INSTITUTE FOR Sustainability Science AND TECHNOLOGY

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Fostering co-creation tools for more inclusive digital mobility services: The DIGNITY Toolkit

Master's Thesis

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Resum

La necessitat de la transició verda i digital (European Comission, 2022) es fa cada vegada més evident. El desenvolupament digital de les eines de mobilitat estan provocant un canvi de paradigma en la mobilitat, però pot excloure als qui no tenen accés a les eines digitals o els resulta difícil utilitzar-les per diverses raons. Això pot comportar majors desigualtats socials i limitar el desenvolupament urbà sostenible en diferents dimensions.

Aquest projecte es basa en la co-creació d'un *toolkit*, una plataforma digital emmarcada en el projecte europeu H2020 DIGNITY. L'objectiu general del DIGNITY és fomentar un ecosistema de mobilitat digital sostenible, integrat i fàcil d'usar que millori l'accessibilitat i la inclusió social.

Aquest *toolkit* presenta una metodologia amb eines sobre com avaluar i fer front a la bretxa digital per promoure la inclusió en la mobilitat. El toolkit està adreçat principalment a *policymakers*, proveïdors i operadors de mobilitat, però també pot ser utilitzat per altres *stakeholders*.

La recerca s'ha basat en el procés de co-creació i el disseny centrat en l'usuari, amb la finalitat d'identificar les necessitats dels usuaris finals d'aquest *toolkit*, per a poder incloure'ls i tenir-los en compte durant tot el procés. S'ha seguit un procés de tres fases (*framing*, *bridging* i *evaluating*), seguint les mateixes fases DIGNITY approach.

La primera fase (*framing*) ha consistit a entendre la problemàtica i identificar les necessitats, fent una revisió de la literatura, creant un mapa de *stakeholders*, fent un *benchmarking* i entrevistes. Durant la segona fase (bridging), orientada a co-crear la solució, s'ha realitzat un taller de co-creació amb *stakeholders* rellevants, i s'ha dissenyat l'arquitectura web, prototips i una llista de requisits per assegurar que es tindran en compte necessitats dels usuaris finals. La tercera fase (*evaluating*) es basa en una proposta d'eines que consisteix en una avaluació d'accessibilitat, un taller de validació amb els *stakeholders* i un qüestionari als usuaris finals del toolkit, a completar durant la fase final del projecte.

Els resultats de la recerca, és a dir el conjunt de dades qualitatives obtingudes a través d'eines de disseny centrat en l'usuari i la seva anàlisi, permetrà reforçar el procés de co-creació i disseny final del DIGNITY Toolkit. Aquest toolkit serà una eina de suport pels usuaris/es finals en l'avaluació de la seva bretxa digital en cada context i la promoció de la inclusió i l'accessibilitat en els ecosistemes de mobilitat.

Paraules clau

Disseny inclusiu	Co-creació	Caixa d'eines	Mobilitat	Bretxa digital	Disseny centrat en l'usuari

Resumen

La necesidad de la transición verde y digital (European Comission, 2022) se hace cada vez más evidente. El desarrollo digital de las herramientas de movilidad están provocando un cambio de paradigma en la movilidad, pero puede excluir a quienes no tienen acceso a las herramientas digitales o les resulta difícil utilizarlas por varios motivos. Esto puede comportar mayores desigualdades sociales y limitar el desarrollo urbano sostenible en diferentes dimensiones.

Este proyecto se basa en la co-creación de un *toolkit*, una plataforma digital enmarcada en el proyecto europeo H2020 DIGNITY. El objetivo general del DIGNITY es fomentar un ecosistema de movilidad digital sostenible, integrado y fácil de usar que mejore la accesibilidad y la inclusión social.

Este toolkit presenta una metodología con herramientas sobre cómo evaluar y hacer frente a la brecha digital para promover la inclusión en la movilidad. El toolkit está dirigido principalmente a *policymakers*, proveedores y operadores de movilidad, pero también puede ser utilizado para otros *stakeholders*.

La investigación se ha basado en el proceso de co-creación y el diseño centrado en el usuario, con el fin de identificar las necesidades de los usuarios finales de este *toolkit*, para poder incluirlos y tenerlos en cuenta durante todo el proceso. Se ha seguido un proceso de tres fases (*framing*, *bridging* y *evaluating*), siguiendo las mismas fases DIGNITY approach.

La primera fase (*framing*) ha consistido en entender la problemática e identificar las necesidades, haciendo una revisión de la literatura, creando un mapa de *stakeholders*, haciendo un *benchmarking* y entrevistas. Durante la segunda fase (*bridging*), orientada a co-crear la solución, se ha realizado un taller de co-creación con *stakeholders* relevantes, y se ha diseñado la arquitectura web, prototipos y una lista de requisitos para asegurar que se tendrán en cuenta necesidades de los usuarios finales. La tercera fase (*evaluating*) se basa en una propuesta de herramientas que consiste en una evaluación de accesibilidad, un taller de validación con los *stakeholders* y un cuestionario a los usuarios finales del toolkit, a completar durante la fase final del proyecto.

Los resultados de la investigación, es decir, el conjunto de datos cualitativos obtenidos a través de herramientas de diseño centrado en el usuario y su análisis, permitirá reforzar el proceso de co-creación y diseño final del DIGNITY Toolkit. Este toolkit será una herramienta de apoyo para los usuarios/as finales en la evaluación de su brecha digital en cada contexto y la promoción de la inclusión y la accesibilidad en los ecosistemas de movilidad.

Palabras clave

Diseño inclusivo	Co-creación	Caja de herramientas	Movilidad	Brecha digital	Diseño centrado en el usuario

Abstract

The need for the green and digital transition (European Comission, 2022) becomes increasingly clear. Digital development of mobility tools is causing a paradigm shift in mobility, but it may exclude those who do not have access to digital tools or find it difficult to use them for various reasons. This may lead to greater social inequalities and limit sustainable urban development in different dimensions.

This project is based on the co-creation of a toolkit, a digital platform framed in the European H2020 DIGNITY project. The general objective of DIGNITY is to promote an ecosystem of sustainable, integrated, and user-friendly digital mobility that improves accessibility and social inclusion.

This toolkit presents a methodology with tools on how to evaluate and tackle the digital divide to promote inclusion in mobility. The toolkit is primarily aimed at policymakers, mobility operators and providers, but can also be used for other groups.

The research has been based on the user-centred design and co-creation process, to identify the needs of end users of this toolkit, so they can be included, and their perspective can be considered throughout the process. A three-phase process (framing, bridging, and evaluating) has been followed, using the same DIGNITY approach phases.

The first phase (framing) has consisted of understanding the problem and identifying needs, reviewing literature, creating a list of stakeholders, doing benchmarking and interviews. During the second phase (bridging), aiming to co-create the solution, a co-creation workshop with relevant stakeholders has been carried out. Also, the web architecture, some prototypes and a list of requirements have been co-designed to ensure that end users' needs will be taken into account. The evaluating phase is based on a proposal consisting of an accessibility assessment, a validation workshop with the stakeholders and a questionnaire to end users of the toolkit, to be completed during the final phase of the project.

The results of the search, meaning the set of qualitative data obtained through user-centred design tools and their analysis, will strengthen the process of co-creation and final design of the DIGNITY Toolkit. This toolkit will be a support tool for end users in assessing their digital divide in each context and promoting inclusion and accessibility in mobility ecosystems.

Key words

Inclusive design	Co-creation	Toolkit	Mobility	Digital gap	User-centred design

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1. Introduction

How does society cope with technology moving forward at an unimaginable speed? Recent technological developments characterising the mobility sector such as digitalization, or location-based digital services have been radically altering mobility patterns. The process of digitization aims to help improve or evolve as we live our daily life, and it has a great potential to improve users' transportation options and experiences. Despite that fact, some groups – such as people with low levels of education or with low income, elderly people, rural inhabitants, migrants or disabled people – may be vulnerable to exclusion due limits of access to and use of this technology.

Scientific literature identifies various digital gaps in the digital complex mobility systems, which prove that large parts of the population cannot access or properly operate in the current transport services, lacking the means or the required knowledge and skills. Consequently, a considerable percentage of the population currently not only is not able to take full advantage of novel digital transport services, but also the trend towards massive digitalization is progressively increasing their risk of exclusion.

Understanding and promoting the aspects related to the integration of inclusiveness in digital mobility services is one of the research objectives of the DIGNITY H2020 initiative, a European initiative funded as part of the European Union's Horizon 2020 research and innovation programme. Different pilots have been testing methodologies to assess the digital gap in specific context and their potential to make a more inclusive mobility ecosystem.

As part of the DIGNITY project, these methodologies have been analysed and evaluated to contribute to the design of a tangible output: **an educational toolkit for policy makers, mobility providers and other relevant stakeholders on how to embed the DIGNITY approach in the decision-making process**, including insights for inclusive design.

The DIGNITY toolkit provides a methodology consisting of a series of tools so that end-users can assess their digital divide and be able to address strategies and policies in their mobility ecosystem to make it more inclusive. Therefore, it was essential that this toolkit followed the same inclusion criteria, to raise awareness among stakeholders about the importance of the issue and to promote this inclusion in digital mobility services.

Historically, the purposes and methodologies of designers have not corresponded to those of policymakers and public administrators. But this is changing as governments across the world experiment with design and innovation methods from an interdisciplinary approach, to improve the understanding of citizen problems and needs.

Design has been evolving, driving it to redefine the discipline and the designer role. This evolution has replaced the focus from products into ideas, people, and experiences. Consequently, new design disciplines have appeared such as design thinking, service design, or co-design (Garcia-Lopez et al., 2019).

Moreover, mobility issues are linked to many of today's urban challenges, such as unemployment, land use, public space, segregation, lack of social cohesion and deteriorating health (Bosetti et al., 2014). So, addressing a challenge like this becomes an opportunity to promote it through a sustainable pathway.

I found this task and project as a great opportunity to leverage my knowledge and motivation on implementing user experience design tools and design included, to be able to participate in the DIGNITY toolkit design process. This motivated me to develop this research project and research on co-creation processes and how tools can be designed in a more inclusive way, considering end-users and other stakeholders throughout the process.

The research question of this project is *if co-creation processes and user-centred design tools help to design an inclusive toolkit*. The research has followed the DIGNITY approach process, defining three iterative phases: i) framing the problem, ii) bridging the solution, iii) evaluating the process. The aim is to co-create the DIGNITY toolkit, which is the final output of this project.

This project consists in a first and second chapter which introduces the DIGNITY project, followed by the objectives and scope of this research. The third chapter describes the methodology used, defining the process of each of the tools implemented to develop the project. The next chapters include the main insights and results of the research, divided by three phases (framing, bridging and evaluating). Finally, a discussion of these results is presented.

1.1. The DIGNITY project

Figure 1. DIGNITY logo

The overarching goal of DIGNITY is to foster a **sustainable**, **integrated,** and **user-friendly digital travel ecosystem** that improves accessibility and social inclusion, along with the travel experience and daily life of all citizens. The project delves into the digital transport eco-system to grasp the full range of factors that might lead to disparities in the uptake of digitalized mobility solutions by different user groups in Europe (DIGNITY, 2020)

1.1.1. DIGNITY approach

Analysing the digital transition from both a user and provider's perspective, DIGNITY looks at the challenges brought about by digitalization. It will inform the design, testing, and validation of the DIGNITY approach, a novel concept that combines analysis with concrete actions to make digital mobility services inclusive over the long term. The approach connects users' needs and requirements with the provision of mobility services, and at the same time connects those services to the institutional framework.

The starting point of DIGNITY is that to activate the entire process, and develop an inclusive digital travel ecosystem, it is necessary to cover all three levels in a dynamic process, which is made of three consecutive phases, detailed below.

This dynamic and iterative process is reflected visually in the DIGNITY approach scheme (Fig. 2). The figure represents the three phases and the tools involved in each of these.

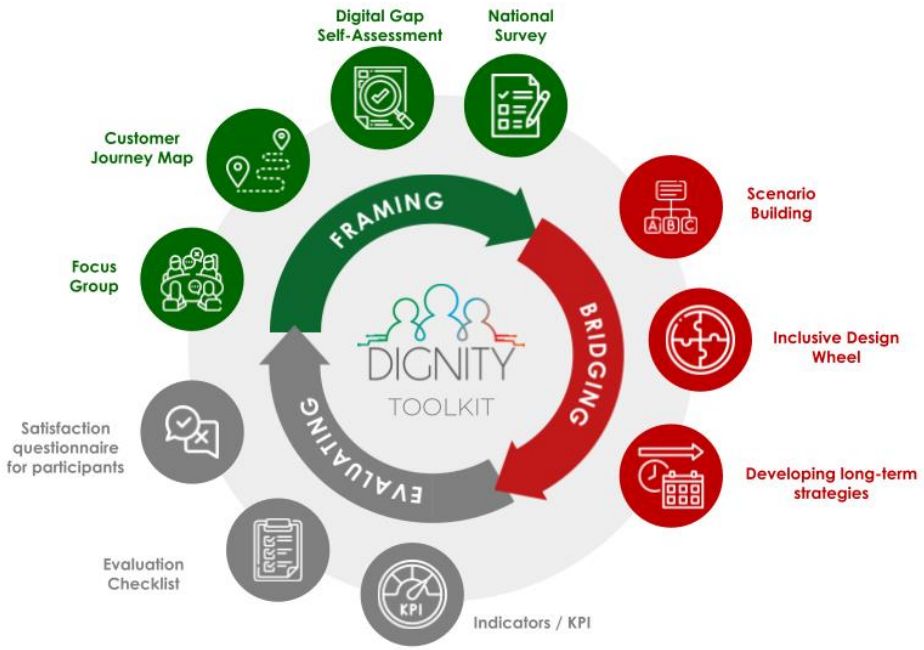


Figure 2. DIGNITY approach process.

