too many are not really good and are actually deleted.
- Some like to download new apps to try them out.
- If someone recommends, people are more open to download.

CON arguments:

- Avoiding 3-4 pages of apps. Prefer to keep all apps on one page.
 - Keep one general app instead of several specialized apps.
 - No WhatsApp. Telegram and Signal are enough (protection of data).
 - Mobility: choose what truly is needed.
 - Prevent from having photo apps on the smartphone, better on the laptop.
 - Better to store things in the laptop and not on the phone.
 - It's better to look for a function and not an app in particular.
 - While working from home, having everything I need there, its better to have less apps. You download apps you need while on the go.
 - Try not to have too many apps.
 - One app allows to compare the options better.
 - Registration in advance is not desired. Preferably you check a new app after you download it first and only then register if you like it.
- Top app was mapping selected by 75%. 50% chose calendar, telegram/WhatsApp/chat, and e-mailing apps. 25% selected social media, web surfing and SMS.

4.4 CoP appropriation exercise discussion

By sharing information, we build new ideas and familiarize with new behaviours. This dialogue was led and encouraged by specialists on the topics, which provide their own valuable inputs. Following the key conclusions of the five pilot CoPs are highlighted.

- The usage of apps has become part of human daily lives.
- Ads that tend to be subtle, non-invasive, and simple to understand work well to get people interested in installing new apps.
- As a rule, mobile app users dislike notifications, with the exception of notifications that are found useful in enhancing application effectiveness. In this case, users are willing to tolerate them.
- Most users download apps if they find the app to be useful, reliable, feature-rich and user-friendly.
- Many participants have expressed concern about data privacy. Despite this, many people are not aware of the extent to which data is being used by various applications.
- Concern has been raised about battery consumption and mobile device storage as factors influencing the decision to download and/or keep an app.





- The environment and social norms play a major role in determining the use of apps and, therefore, how they satisfy users' needs.
- It was found that preferences of apps varied by gender, location, occupation, personal interests, and daily needs.

5. Key Recommendations: A Summary

The following recommendations are based on a literature review, findings from WP1 and pilot CoPs, and represent a comprehensive synthesis of what has so far been learned about appropriation of digital mobility solutions.

Overall, in order to enhance appropriation of digital mobility solutions while meeting the target of sustainable urban mobility, it is necessary to take into account the needs of the different target-groups of users and to offer transportation that is accessible and inclusive to all target groups equally. Hence, policymakers, developers, and operators need to adhere to a target-group sensitive vision of appropriation of digital mobility and delivery services.

The following are the key recommendations intended to help improve appropriation of inclusive and accessible digital mobility (DMS/DDS) solutions:

- Implementing mobile mobility and delivery solutions (DMS/DDS) require **on-going support and human contact**. Having human contact is key to overcoming some of the apprehensions tied to the digital domain.
- **Consider gender, residence, occupation, subject of interest, and daily needs that influence user preferences**. Additionally, perceptions of usefulness, costs, safety, and privacy impact the users' opinion. Considering these different aspects can enhance the chances of appropriating digital solutions.
- Bear in mind that **social and environmental norms** play a major role in determining how apps are downloaded and, consequently, their use.
- In today's society, digital mobility is a part of daily life. However, **appropriation of mobility technology needs to be addressed both for digital and physical users**.
- At all levels of education and communities **allocate resources for technologies education and training**.
- Utilize targeted campaigns and communities of practice (CoP's) to **increase public awareness**.
- **Open up scientific information on DMS/DDS to the general public on the web for free**.
- To encourage people to download new apps, **use subtle, non-invasive ads**.
- Users of mobile apps dislike notifications as a rule, except when they are useful for enhancing the functionality of apps. Hence, **provide a clear statement of the added value provided**.





- When you develop an app, make sure you meet the main objectives for most users to download the app. Applications should be **convenient, reliable, appealing, and user-friendly**.
- **Provide a clear explanation of how data privacy is addressed.** Many users are unaware of the extent to which their data is used by various applications, so rather than expose themselves to privacy risks, they choose to not use apps at all.
- As a key factor influencing the decision regarding an app's download or keeping, please clearly **address the concerns about battery consumption and mobile device storage**.

6. Conclusion

As presented in this report on how to enhance the appropriation of digital mobility solutions, we have developed recommendations about how to influence the uptake of digital mobility solutions.

Recommendations are based on the analysis and synthesise of the key findings from the various knowledge sources including a preliminary review of the literature (see section 2), an analysis of WP1's findings (see section 3), and a discussion of the results of the 5 pilots' Communities of Practices (CoPs) on enhancing appropriation of digital mobility services (see section 4).

The provided recommendations (see section 5) could help improve the adoption of digital mobility solutions. The key findings and outcomes from T2.3 and the recommendations in this report will be mainly fed into the INDIMO Policy Evaluation Tool compiled in Task 2.5.

In addition, the preliminary review of the literature (section 2), will be extended in the coming months on WP2 and will be included in the document D2.7 "Recommendations for policy makers and operators for implementing an inclusive digital transport system", due by M35.



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