1.1.2. Phases and tools

Table 1. DIGNITY phases. (DIGNITY, 2019)

Phase	Goal	Tools
Framing	Understanding of needs and attitudes regarding digitally related user requirements and to identify the obstacles to digital mobility	- National Survey - Digital Gap Self-Assessment - Customer Journey Map - Focus Group
Bridging	Co-creating solutions for the design of more inclusive policies, products, and services	- Scenario Building - Inclusive Design Wheel - Developing long-term strategies
Evaluating	Impact assessment and formulation of long-term strategies to fill the gap.	- Evaluation checklist - Satisfaction questionnaire - Indicators/KPI list

- **Framing phase tools**

- **National survey**: Gather population level data on user factors that affect people's use of digital products and services. This contributes to gain a holistic perspective on who would be excluded from using a particular product or service and why.

- **Digital Gap Self-Assessment**: collect a baseline set of information for each pilot to frame the current transport situation with specific attention to digital gap related to mobility in a specific metropolitan/regional context.

- **Customer Journey Mapping:** get insights in the daily activities and trips (user choices, difficulties, opportunities, etc.) of vulnerable-to-exclusion groups in a specific metropolitan/regional context.

- **Focus groups:** Get insights in motivation and reasons why mobility solutions, services and products are (or not) used. Get in-depth knowledge of which aspects help to understand the mobility behaviour of the target groups.

- **Bridging phase tools**

- **Inclusive Design Wheel:** Facilitate the co-design of initial ideas and concepts in the four pilots. Assess and refine the "inclusivity" of initial ideas and concepts and select the most promising to take forward for further development.

- **Scenario Building:** Provides a foundation for strategic decision-making focused on future strategies. Increase the ability of organisations to deal with future uncertain environments.

- **Developing long term strategies:** Development of long-term strategies for each pilot, starting from the input of Inclusive Design Wheel (micro and meso) and Scenario Building (macro strategies).

- **Evaluating phase tools**

- **Evaluation checklist:** DIGNITY tools and approach evaluation is based on collecting information allowing pilot partners expressing their personal vision and opinions of a given situation using their own perceptions and terminology. This evaluation is proposed to be carried out at the end of the framing phase and the bridging phase.

- **Questionnaires:** Semi-structured surveys to be addressed to workshop participants: a mix of qualitative and quantitative data collected, with open-ended questions to collect participants' experience, carried out at the end of each workshop.

- **Indicators/KPI:** A list of possible KPI according to each case study. An integrated assessment has been selected to evaluate and compare experiences in each region/pilot. Some aspects to be taken into consideration are related to the systemic and complex nature of inclusiveness challenge, such as: social inclusion indicators, governance arrangements, changes in social behaviour/attitudes, contextual factors, economic cost of the technology, etc.

1.1.3. Levels

For modern metropolitan cities, regions, and their inhabitants to develop a healthy and inclusive society, the whole societal system must be coherent. The main and final objective is to develop and cater for sound services that meet the needs of the (potential) end-user on an individual (micro) level, and that also fit within the policy framework and objectives on a generic (macro) level. The services themselves can be considered to sit at an intermediate (meso) level. (DIGNITY, 2019)

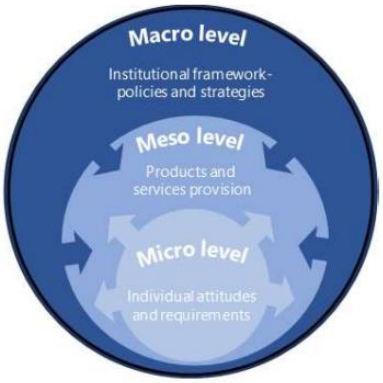


Figure 3. DIGNITY levels. (DIGNITY, 2019)

Thus, the key activities at each level are:

- **Micro**: identify the mobility needs of a specific community

- **Macro**: make decisions that include representation by the specific communities that are striving for accessible and inclusive mobility

- **Meso**: prioritise transportation technologies that best meet users' needs while maximising benefits and minimising burdens.

1.1.4. Target groups

The approach combines proven inclusive design methodologies with the principles of foresight analysis to examine how a structured involvement of all actors - local institutions, market players, interest groups, and end-users - can help to bridge the digital gap by co-creating more inclusive mobility solutions and by formulating user-centred policy frameworks.

By focusing on and involving end-users throughout the process of designing policies, products, or services, it is possible to reduce social exclusion while boosting new business models and social innovation.

- **Vulnerable-to-exclusion groups (end-users)**

There are some groups that could benefit the most from improved access to transport are also at higher risk of digital exclusion. They have to be specifically taken into account in the design of digital mobility services to ensure that they are for and can be used by these groups. To do this, it is important to understand the characteristics and needs of people in general and of vulnerable to exclusion groups in particular.

An examination of the literature (Hoeke et al., 2020)has identified seven groups that are more likely to be affected by digital mobility exclusion listed below. Previous research tends to focus on aspects that may cause difficulties for a particular vulnerable group, but people might belong to multiple groups.

- **Older people:** This group has lower levels of technology use and digital skills and may also experience mobility issues, capability loss and psychological constraints.
- **Women**: Although many European countries report little gender gap in digital technology use, there are still noticeable gaps in some countries.
- **People with low levels of education:** Education attainment has been found to be highly correlated with a range of digital skills.
- **People with low levels of income:** Low income affects access to and ownership of technology devices, as well as car ownership and transport patterns.
- **Inhabitants of rural areas:** Transport provision and needs differ between rural and urban areas. Rural areas also often lack communication infrastructure.
- **Migrants:** This group may experience barriers to technology and transport use due to language and culture. Some may also have different transport needs.
- **People with disabilities:** This group often experiences difficulties with transport use and may require additional information and assistance when travelling.

1.1.5. Pilots

DIGNITY has been working directly with four regions/metropolitan areas located in different parts of Europe, providing guidance on how to design mobility services for maximum inclusion. User groups have been involved in the co-design of innovative digital transport products and services, so that they can be used by everyone, regardless of age, income, social status, or disability. This use, testing, and validation of the DIGNITY approach has allowed the formulation of a robust and socially inclusive transport policy framework.

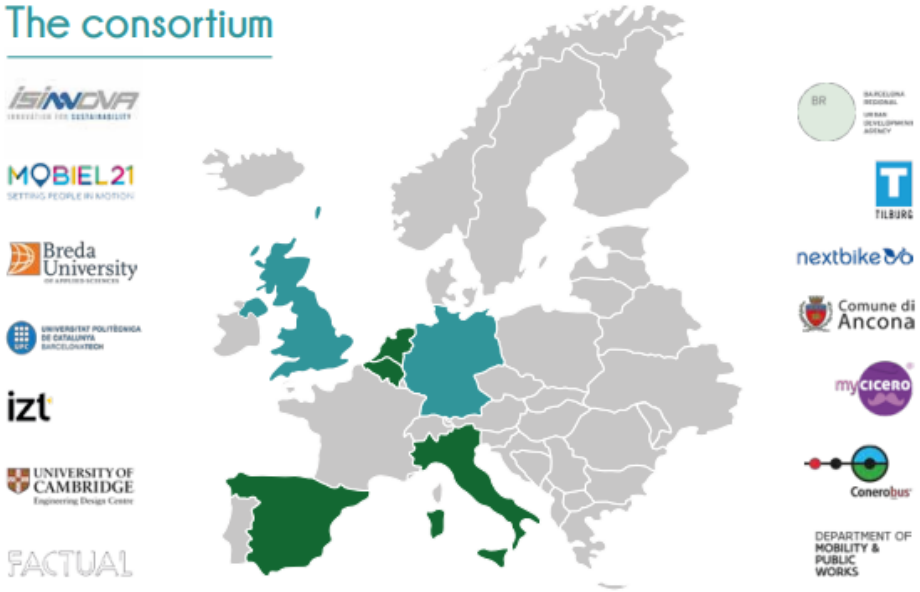


Figure 4. DIGNITY pilot partners location (DIGNITY, 2020)

1.2. Sustainability dimensions

A key issue for cities and regions is to monitor and manage the impact of digital transformation on the overall transport system, not only to keep it in line with sustainability goals and local mobility agendas, but also to prevent social injustice (DIGNITY, 2019).

To meet the goals and follow the guidelines of Agenda 2030 (United Nations, 2015), mobility sector needs to undergo some fundamental changes. Therefore, some Sustainable Development Goals have been identified as part of DIGNITY's challenge are listed below. There are also other SDG that could also be included, but those mentioned are the ones directly related to the problem framed.

- **Goal 5: Achieve gender equality and empower all women and girls:** as mentioned before, there are still noticeable gender gaps in digital technology use in some countries and often have different transport needs and patterns. Gender intersects with limitation factors (security, social exclusion, cultural and educational limitations) that need to be addressed.

- **Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all:** Transportation sector represented the 28,4% of the final energy consumption (Eurostat, 2020), being the highest energy consuming sector. It is crucial to ensuring a fair and ecological energy transition, and especially focusing on certain groups that could be excluded from this transition.

- **Goal 10: Reduce inequality within and among countries:** promote social, economic, and political inclusion of all, in relation to the vulnerable-to-exclusion groups, not only in the digital gap framework, but among all inequalities.

- **Goal 11: Make cities and human settlements inclusive, safe, resilient, and sustainable:** this goal includes providing access to safe, affordable, accessible and sustainable transport systems for all, with special attention to the needs of those in vulnerable situations.

Moreover, there are many other impacts and challenges to be considered that have not been mentioned due the complexity of the framework of this project. The main factors identified to be considered are related to two of the main challenges that the European Commission is facing and addressing complex reforms:

- **Green transition:** Supporting reforms to transition to a green economy and fight climate change (European Comission, 2022). Green transition must ensure inclusivity, not leaving behind precisely those who need public transport the most, promoting its use making it more inclusive and affordable.

- **Digital transition:** Supporting reforms to unlock digital growth potential and deploy innovative solutions for citizens and businesses (European Comission, 2022). Ensuring access to services to all populations. Not just from a social perspective, but it is also relevant to raise awareness and quantify the possible impact and emissions of digitalization.

2. Objectives and scope

The DIGNITY approach is a multi-phase process that first seeks to understand and bridge the digital gap, and then to test, evaluate and fine-tune the approach, so it can be applied in other contexts even after the project's end. This approach is a theoretical approach that should be operationalised to make it useful for specific target groups (policymakers, practitioners, end-user representatives), so it was proposed to develop an open-access DIGNITY toolkit (a website comprising tools for co-design and education).

The objective of this research project is to implement user-centred design processes and principles to develop a product - through co-creation processes. Respectively, the aim of this product is to provide **a practical and educational digital tool that will facilitate step by step methods on how inclusiveness could be strategically envisioned and conducted for mainly policy makers and mobility providers.** The principal research question defined in this study is:

Do co-creation processes and user-centred design tools help to design a toolkit?

The scope of this project is limited to understanding the problem (framing phase) and co-creating the solution (bridging phase). The evaluating phase could not be completed since the toolkit was still under the co-creation process. The final output of this project is a proposal, so the final product will be developed in the following months and finished with the co-creation results by a web designer and a programmer.

3. Methodology

This project has followed mixed research methods. The overall process includes user-centred design methods, adapted to the DIGNITY approach phases, to define and understand users' needs and to design an online toolkit based on the DIGNITY framework, from a co-creation perspective. The methods used include mainly qualitative research.

The phases used are an integration of the DIGNITY approach scaled into this project, based on an **iterative approach**, including tools for this research, as can be observed in Fig. 5, and described below.

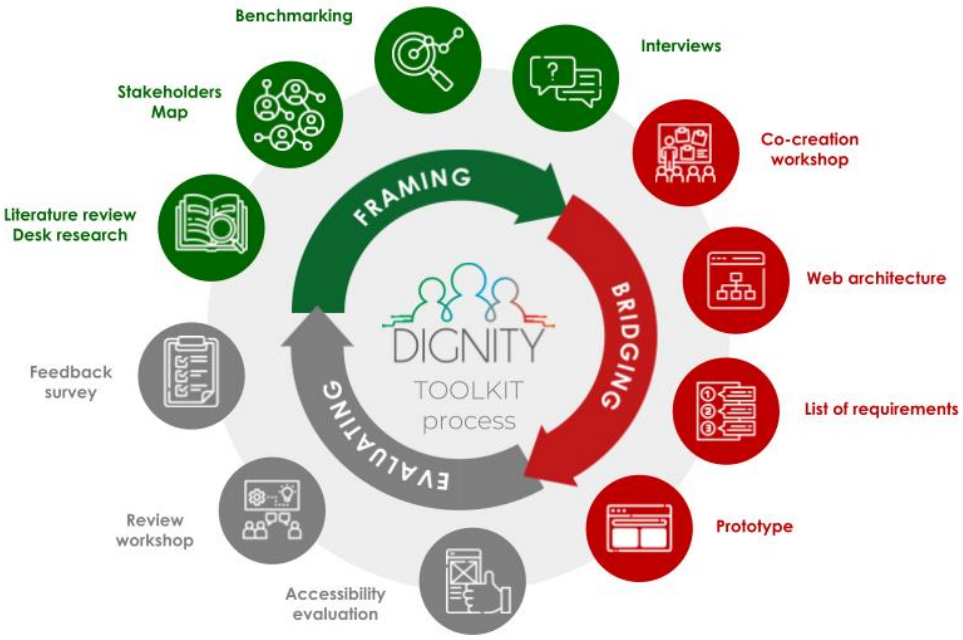


Figure 5. DIGNITY Toolkit co-creation process. Self-elaborated.

- **Framing**: Understanding the context, gathering information, and defining the users and their needs.
- **Bridging:** Co-creating solutions for the design of an online toolkit with stakeholders.
- **Evaluating:** Proposal to evaluate the toolkit usage and process, making sure that the toolkit addresses users' needs.

It is relevant to highlight the fact that most of the tools should not be considered exclusive from one phase, since this approach is an iterative process and tools are retroactive between each other, as can be observed below in Fig. 6.

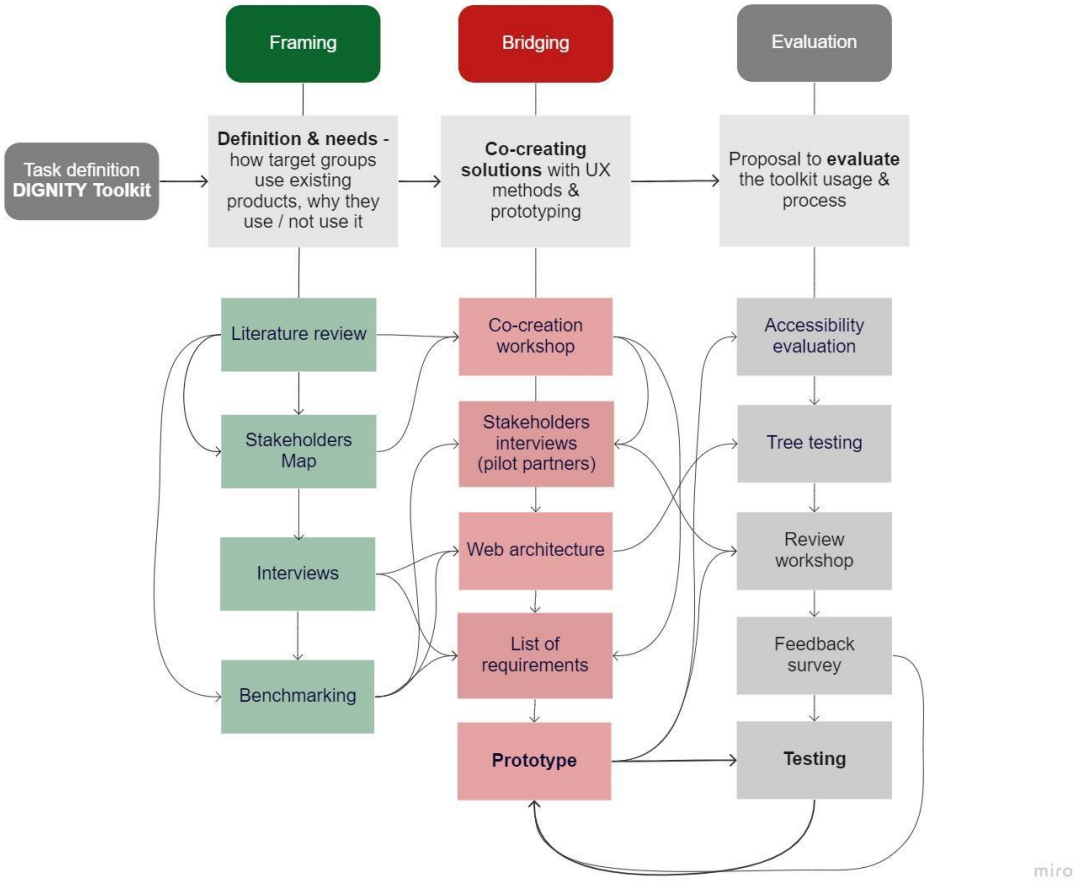


Figure 6. Process of this research. Self-elaboration.

The data analysis for the results of each tool has been divided by categories, adapting it to the tool structure. This categorization helped to order and validate shared results obtained through the different tools implementation. The categories are the following:

Table 2. Results categories for data analysis.

Categories	
	**Actors and needs**
	**Design process**
	**Content**

A research plan has been followed to clarify the research that has been approached, considering the research goals and the stakeholders involved for each method:

Table 3. Research plan. Self-elaboration.

Phase	Method	Objective	Stakeholders involved
Framing Understanding of needs and attitudes regarding user requirements	Literature review	Definitions of concepts and keywords	-
	Toolkit benchmarking	What existing products are there, learn about their good practices & pain points	-
	Stakeholders Map	Define all stakeholders involved during the toolkit co-creation design process	DIGNITY partners
	Interview	Obtain feedback about a toolkit design process already implemented	Design toolkit author
		Understand policymakers needs and requirements as end-users	Political policy maker
			Technical policy makers
Bridging Co-creating solutions for the design of an online toolkit	Co-creation workshop	Obtain feedback from different stakeholders about specific toolkit-related topics	DIGNITY partners
	Web architecture	Quick ideation about the structure that the toolkit needs	DIGNITY partners, toolkit web designer and programmer
	Interviews	Co-create and “validate” with pilot partners the proposals, and keep them updated with progress	DIGNITY partners, toolkit web designer and programmer
	List of requirements	List that describes the main characteristics that the toolkit should meet defined by its co-creation.	All co-creation participants
	Prototype	Quick prototype of the DIGNITY toolkit website and its content	Toolkit web designer and programmer, pilot partners
Evaluation Proposal to evaluate the toolkit usage and process	Accessibility evaluation	List of recommendations based on WC3 guidelines and standards	Accessibility experts, toolkit web designer and programmer
	Review workshop	Workshop to validate the DIGNITY toolkit proposal and its content	DIGNITY partners and other stakeholders
	Feedback survey	Adding feedback features in the toolkit to obtain feedback from users to improve it	End-users

3.1. Methodology of the **Framing** phase

- Literature review

Literature review is a method of secondary research that intends to collect and synthesise research on a given topic (Martin & Hanington, 2012). In this case, many concepts related to co-creation, design processes and digitalization were explored and defined.

A review of academic and grey literature has been done using keywords search of the different concepts: ‘user centred design’, ‘co-creation, ‘co-creation and toolkit’, ‘inclusive design’, ‘digital gap’, ‘policy making process’, ‘toolkit co-creation’ and ‘toolkit’. The research engine used is Google Scholar, and the publication sources were scientific literature sources. Many publications about user-centred design and co-creation processes in different contexts and knowledge fields were found, but there was a lack of literature about how toolkits are created.

Other relevant literature resources have been reviewed: *Universal Design Methods* (Martin & Hanington, 2012) and *Delft Design Guide* (Boeijen et al., 2014). Also, toolkit websites available online were reviewed and benchmarked.

This literature review has been organised by concepts introduced by relevance and coherence throughout the research.

- Stakeholders Map

A stakeholders map has been done to identify those actors involved during the research and DIGNITY toolkit co-creation process. This tool has been useful for clarifying each stakeholder’s needs and roles. Furthermore, it has also helped to decide which tools had to be used depending on which specific information from each stakeholder was required for the toolkit co-creation development.

During the co-creation workshop participants (DIGNITY partners) defined who the end-users of the toolkit would be. Additional stakeholders were identified mainly during the literature review and interviews.

- Benchmarking

A benchmarking consists of an evaluation of products that have similar functionalities and content of the toolkit we are designing, to understand characteristics of the product, discover the design trends and detect their strong and weak points.

There are many existing toolkits with different formats and functions, and this tool helped to build a state of the art and select which ones were interesting to be implemented in the DIGNITY toolkit.

Figure 7. Overview of toolkits analysis. Self-elaboration.

The process followed was the Benchmarking guide by Design Toolkit (Universitat Oberta de Catalunya, n.d.-c). The first step to develop a benchmarking was to select which product had to be analysed - an online toolkit. Through secondary research a range of toolkits were listed and selected if they were interesting to be analysed, highlighting their strong and weak points.

For the 16 toolkits selected, a quick analysis was done to select those best toolkit practices and relevant for this research:

Table 4. Toolkit analysis process. Self-elaboration.

Introduction	Name of the toolkit, author, and main image of the toolkit
Strong points	List of good practices that are interesting (i.e., aligned topic, functionalities, content)
Weak points	Characteristics and further improvement of the toolkit
Include in benchmark	Yes / No - if it is interesting to do a deep analysis through benchmarking criteria

After this generalised analysis, a total of 9 toolkits that had interesting functionalities or content were selected. The following categories and criteria were defined and completed to analyse and compare the toolkits.

Table 5. Benchmarking criteria. Self-elaboration.

Topic	Criteria		
General	Author	Topic related	Licence
	Language	Complexity	-
Key actors	Toolkit end-users	Tools segregation by end-users	-
Format and design	Icons usage	Format	-
Navigation	Main menu content	FAQs	User manual
	Accessibility functions	Responsive	-
Content and organisation	Content updated	Number of tools	Classification of methods
	Filters/tools categories	Tool structure	Downloadable material
	Relevant data related	Policy recommendations	-
Functions	Translation button	Searcher	Feedback channel
	Newsletter	Social media share	-

The table was completed analysing each toolkit with the same criteria, allowing to compare the toolkits to each other. This comparison, the principal conclusions and insights were summed up can be found in the results section.

- Interviews

Interviews are a fundamental research method for direct contact with participants, to collect first-hand personal accounts of experiences, opinions, attitudes, and perceptions (Martin & Hanington, 2012). In this case, online interviews were carried out to different stakeholders.

First, a structured script with a set of questions and topics were listed to be addressed in the interviews, according to the context and objectives of each interview.

The first interview carried out was targeted to a key informant, who is someone specialised or who has expert knowledge to contribute. In this case, it was a toolkit creator expert, who helped to understand the design process that they followed and some meaningful insights and recommendations for this project.

The other interviews done were to key stakeholders, focused on information from specific roles. These roles were policymakers, one of the end-users of the DIGNITY toolkit, so it was also interesting to understand their needs and their opinion about toolkits as useful resources.

The interviews were recorded (with specific permission of the interviewee) and once the interviews were done, a transcript for each interview was done. There was a posterior analysis of the transcript by topics (highlighting relevant insights as in Fig. 8), and a synthesis of the most relevant insights.

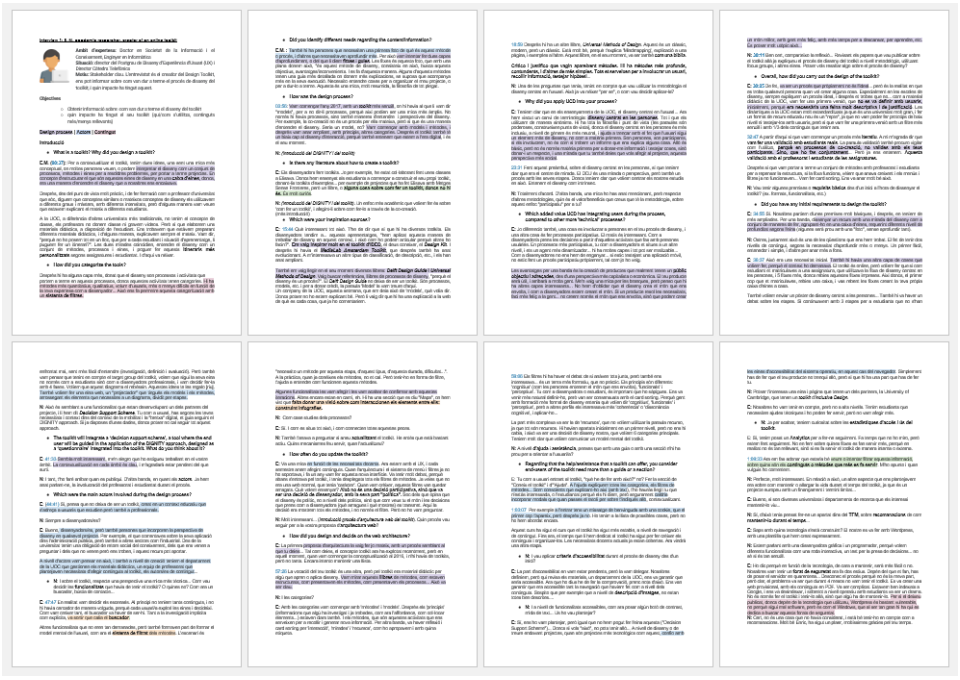


Figure 8. Transcript of one of the interviews analysed. Self-elaboration.

- **First interview: academic researcher, toolkit expert**

Key informant. The interviewee is one of the authors and coordinator of the Design Toolkit (Universitat Oberta de Catalunya, n.d.-a). He explained how they carried out the toolkit design process, and what impact it has had, and very useful since literature about 'how to create a toolkit' was not found.

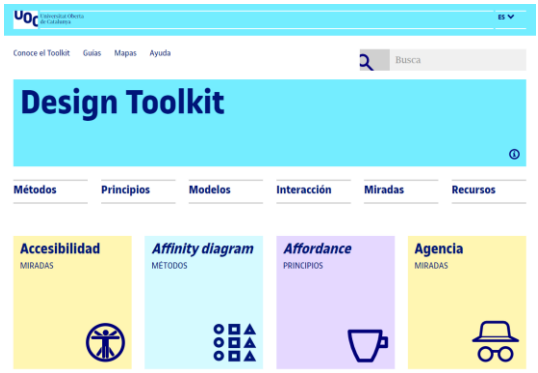


Figure 9. Design Toolkit (UOC, 2022)

The Design Toolkit is a design toolbox. The contents are presented in alphabetical order on the main page, which offers a menu that classifies them according to their type, characteristics, and attributes. The Design Toolkit collects the most representative and used tools, especially those that are worked on throughout the different UOC studies. The toolkit has many different authors and content contributors, and their target audience are design students and professionals.

Table 6. First interview questions

Category	Questions
Actors and needs	- Who was involved in the design of the toolkit? - Did you consider the definition of different end users (who would use it and how) when developing the toolkit? (Not just designers) - How did you define the level of help / support for the Design Toolkit? Is a guide enough? - Were accessibility / inclusive design features or criteria considered?
Design process	- How did you apply Human-Centred Design methodology? What tools did you use during the process? - What value or benefits do you think the methodology considers the user? (Compared to other technical approach) - How did you define the *design requirements*? Did you specify basic premises when designing? (Website or PDF format, accessibility principles?)
Content	- How was the web design process? How did you decide what content it should have? - How did you decide to categorise the tools? (Methods / Principles) - Is the toolkit often updated? What mechanisms do you use? - How did you decide which features/functions the toolkit should have? (Languages, search engine, contact, others) - We are developing a tool (Decision Support Scheme) where the end user will be guided towards to use the DIGNITY approach, designed as a 'questionnaire' integrated within the toolkit. What do you think? - Do they have statistics about the use of the toolkit? Is there any content that has more/less 'audience'? - Any suggestions about how to maintain the website over time?

- **Second interview: political policy maker**

Key stakeholder. She was politically related to the Mobility area of the municipality of Barcelona, with expertise in mobility and environmental policies, and promoting participatory processes. The aim of this interview was to obtain feedback from her knowledge and experience in policy-making processes, from the political perspective.

Table 7. Second interview questions

Category	Questions
Actors and needs 	- What is your role in the organisation? What is your organisation doing in inclusive mobility (and digitalisation)? - Is there integral cooperation between departments (mobility, digital and social) in this area? - Looking at different policy-making models, is there any which you find more consistent / appropriate based on your experience, in the context of mobility?
Design process 	- Do you consider that user-centred design tools can be useful as a policy maker? (Tools to understand user's experience, i.e., how is a travelling in public transport for an old person) - What resources do you use when working as a policy maker? (i.e., DIGNITY toolkit, policy recommendations, etc.)
Content 	- Further than tools to be implemented, which other resources are useful for you? (Templates, Guidelines, Literature list, Case studies...) - Is there a need for a decision support scheme?

- **Third interview: technical policy makers**

Seven semi-structured interviews were driven by Breda University of Applied Science (a DIGNITY partner) to mobility policymakers from five different organisations in The Netherlands, to understand the needs and requirements from a user perspective regarding the DIGNITY Toolkit and the Decision Support Scheme (a tool designed to be implemented in the DIGNITY toolkit described in section 5.4). Data collected by them was also analysed and useful for this research.

Table 8. Third interview questions

Category	Questions
Actors and needs 	- What is your role in the organisation? What is your organisation doing in inclusive mobility (and digitalisation)? - Is there integral cooperation between departments (mobility, digital and social) in this area? - Have you ever used a toolbox/toolkit? How do you decide whether to work with a specific tool?
Design process 	- Do you consider that user-centred design tools can be useful as a policy maker? (Tools to understand user's experience, i.e., how is a travelling in public transport for an old person)
Content 	- Further than tools to be implemented, which other resources are useful for you? (Templates, Guidelines, Literature list, Case studies...)

- **Other interviews**

Periodic meetings with other stakeholders have been carried out during the project development as part of the co-creation process. The interviews have involved different DIGNITY partners such as researchers, experts and pilots, and other stakeholders such as the final web designer and programmer that will develop the DIGNITY toolkit final version.

3.2. Methodology of the Bridging phase

- Co-creation workshop

The purpose of a Co-Creation workshop is to convene a group of people you're designing for and then bring them into the design process, empowering them to design (IDEO, n.d.). Specifically, this workshop helped to capture meaningful feedback incorporating stakeholders into the design process getting feedback on ideas and experiences.

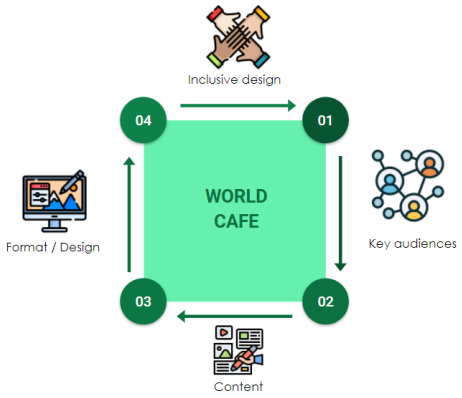


Figure 10. Co-creation workshop illustration.

The workshop was carried out in Leuven (Belgium) the 18th of March during the 3rd General Assembly of DIGNITY project. The workshop lasted around 1 hour and 30 minutes. The activity was inspired by World Café methodology (The World Cafe, 2022), consisting in a conversation structured process with different topics and participants. Stakeholders involved in this workshop were all DIGNITY partners (Fig. 11).

The activity started with an introduction to the workshop. A slide presentation supported this explanation. The activity consisted of four main topics to be addressed (Fig. 10) and complementary questions to dynamize the brainstorming (Table 8). Then, the participants were split into groups. Each group was assigned to a table that had a moderator who asked the questions defined and guided the discussion. Participants had to go to different tables (not necessarily in order), talking to each other and writing down in post-its their ideas. The moderator stood in the same table collecting the feedback, and participants will change to another table.

The moderator had to summarise what had been discussed previously to the new group, and participants started a further discussion. Four iterations were carried out, so everybody could provide feedback for each topic. Results were shared commonly at the end of the session by the moderators. The session was finally transcribed and analysed to obtain results and apply the insights in other tools to create the toolkit.

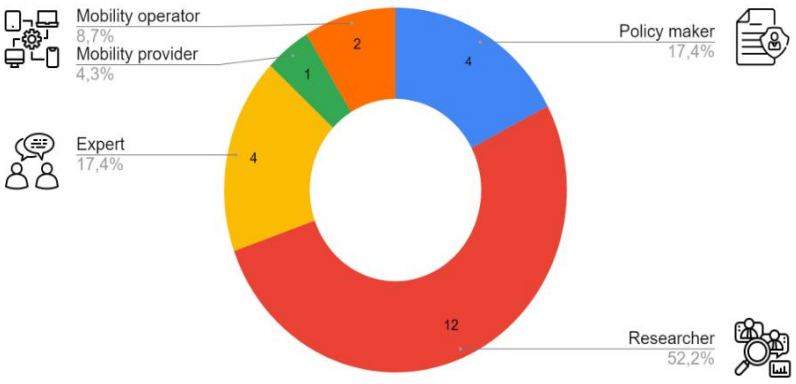


Figure 11. Co-creation workshop participants profiles. Self-elaboration.

Table 9. Co-creation workshop guiding questions. Self-elaboration.

Topic	Questions
Key audiences / Actors	• To which actors should the toolkit be addressed? • Which are the needs for each actor (or commonly)? • How/When are the actors going to use the toolkit?
Content	• What content should be included? • How can the different content be classified? • (ex. by actors, steps, duration, resources, results…) • Should we include the different results of the application of the tools? Or only the process? • Which best practices should be included? • Should other DIGNITY resources and results be added? (policy recommendations, good practices inventory…)
Format and Design	• Which formats should the toolkit have? Why? (PDF, printable version, interactive online webpage) • What functionalities would be useful for the actors? (ex. web searcher, accessibility buttons…?) • How should the content of the toolkit be organised?
Inclusive design	• How can we make sure that the toolkit is accessible and inclusive? • Which inclusive principle should we consider?

Figure 12. Co-creation workshop participants in Leuven (Belgium).

- Web architecture

The web architecture consists in designing the structure content of the toolkit, to organise and label the different content.

The process followed is defined in the Information Architecture guide by Design Toolkit (Universitat Oberta de Catalunya, n.d.-b). The process started by creating a content inventory. The format used was a mind map - tree content of the website, first on paper as a quick iteration, considering feedback data gathered with previous tools (co-creation workshop, benchmarking, and interviews). Then, this information was grouped and labelled, considering the requirements that the toolkit had (defined by stakeholders).

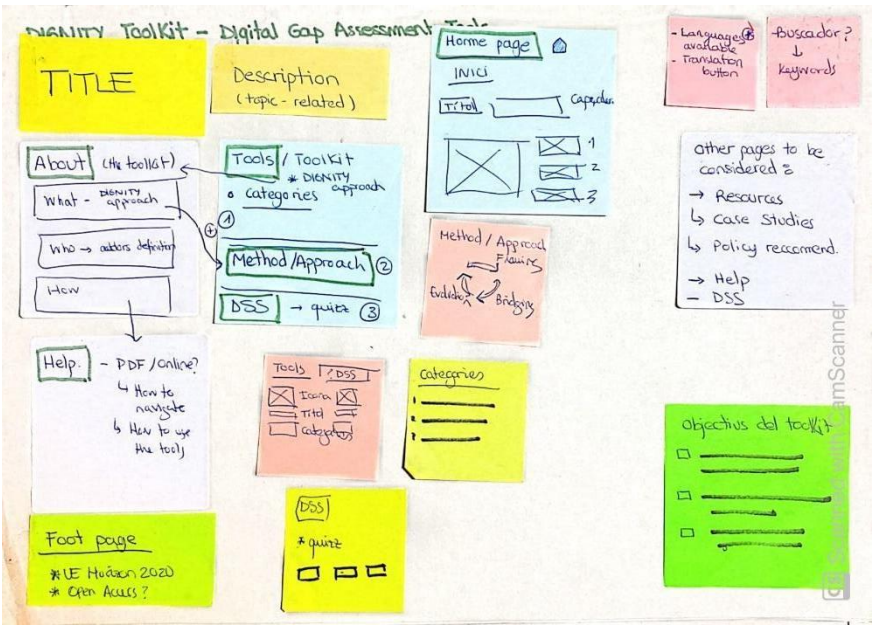


Figure 13. First prototype of the web architecture. Self-elaboration.

After this first iteration, a new version was created through Miro (an online collaborative tool) to co-create and evaluate this structure, involving the DIGNITY partners and web designer and programmer of the final DIGNITY Toolkit. The web architecture has the expectative to obtain a final validation - through card sorting and/or tree testing.

- List of requirements

A list of requirements consists of a structured list of questions that can be asked when creating a design specification. Checklists ensure that you adopt a systematic approach to the creation of the programme of requirements. In this case, this tool helps to structure all the information gathered on the design problem.

This tool sometimes is used to compare between design and alternatives to analyse them by requirements, but in this case, it has been used to only analyse a single co-created product.

The requirements list used is based on **Pugh's checklist**, as used in the *Delft Design Guide* (Boeijen et al., 2014). The requirements were selected, choosing those that fit and were aligned with the DIGNITY toolkit development and the data and insights provided by stakeholders and collected during the Framing and Bridging phase. The following table shows the requirements selection.

Table 10. List of requirements.

Requirement	Yes/No	Requirement	Yes/No
1. Performance	✓	13. Product life span	✗
2. Environment	✗	14. Standards, rules and regulations	✓
3. Life in service	✓	15. Ergonomics	✓
4. Maintenance	✓	16. Reliability	✗
5. Target product cost	✓	17. Storage	✗
6. Transport	✗	18. Testing	✓
7. Packaging	✗	19. Safety	✓
8. Quantity	✗	20. Product policy	✗
9. Production facilities	✗	21. Societal and political implication	✓
10. Size and weight	✗	22. Product liability	✓
11. Aesthetic, appearance and finish	✓	23. Installation and initiation of use	?
12. Materials	✗	24. Reuse, recycling	✗

Most of those requirements discarded is due its definition related with a tangible/physical product or not especially relevant for the DIGNITY Toolkit development.

- Prototyping

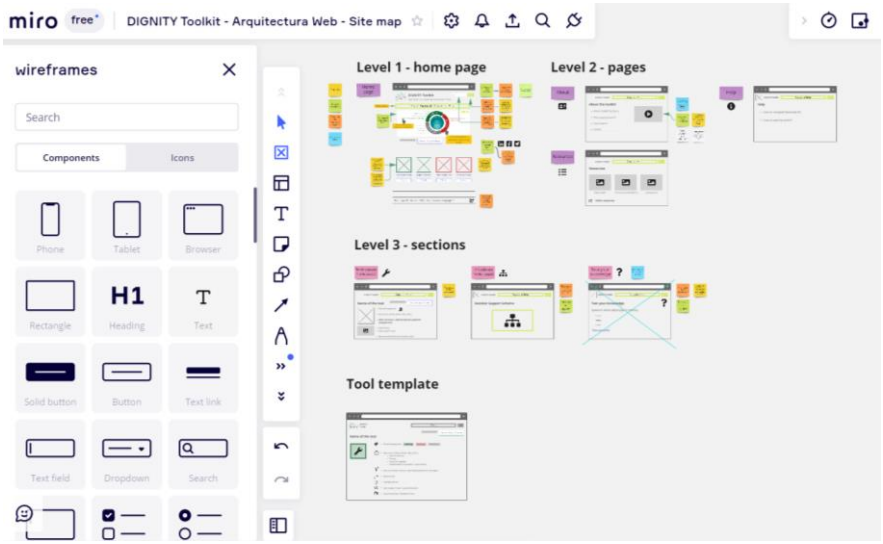


Figure 14. Co-created prototyping process in Miro platform.

A prototype is a product model, based on wireframes that represent an early model of the design, but it is still a rapidly developing prototype that includes little level of detail. Its objective is to evaluate and iterate the proposal to advance towards more evolved models (Universitat Oberta de Catalunya, n.d.-e).

Therefore, considering the co-created web architecture, this tool provides a first proposal of the content and how the DIGNITY toolkit should look, co-creating it online with stakeholders involved (toolkit web designer and programmer and DIGNITY partners). The wireframes were created with the online tool Miro, that allows draw wireframes, with different functions and shapes.

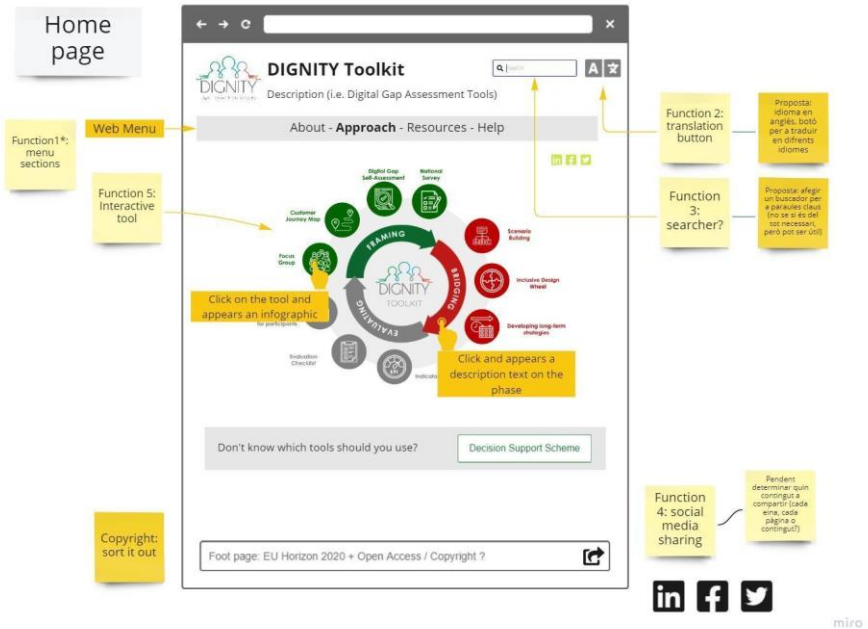


Figure 15. Co-created prototype of the homepage.

4. Results of the Framing Phase

4.1. Main concepts

A review of academic and grey literature has been done to define relevant concepts to create a deep understanding of the field of research. The main concepts introduced in this section are related to relevant methodologies and resources for this research project.

- User-centred design

User-centred design (UCD) is an approach to product and application design that puts the user at the centre of the whole process, being considered in all phases of the design. In addition, we can also understand the user-centred design as a development methodology: a way of planning projects and a set of methods that can be used in each of the different phases (Universitat Oberta de Catalunya, n.d.-d).

Aligned with UCD, Mor (2019) suggests another concept known as *person-centred design*, with the same conception, but highlighting the fact of considering the user as part of the whole process, and not being just an element of this.

The Interaction Design Foundation (n.d.) also considers UCD as an iterative design process, where design teams involve users throughout the design process via a variety of research and design techniques, to create highly usable and accessible products for them.

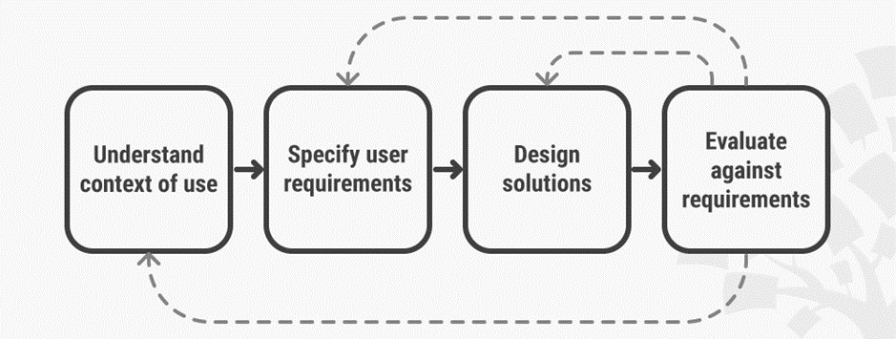


Figure 16. UCD iterative process. (Interaction Design Foundation, n.d.)

Besides the end-users, UCD is also interesting from a point of view of stakeholders: this methodology promotes multidisciplinary design teams, considering not just designers, but also engineers, researchers, marketers, and other stakeholders that can be involved during the design process (Interaction Design Foundation, n.d.).

While user-centred design (UCD) refers to the process or strategy applied to engineer experiences, user experience (UX) deals with the specific experience users have with the products they use (Justinmind, 2018). This is also relevant to mention to avoid confusion between concepts and methodologies.

As it has been introduced, the concept and process of User-Centred design has been evolving - recent literature is presenting new approaches such as humanity-centred design or planet-centric design. Although they are both interesting to be further analysed and developed, **in this research, the concept that will be used is UCD, since it has most of the literature available.**

- ## Co-creation

Co-creation is a term whose usage and application has increased in many interdisciplinary fields lately, such as design, collaboration with users as innovators or participatory roles of consumers. According to De Koning et al. (2016), the very literal meaning of co-creation is: together **(co-)** and to make or produce something (new) to exist **(creation)**. There is a huge diversity in its definition, but there is also surprisingly little consensus on what "co-creation" is (Ramaswamy & Ozcan, 2018).

Literature locates the term first introduced to achieve cost-minimization and later around customer satisfaction and participation. In the field of design, co-creation has its origin in human-centred design and participatory design (De Koning et al., 2016), considering participants as beneficial contributors to the design process.

Does the DIGNITY Toolkit development fit in a co-creation framework? Co-creation indicates new modes of engagement between people to either create shared value or unleash the creative potential of diverse groups (Rill & Hämäläinen, 2018). This definition is one that best describes and fits with the purpose of this project and the DIGNITY approach, which considers the diversity of people for an inclusive mobility system. For this, stakeholders must be keen on to involve end-users in the process. In this case, the DIGNITY stakeholders have demonstrated to involve end-users throughout the process.

The project LIVIN: Living Innovation H2020 (2021) identified that co-creation treats all participants on an even level, taking the view that everyone can learn from each other and that all users are experts - experts of their own experience. Therefore, seriousness, transparency and fairness are highly important in co-creation.

- ## Inclusive design

The (British Standards Institute (2005) defines inclusive design as "the design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible, without the need for special adaptation or specialised design".

Every design decision has the potential to include or exclude customers. Designing inclusively enables to develop products and services which exclude fewer people and delight more people. Doing so can benefit wider society. Therefore, inclusive design emphasises the contribution that understanding user diversity makes to informing these decisions, and thus to including as many people as possible. User diversity covers variation in capabilities, needs and aspirations (British Standards Institute, 2005).

- Digital gap

DIGNITY project has published a Literature review (Hoeke et al., 2020) about the *Effects of digitalization in mobility in society,* where the digital gap and other relevant concepts to the topic are defined and analysed.

Literature evidence that not everyone benefits from digitalization in society, since there is a variation of the levels of access to digital infrastructure, technologies, knowledge, and the skills required to use digital systems. These have led to notions of the 'digital divide' with gender, age, income, ethnicity, and location being identified as significant factors (Hoeke et al., 2020).

A definition of the digital divide is described in Barcelona Mobile World Capital (2016) study as "referring to the inequality between people who have access and knowledge of new technologies and those who do not".

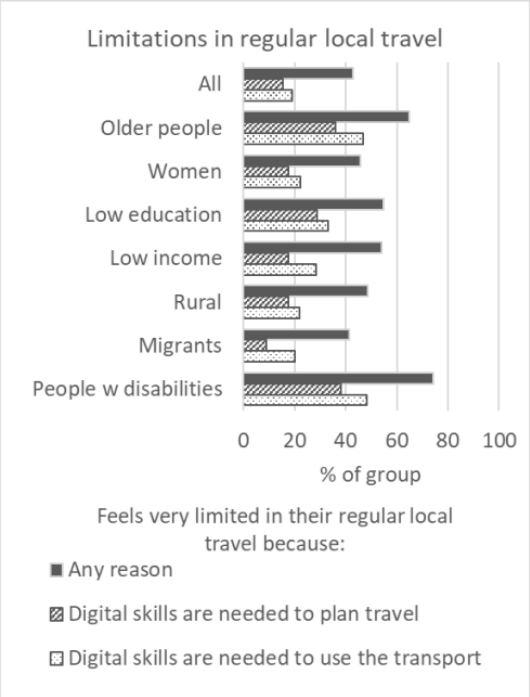


Figure 17. Limitations in regular local travel of Germany population (Goodman-Deane et al., 2022)

Goodman-Deane et al. (2022) published an article examining a population-representative survey that was carried out in five different European countries (Belgium, Germany, Italy, the Netherlands, and Spain) as part of the DIGNITY project. The paper reports on initial results from the German survey.

According to the paper, older people (aged 65+), people with disabilities and people with low levels of education were found to have particularly low levels of digital technology access, use, attitudes, and competence.

The survey also found large numbers of people reporting being very limited in their regular travel because of the need for digital skills to plan travel or use transport. These numbers were particularly high among older people and those with disabilities.

- Toolkit

Toolkits are meant to offer practical advice and guidance regarding an issue of concern or importance – especially when the issue is emerging or evolving, and well-established processes for addressing them are not yet widely adopted. Toolkits can help translate theory into practice, and typically target one issue or one audience (YALSA - American Library Association, n.d.).

Design content has been developed recently under a tool perspective, promoting the aggregation of contents through toolboxes. In this scenario, new design contents with a “tool perspective” have been created mostly by practitioners, but increasing lately in different fields, not exclusively related to design.

The toolkit evolution has been growing as a need of problem-solving, for each context and being noted as digital repositories. The preceding resource of an online toolkit were printed books: some of the toolkits are only published as books or they are available in both formats. An increase of using the Internet has emerged and online platforms and ways to share information and knowledge have also evolved.

As Garcia-Lopez et al. (2020) cites, “most of design toolkits are addressed to practitioners [of design]”. The author also highlights the opportunity for providing an open-ended organisation of design resources for different stakeholders. In this case study, under the DIGNITY framework, the user profile goes beyond, and end-users do not have a specific designer-role but will end up being design practitioners under their context as policy makers or mobility providers and operators.

4.2. Stakeholders map

The design of a specific digital online resource as a toolkit requires a deep understanding of the end-users, but also of the different stakeholders that can take part in the design process. Stakeholder definition was a priority from the outset to identify the actors and their needs and to include them in the co-creation process. Target groups involved were defined in the DIGNITY H2020 proposal (2019), as shown in Table 11, divided in three different levels (levels definition can be found in Introduction chapter).

Table 11. DIGNITY target groups. (DIGNITY, 2019)

DIGNITY Approach levels	Micro	Meso	Macro
Target groups involved	Citizens	Providers/manufacturers of digital mobility products/services	Policy makers (EU and national/regional levels)
	User associations		Public transport operators
	Researchers	Researchers	Researchers

This way, these DIGNITY project stakeholders were involved through a co-creation workshop, to identify the main toolkit stakeholders. The toolkit is addressed to different audiences, but mainly focused for **policy makers** and **mobility providers**, but it was found that it could be interesting to include **researchers** and **end-users' representatives**. Furthermore, other stakeholders have been included in the toolkit development process.

In the following page a table can be found listing all stakeholders, including the identification of their needs and the benefits that the DIGNITY Toolkit can offer to each stakeholder, according to this research.

Table 12. List of stakeholders, their needs and benefits that the DIGNITY toolkit can offer.

Description	Needs	Benefits
 **Policy makers** - *End-users of the toolkit* They are responsible or involved in formulating policies. They can play a key role in enabling and setting the direction for an inclusive transition in the mobility field to eradicate the digital gap. There are two profiles identified: technical and political policymakers. According to the interview's results, the DIGNITY toolkit is more aligned with technical profiles, as it is a practical resource.	Technically: - Better interdepartmental cooperation to address complex issues like digital gap (i.e., between IT, social affairs, and mobility departments) - Online platform with an overview and the resources to understand the issue	- Help to frame the problem and formulate policies and regulations to face the digital gap - Have tools to promote participative/co-creation processes - Having different levels of information will be useful: a level to get an overview and another to deepen
	Politically: - Need of data to frame and quantify the issue - Lack of evaluation of policies implemented	- Decision-making can be done evidence-based with the data provided by DIGNITY Toolkit - Also provides KPI and tools to help to evaluate policies
 **Mobility providers and operators** *End-users of the toolkit.* Operator of a transportation service or platform that provides or facilitates transportation of users.	- Required to provide transportation related data and information to end-users - Successful case studies to implement the DIGNITY approach in their context	- Insights on how existing gaps might be addressed, potentially leading to new innovations and new, specialised products and services. - Knowledge about challenges faced by vulnerable to exclusion citizens and practical knowledge on how existing systems could be improved.
 **Researchers & experts** *End-users of the toolkit* Academic researchers or experts that have interest in digital gap and inclusivity.	- Knowledge and data about the topic - Successful case studies	- Resources such as literature and case studies - A systematic review of mobility gaps, and new research that can be built on regarding how to fill these gaps.
 **<u>Vulnerable-to-exclusion representatives -</u>** *End-users of the toolkit* People chose to act and speak on behalf of a wider group, in this case, those vulnerable groups.	- Channels and resources to provide the concerns of their members to relevant stakeholders to create a truly inclusive digital transport system. - More accessible digital mobility ecosystems, including products and services	- Lobby / put pressure to promote inclusivity in the complex mobility ecosystem - Co-creation includes them during the processes - DIGNITY end-users (not the same as the toolkit end-users) will also benefit from the DIGNITY approach application.
 **Toolkit developers** A web designer and programmer will develop the final output of the DIGNITY Toolkit to ensure it addresses all the requirements.	- Co-creation results to address users' needs - Specific toolkit system and design requirements and the toolkit content expected	- A co-created process will help them to design and programme the toolkit and easily validate the results - The iterations will help to cover end-users needs

4.3. Toolkit Benchmarking

The toolkits analysed were:

1. Design Toolkit, by Universitat Oberta de Catalunya
2. Design Kit, by IDEO
3. Service Design Tools, by Service Design
4. UNaLAB Toolkit - Tools for Co-creation, by UNaLAB
5. Going Digital Toolkit, by OECD
6. Delivering the circular economy: a toolkit for policymakers, by Ellen MacArthur Foundation
7. Inclusive Digital Mobility Toolbox, by INDIMO
8. Inclusive Design Toolkit, by University of Cambridge
9. Biomimicry Design Toolbox, by Biomimicry Institute

The main insights have been classified according to the criteria grouped by topics:

- **General**
  - Regarding **languages**, most of the toolkits are only available in English (except one, being available in Spanish and Catalan).
  - The toolkits analysed have different **licences**: six of them have Copyright licence, two under Creative Commons licence and one not specified.
  - Toolkits with a wide range of methods and resources tend to have more **complex** functions and classifications (filter systems, stakeholders' roles…)

- **Actors**
  - Most of the toolkits are addressed to individuals or organisations with interest on the specific topic that the toolkit is related to. Other toolkits are addressed specifically to **designers** (or people who practised design methods) or **policymakers**, with a specific language and resources addressed and adapted to their profile needs.

- **Format and design**
  - Almost all toolkits use icons and visual resources to support the content.
  - Most toolkits have an online website format, and some toolkits also provide downloadable versions of the toolkit. *Delivering the circular economy: a toolkit for policymakers* was only available as a PDF file.

- **Content**
  - It has also been analysed how content is classified, and the structure that toolkits followed to present each tool/method (including description, phase, categories, step by step process and related resources).

- **Functions**
  - Functions that a toolkit can have were listed and checked if the toolkits benchmarked had them, such as a web searcher, translation button, feedback or contact forms, newsletter and social media share buttons

Table 13. Benchmarking. Self-elaboration.

Topic	Dimensions	Design Toolkit	IDEO Design Kit	Service Design Tools	UNaLab Toolkit	OECD Going Digital Toolkit	Delivering the circular economy: a toolkit for policymakers	INDIMO Inclusive Digital Mobility Toolbox	Inclusive Design Toolkit	Biomimicry Toolbox
General	**Topic related**	Human centred design	Human-centred design	Service Design	Nature-based solutions	Digital development	Circular economy	Inclusive digital mobility	Inclusive design	Biomimicry
	Author	Universitat Oberta de Catalunya	IDEO	Roberta Tassi & other	UnaLAB	OECD	Ellen MacArthur Foundation	INDIMO	University of Cambridge	The Biomimicry Institute
	Licence	CC BY SA	Unspecified	CC BY NC ND	Copyright	Copyright	Copyright	Copyright	Copyright	Copyright
	Language									
	Complexity (basic/medium/ advanced)	Medium	Medium	Medium	Simple	Advanced	Medium	Simple	Medium	Medium
Key actors	**Toolkit end-users** (list of end-users)	Designers and design practitioners	Individuals and organisations	Designers	Individuals and organisations	Policy makers	Policy makers	Developers, policy makers and service operators	Designers and design practitioners	Designers
	Tools segregation by end-users (list of actors)	✗	✗	Experts, Stakeholders, Service Staff, Users	✗	✗	✗	✗	By user capabilities	✗
Format and design	**Icons usage**	✓	✓	✓	✓	✓	✓	✓	✗	✓
	Format (website, PDF…)	Website	Website, PDF, and printed	Website	Website and PDF	Website	PDF	Website	Website	Website
Navigation	**Main menu content** (List of menu content)	About the toolkit, Guides, Maps, Help	Mindsets, Methods, Case Studies, Resources	Tools, Enhanced tools, Tutorials, About, Resources, Contribute	Tools, Toolkit (About), UnaLAB	Home, Policy Dimensions, Countries, Themes, Data Kitchen, Notes	-	Tools	Home, Introduction, About users, Process, Tools, Applied to, Contact us	Introduction, Core Concepts, Methods, References, About the toolbox
	FAQs	✗	✓	✗	✓	✗	✓	✓	✓	✓
	User manual	✓	✗	✗	✓	✓	✓	✗	✗	✗

Topic	Dimensions	Design Toolkit	IDEO Design Kit	Service Design Tools	UNaLab Toolkit	OECD Going Digital Toolkit	Delivering the circular economy: a toolkit for policymakers	INDIMO Inclusive Digital Mobility Toolbox	Inclusive Design Toolkit	Biomimicry Toolbox
Navigation	**Visible accessibility functions**	-	-	-	-	-	-	Text size, Colour Mode, Reset accessibility	Integrated accessibility, "Back to top"	-
	Responsive	✓	✓	✓	✓	✓	-	✓	✓	✓
Content and organisation	**Content updated**	✓	✓	✓	✗	✓	✗	✓	✓	?
	Number of tools available	117	67	45	29	-	11	4	4 (11)	-
	Classification system of methods (list of categories)	Methods, Principles, Models, Interaction, Perspectives, Resources	By Phase and By Question	When, Who, What, How	Need finding, Ideation, Strategy, Experimentation, Feedback	Policy framework dimensions, Countries, Themes	By phase	Not defined	Not defined	By phase
	Filters/tools categories* (how tools are categorised)	- Phase - Type (Quali. / Quanti.- With users / Expert) - Classification (Duration, Difficulty, Experience, Participants)	- Suggested time - Level of difficulty - Materials needed - Participants - Process phase	- When (by phase) - Who (by stakeholders - What (by resource) - How (by channel)	Format, Timeframe, Group size, Facilitation level, Required materials	For each "Policy Dimensions": Access, Use, Innovation, Jobs, Society, Trust, Market openness	-	-	Capability loss simulation, Exclusion calculation, Managing the process, Personas & links	Overview, Tips and suggestions, resources (tools)
	Tool structure (what content is defined for each tool)	Phase, Type, Classification, Definition, Materials, When, How, Advantages, Notes, Guides, References	Description, Stats, Process phase, Steps, Downloadable material	Description, Categories, Also called, What is it, Use it to, Remember to, References, Case studies, Related content	Description, Categories, Steps, Benefits, Tips, Sources, Download tool, Supporting files	"Theme": Data, Description, Related Publications, Policy Guidance, Measurement roadmap, Related Links	Objective, End Product, Description, Steps	Description	Description	PDF sheet, depending on the tool: Description, Materials, Instructions, Suggestions...

Topic	Dimensions	Design Toolkit	IDEO Design Kit	Service Design Tools	UNaLab Toolkit	OECD Going Digital Toolkit	Delivering the circular economy: a toolkit for policymakers	INDIMO Inclusive Digital Mobility Toolbox	Inclusive Design Toolkit	Biomimicry Toolbox
Content and organisation	**Downloadable material** (templates)	✓	✓	✓	✓	✓	-	✗	✓	✓
	Relevant data related to the topic	✗	✗	✓	✗	✓	✓	?	✓	✓
	Case studies	✓	✓	✓	✗	✓	✓	?	✓	✓
	Policy recommendation	✗	✗	✗	✗	✓	✓	✓	?	✗
Functions	**Translation button**	✗	✗	✗	✗	✗	✗	✗	✗	✗
	Searcher	✓	✗	✓	✗	✗	✗	✗	✓	✓
	Feedback channel	Email	Email, Facebook Community, Submission form	Email, Submission form	Forms (not available)	Email	-	Email	Email, Submission form	Submission form (contact), survey (feedback)
	Newsletter	✗	✓	✗	✗	✗	✗	✓	✓	✗
	Social media share option	✗	✓	✓	✓	✓	✗	✗	✗	✗

Table 14. Benchmarking insights.

Toolkit	Main insights	
	✓ - Strong points	✗ - Weak points
Design Toolkit	- It has been the main reference of this research and design process - It has a consistent and interesting structure for each tool - Well defined categorization and system of filters for the tools - Two levels of deepness for each tool	- Not all tools have an extended guide (second level of deepness) - More case studies should be included
IDEO Design Kit	- Based on The Field Guide to Human-Centred Design (a step-by-step guide for problem-solving). - Good and simple tool structure - Registration option to save your methods + Discussion groups	- Missing some basic methods
Service Design Tools	- Filters include an example of a Decision Support Scheme - Contribution button: submission forms to share your case study (retrofeed)	- It doesn't include 'layers of information'
UNaLab Toolkit	- Very simple and visual to use - Good categorization and tool content structure	- Lack of content and case studies
OECD Going Digital Toolkit	- Assess countries state of digital development & formulates policies - Guide of the toolkit - Each page has a help button - "How to" is really visual	- Complexity of tools, data and content is not aligned with our idea.
Delivering the circular economy: a toolkit for policymakers	It is addressed to policy makers, so language and format might be aligned with the DIGNITY toolkit requirements.	- Format is not aligned with DIGNITY toolkit - Topic not related
INDIMO Toolbox	- Accessible functions	- Not completed yet, under development
Inclusive Design Toolkit	- Inclusive design as main topic (data/content related) - Similar approach - Accessible	- Not as attractive as other toolkits
Biomimicry Toolbox	- Good explanation to describe the method - as idea about how to introduce the DIGNITY approach - References include - Reading list, glossary, case studies, business planning - Feedback survey	- Not related with the topic

4.4. Insights from the interviews

Interview 1: academic researcher, creator of an online toolkit (expert)

Table 15. Insights from academic researcher interview.

Category	Insights
Actors and needs 	- The main **end-users** of the toolkit are students and professionals who incorporate the design perspective on their projects. Other actors involved were teaching resources managers, a team of teachers who needed the toolkit, and the content authors. - Regarding their needs, there are end-users that need a first picture of what this method or process is, and others who need to go deeper. That's why there are **two layers of deepening**: sheets (light content) and guides (deep content). - They also wanted to create a web tool, a "projector" that had the models and methods, dragging the elements you need into a **diagram**, divided into stages, to give an overview of the processes (which is like Decision Support Scheme). - Assistance and help consist in explaining all the categories, methods, filters. - Regarding accessibility, they relied on the page developers and the accessibility tools of the operating system available, in this case the browser.
Design process 	- The main inspiration for design process sources were the online IDEO Design toolkit and the books *Delft Design Guide (2017)* and *Universal Methods of Design (2012)*. They did not find any references about **how to make a toolkit.** - The **method** followed to design the toolkit is **user-centred design**. This helped them to have an objective and well-targeted audience, considering the user not as an element and source of feedback, but as a key perspective during the process. - The **process** following a user-centred design approach is not always ideal: reality differs with what you plan, but that's why it's flexible and iterative. It needed a first descriptive process of what the project would be to justify it and get it funded. - The **initial requirements** were to design a resource, understanding design as a set of ways to do it, grouping it in a toolbox, requiring different levels of depth depending on the tool. I made the web architecture proposal myself, with a process similar to the DIGNITY toolkit process that you are following.
Content 	- The **organisation** of the content was first based on models and methods, and then it was expanded, adding principle and resources as other categories. Then the toolkit also has a bias towards interaction design (we are in the digital age). - The main **function** developed is a **filter system**. Since the toolkit has methods that can be categorised (as quantitative, qualitative, volume of users, expertise difficulty…). Through user research, they also implemented a **searcher**. Some features were claimed by users, and some were added and confirmed with them through iterations. They also found it interesting to add a **visual overview** of the processes: giving an insight into how the elements interact with each other. So DSS seems interesting depending on how you want to use the toolkit. - They are not specially tracking the web analytics since it is an educational resource with a specific target. They had a **cyberattack** two years ago that blocked their website, so security and maintenance is important.

Interview 2: political policymaker

Table 16. Insights from the political policymaker interview.

Category	Insights

Actors and needs 	- Her role and vision were from the political perspective. She mentioned a **need for data** to frame the problem. Make it clear that digital exclusion is not static, but dynamic, as everything evolves and changes. Many people may be affected, and exclusion is gradual. Understanding diversity and exclusion can be given much earlier than perceived.
	
	- **Interdepartmental cooperation** is **difficult** to operate. Technically it's complicated, but politically even more so. It is difficult to pursue strategic policies that involve different departments.
	
	- Regarding the **policy-making process** about literature and conceptualisation, there is no model that can concretize it. From a technical point of view, the models are consistent. But not from politics. There are some key aspects during the process:
	
	  - **Decision making** - importance of political will to get the policy-making process started.
	  - **Participation** - should be part of the entire process. Once you have decided to implement a policy, if there is no participatory process, you cannot do it.
	  - **Evaluation** - evaluations are not always done when policies are implemented. These assessments are sometimes not subject to data or not even requested.

Design process 	- User-centred design (UCD) tools are research resources that **require a lot of time and investment**. I find it useful at the academic level, because at the political level you have to focus on quantitative data. - **Case studies** are useful. Examples of other contexts are key. It's not common to be the first one doing something. The problems are the same everywhere, but their impact is not the same. If you don't have previous examples, you risk more, and the knowledge comes from scratch. - At the political level, resources other than technical ones are used. As a technician, I find it **difficult to use UCD tools** or the toolkit.
Content 	- The resource that she considers most useful is **data** and information about the topic, such as surveys or specific studies, that quantifies the problem and gives clues to possible solutions. Also, case studies are really useful, as mentioned before. - In our Scenario Building process (as part of DIGNITY approach), the importance of making the issue part of the **political agenda** turned out to be very relevant. - She doesn't feel that a **decision support scheme** would specially help at the political level. But it could be from a technical or academic perspective. She considers that **decision-making** is a disputed process since everybody wants to influence with their criteria and interests. Trying to order this is complicated, because some factors play a role that do not always have to do with a rational decision.

Interview 3: technical policymakers

Table 17. Insights from the technical policymakers' interviews.

Category	Insights
Actors and needs 	- The targeted group for these interviews were people related to policymaking. Six of the seven participants work at a Dutch government institution. Their roles are three traffic planners, three strategic advisors and one private consultant. Only one of the interviewees had experience and knowledgement about the digital gap in the mobility field. - Regarding cooperation between different departments (i.e., DIGNITY project shows the need for cooperation between social, IT and mobility departments), most of the interviews showed **little or non-integral cooperation** between those **departments**, but some highlighted the **need for it.** - The **need and utility of online platforms** was evidenced by all interviewees. The platforms mostly used by interviewees were CROW (technology platform for transport, infrastructure, and public space in the Netherlands) and KiM (Netherlands Institute for Transport Policy Analysis). - Some participants even had experience designing toolkits - for those practical policymakers, it was expressed that toolkits are very useful.
Design process 	- Most participants consider that user-centred design tools and the information that can provide can be useful. Some pointed out that not specially for policy making, but for those more practical colleagues who deal with design. On the other hand, another participant highlighted that UCD is useful "especially on a subject like this. Such a tool can certainly help a policy maker in his first steps. I can imagine that it would give you a good overview of what's possible with inclusive mobility and digitalisation". - Providing general information about a new topic is also really well valued, in order to get an overview of the problem and the requirements.
Content 	- Different content and resources that were mentioned as useful, depending on what kind of method they use, such as a list of requirements, guidelines, and case studies of the methods, and being able to consult those documents on a site. - Some showed interest to have **as much information as possible** from a method, giving importance to know what it can produce. In addition, having a manual was pointed out as practical. - Besides that, it also highlighted the need for a **shorter explanation**. This way, the tool overview proposed seems to be very useful. - It was also mentioned as especially useful when all the information can be found on such a website or webpage, and you **don't have to search on different sites**.

5. Results of the Bridging Phase

5.1. Insights from the Co-creation Workshop

A co-creation workshop was carried out in Leuven (Belgium) with DIGNITY partners as a co-creation session to get insights about the DIGNITY Toolkit. Overall, the method process was very positive and adequate for the context. Four main topics were introduced and guided by questions:

- **Key audiences / actors**: identify who are the end-users and which are their needs.
- **Content**: what content should be included and how this should be classified.
- **Format / Design**: debate the main format that the toolkit should have, and as an online website, which functionalities should it incorporate.
- **Inclusive Design**: ensure that the toolkit is inclusive, main inclusive principles

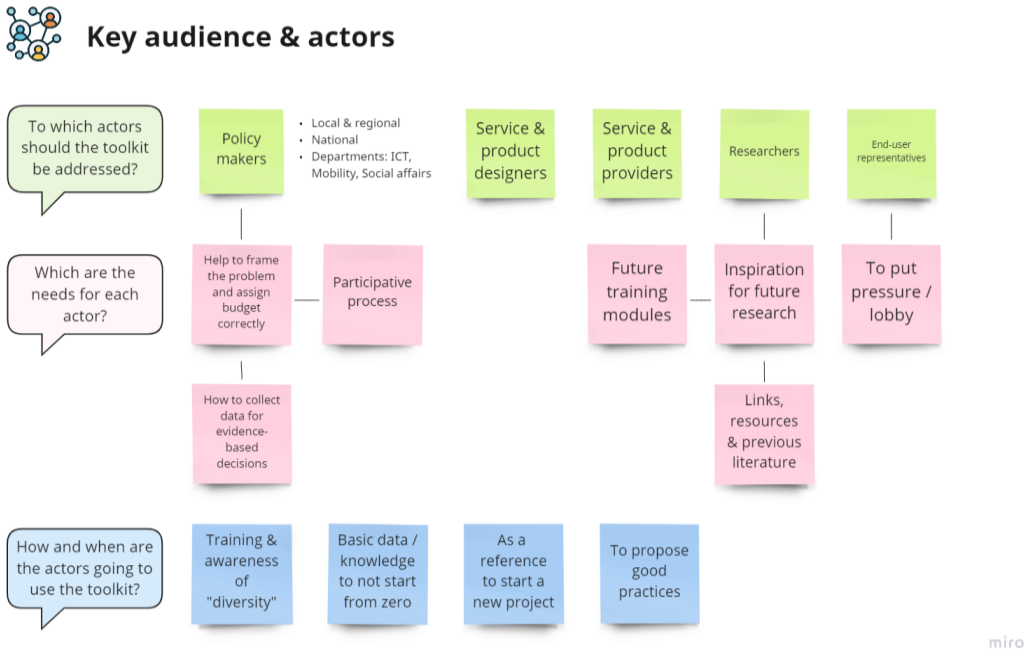


Figure 18. DIGNITY Toolkit key audience and actors' insights.

Participants involved in the workshop agreed on involving four actors as the main target of the toolkit. During the discussion, the needs for each actor were also defined.

- **Policy makers:** Promote inclusivity through regulation and laws, in different scales: national, regional, and local levels of governance. Also, to consider different fields and departments involved: ICT, mobility, social affairs… The toolkit can help to frame the problem, to assign budget, collect data to address policies & take decisions.
- **Mobility providers**: Providers and designers of the product/service.
- **Researchers**: Provide references and literature review - a state of art, about what has been done. Include students (integrating inclusion on their study plans).
- **End-users' representatives:** The toolkit can help them to put pressure to tackle the digital gap and create a lobby. Also, as a resource for training and obtaining data to raise awareness on the topic.

Figure 19. DIGNITY Toolkit content insights.

- The content that participants proposed is based on DIGNITY Deliverables and other related resources. Stakeholders agreed it was relevant to show DIGNITY as an iterative approach: visualising the wheel on the home page. Also show the DIGNITY approach wheel, visual and interactive
- Highlight relevant data (“shocking”) - and add quotes and literals from end-users

- Lessons learned and expectation management - be clear with the outcomes
- A light and a full version of tools - two levels of deepness
- Literature list, providing literature related to the topic

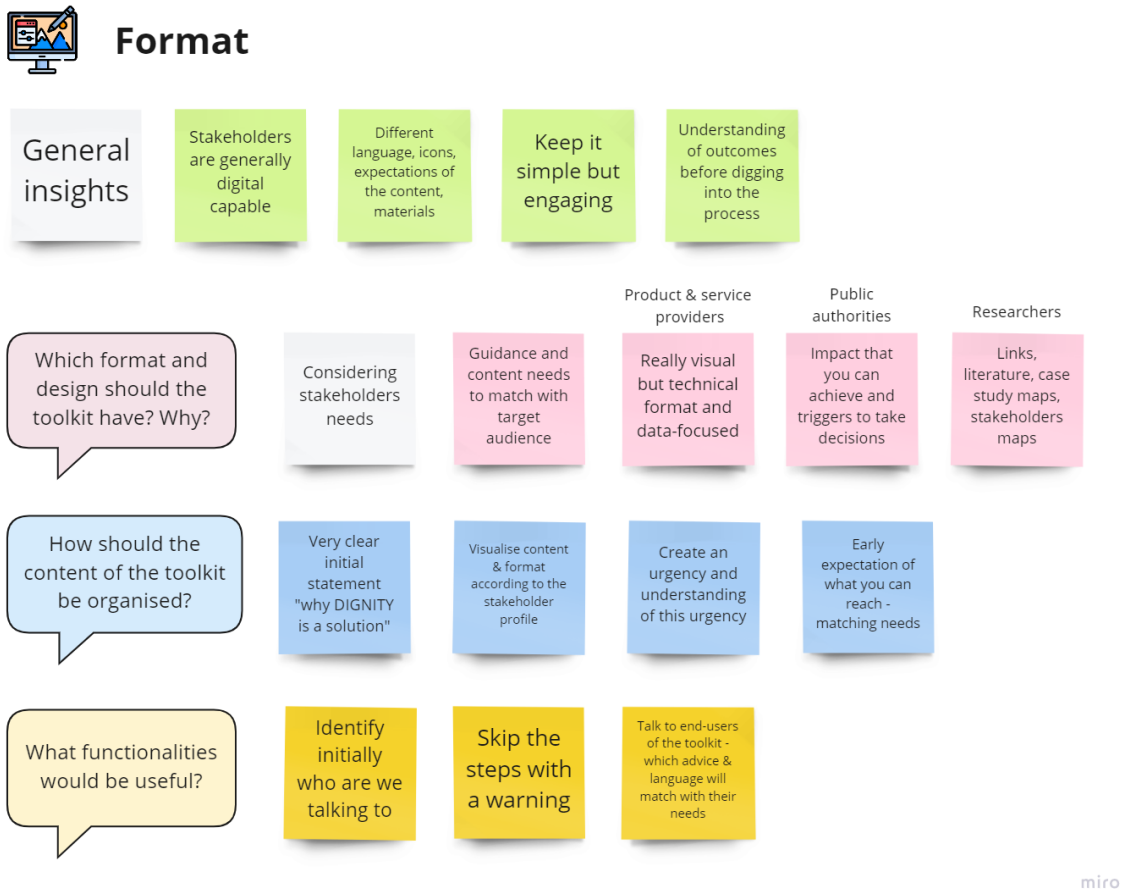


Figure 20. DIGNITY Toolkit format insights.

- The DIGNITY Toolkit format could have different formats (language, icons, content, materials) for each end-user profile, and specific needs were identified. Although it was a really interesting insight, this possibility resulted technically not viable.
- Other relevant insights were to keep it simple and ensure the engagement of users, being able to visualise content & format according to the stakeholder profile.
- Early expectation of what tools can provide.

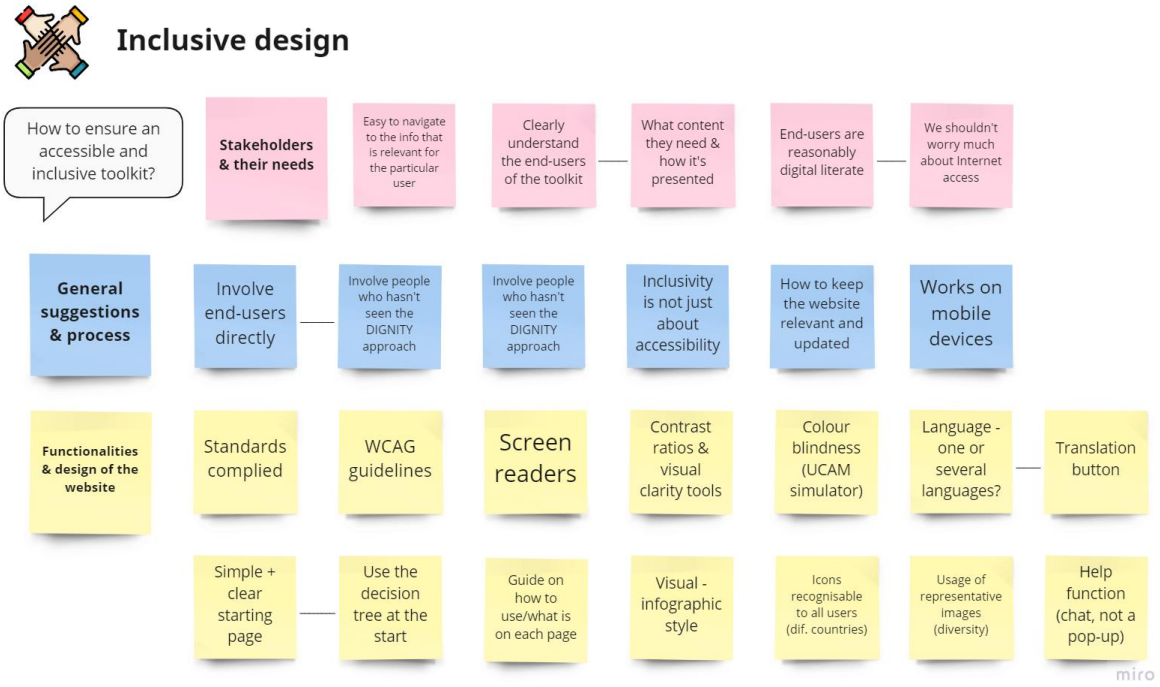


Figure 21. DIGNITY Toolkit inclusive design insights.

- Many functionalities and actions to promote inclusivity were suggested by stakeholders.
- The toolkit needs to be easy to navigate to the relevant information for a particular user.
- It is essential to have a clear understanding of end-users. Also, it was highlighted the importance to involve people who haven't seen the DIGNITY approach.
- Easy navigation of the website, using a decision tree at the start.
- Use available resources (WCAG guidelines, Inclusive Design Toolkit) to ensure the access and use of the toolkit.
- Functions as screen readers, contrast ratios and other tools were suggested to evaluate the website's accessibility.
- Language, representative images and help functions were also part of the discussion.

5.2. Web architecture

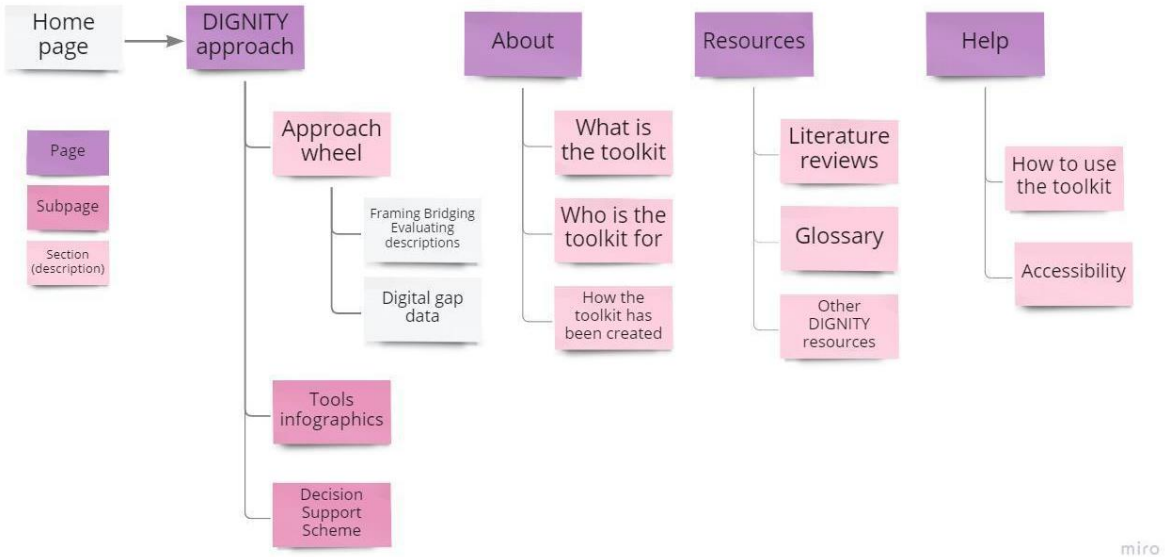


Figure 22. DIGNITY Toolkit web architecture proposal. Self-elaboration.

Web architecture has been evolving during the process with the different stakeholders. It was initially built considering the needs and insights obtained, and this first proposal followed several iterations considering feedback and proposals obtained. Figure 22 shows the latest DIGNITY toolkit website structure proposal.

Organisation - The toolkit is proposed to be organised into four main pages:

- **About**
  - Introduction video of the toolkit
  - What is the toolkit, who is the toolkit for?
  - How the toolkit has been created

- **DIGNITY approach**
  - DIGNITY Approach overview: Summary of the phases and tools used
  - Understanding of the current digital gap: Data to frame the problem
  - Tool infographics: summary of each tool and links to guidelines and other resources
  - Decision support scheme to address the digital gap

- **Help**
  - How to navigate around the toolkit and accessibility of the website

- **Resources**
  - Case studies
  - Literature review
  - Glossary
  - Other resources

5.3. List of Requirements

This tool has been used to create a list of requirements, based on Pugh's checklist, selecting those requirements that were aligned with the DIGNITY Toolkit design and development. These requirements are based on data and insights provided by stakeholders and collected during the Framing and Bridging phase.

This results will help to address a discussion about the next steps and how DIGNITY Toolkit development should proceed.

1. Performance - What main functions does the product need to fulfil?

- The toolkit should be an online tool – having all the information and resources required in one platform facilitates the search for information on a specific topic
- Practical and educational - for mainly policy makers and mobility providers
- Step by step methods on how inclusiveness could be strategically envisioned and conducted
- Give an overview of the problem, creating urgency to solve the digital gap
- Include a Decision Support Scheme tool – developed by other DIGNITY partners

3. Life in service - With what intensity will the product be used and how long it should last?

- This project is funded by the EU and finishes December 2022. In terms of lifetime, many factors and interests rely on this topic, so it should be discussed by partners involved.
- It is an outcome - final product of the project and its approach is designed to be replicable into different contexts, so in terms of the product it is not 'single-use'.

4. Maintenance - Is maintenance necessary and possible? What parts need to be accessible?

- Specifically thought no need to keep updated in terms of content - tools are being evaluated to allow replicability. Some feedback tools have been proposed to collect end-users experience to improve the toolkit.
- It should last at least a few years if the budget allows its maintenance.
- All information regarding the DIGNITY toolkit (outcome and process) will be accessible since it follows an open-source approach.
- Usage of data collected by a web analytics application if possible.

5. Target product cost - What is a realistic price for the product, considering similar products? What margin does it need to deliver?

- This task has a budget for the DIGNITY Toolkit task. It has to be considered that this is possible due EU's Horizon 2020 grant programme.
- Since it is a project funded by the European Union's Horizon 2020 initiatives, there is no profit, so the price is a cost that does not have any economical return.

11. Aesthetic, appearance, and finish - Which preferences do clients and users have? Should the product fit a style?

- There was a clear preference to show the DIGNITY approach wheel in the home page was defined by DIGNITY partners. The toolkit is also aimed to be interactive and visual: tools will be presented as infographic.
- The toolkit has to be attractive and aesthetic but ensure its accessibility and inclusion design principles. This criteria may limit some functions or visual aspects of the toolkit. Also, important to use the appropriate language considering the end-users.
- It is also important and has been highlighted in the interviews the need of layers of deepening - regarding the tools, give an overview of each tool, but making available all information and resources needed to implement it.

14. Standards, rules and regulations - What standards, rules and regulations apply to the product and to the production process?

- Licence conditions should be discussed with DIGNITY partners and web designers, since the DIGNITY project website is owned by ISINNOVA with a Copyright licence, but the DIGNITY Toolkit follows an open-access approach.
- Inclusion standards and regulations must be considered for the final web design of the DIGNITY Toolkit. The World Wide Web Consortium (W3C) develops international Web standards: HTML, CSS, and many more. W3C's Web standards are called W3C Recommendations.

15. Ergonomics - What requirements result from observing, understanding, handling, operating the product?

- Using co-creation and user-centred design tools has helped to identify and understand users' needs and requirements, to ensure toolkit's usability and accessibility. All resources and content must be easy to access.
- Moreover, accessible functionalities should be provided to ensure that DIGNITY Toolkit is an inclusive tool.

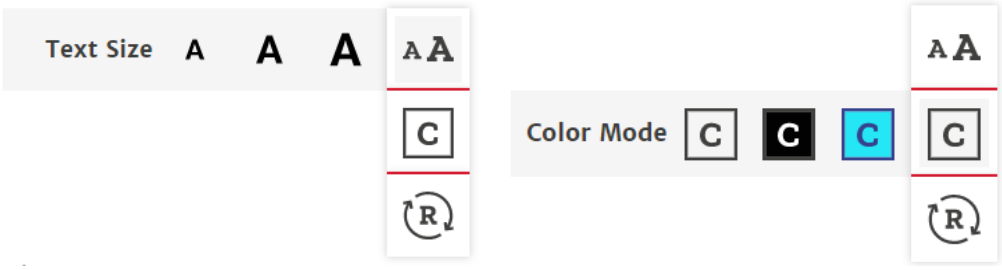


Figure 23. INDIMO Toolbox accessibility functions. (INDIMO, 2022)

18. Testing - What quality tests are conducted on the product?

- Importance of evaluating and testing the toolkit to ensure its usage and impact in eliminating the digital gap. The toolkit will also be evaluated to make sure that addresses users' needs.
- The tools and approach have also been evaluated in order ensure its replicability in different contexts.

19. Safety - Should specific precautions be taken with regards to the safety of users and non-users?

- For non-users, since the product is an online tool, safety taking into account is related to cybersecurity and its maintenance. According to experts and authors of other toolkits it's something to be considered, since there are toolkits that have suffered cyberattacks.

21. Societal and political implication - What opinions are there currently in society concerning the product?

- Since it is a EU initiative for research and innovation, it is expected to have a high social impact - specifically thought to have an impact in society
- Importance to communicate to society what has been done and its impact. Although end-users won't use the toolkit, they will benefit from it. Furthermore, end-users' representatives can use it as a resource to pressure with data and tools.
- Political implication: technical, but difficulty in political policymakers

22. Product liability - For what kinds of design, production or usage mistakes can the producer be held accountable?

- Usage mistakes are not a considerable matter since tools are designed and iterated to be flexible and adaptable to different contexts. For example, Customer Journey Mapping and most of the tools had been adapted to COVID-19 situation, although the DIGNITY approach was thought to be implemented before any restrictions.

5.4. Prototype

This section describes the DIGNITY Toolkit proposal of pages, subpages, and content.

Page 1. Home page

Start navigating through the DIGNITY approach by clicking on the tools (icons/name) on the diagram above.

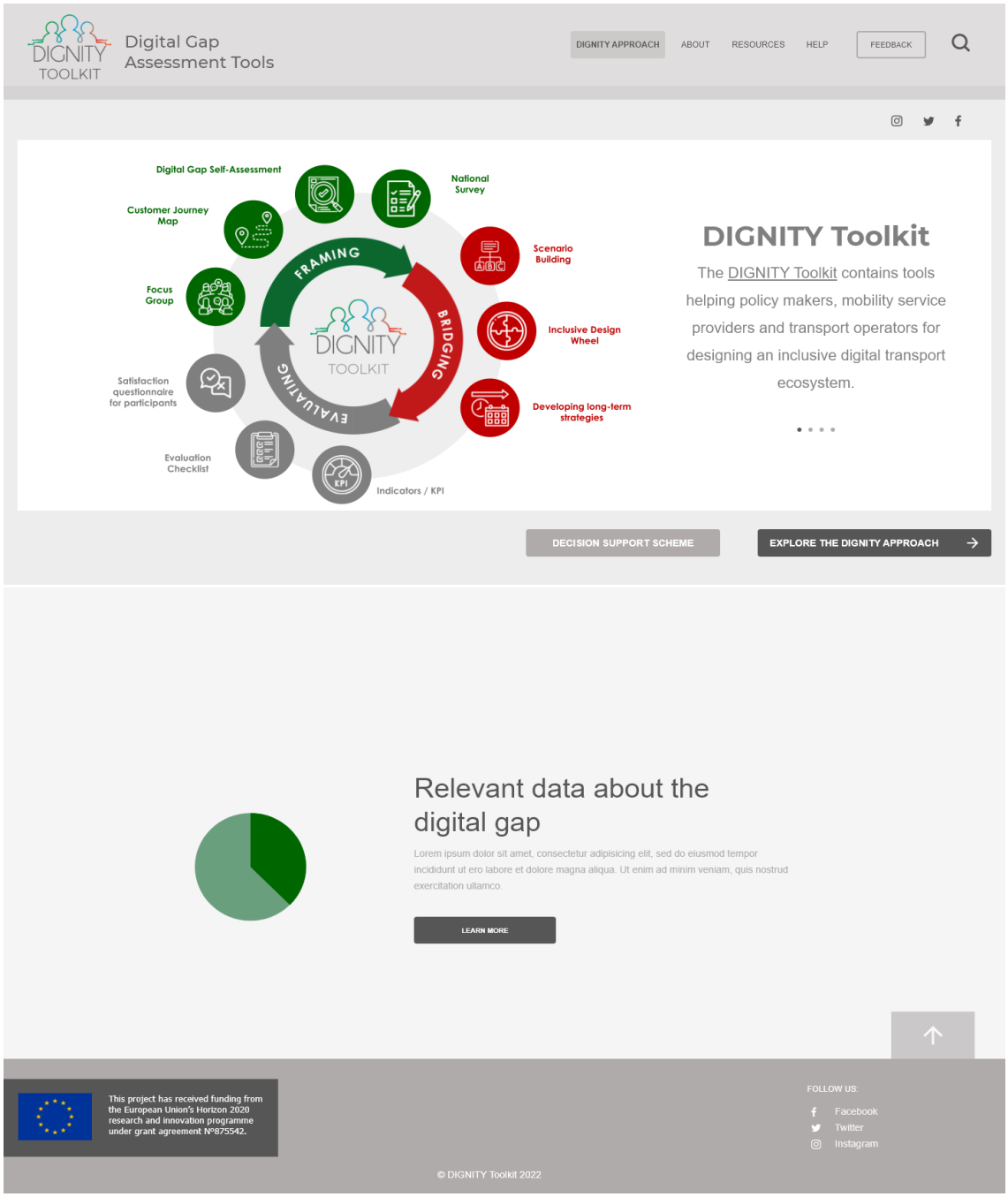


Figure 24. Homepage prototype. Self-elaboration.

The menu of the website will give access to subpages for each main topic. The two subpages in the DIGNITY approach section are the tools and the Decision Support Scheme, defined below.

Subpage 1.1. Tools

The tools included in this toolkit are described in section 1.1. The DIGNITY project - Phases and tools. One of the co-created proposals which has been validated by some end-users (Interview 3) is to provide **two levels of depth of information**. The first level allows an overview of each tool visually, where you can find what it is, when to apply it and what results to expect. This information will be complemented by a second level of depth, through a downloadable document.

The document is a Tool Guideline, and those responsible for implementing each tool (DIGNITY partners) who have applied it during these months, filling in the following table (Table 18). Once all the templates will be filled, the content will be homogenized and adapted in terms of language and format, to be added to the DIGNITY Toolkit.

Table 18. Tool infographic template.

Tool information Structure template		
Name		Name of the method
Phase		**Framing**, **Bridging** or **Evaluation**
Type of results		Quantitative / qualitative
Resources	Time / Duration	Is it possible to give an orientation about how time consuming can be? (i.e., days, weeks…)
	Cost	Is it possible to give an **orientation** about resource investment needed? (i.e., own personal resources, external assistance needed…).
	Materials	Are there any material resources needed? (Space, office materials, software, templates…)
	Expertise	Define if needed the kind of expertise required and the reasons why the method may be easy or difficult.
	Stakeholders involved	Who are the stakeholders involved directly in the method? (i.e., end-users, policymakers, mobility providers, public administration?)
	Nº of participants	Is there an optimum number of participants? (min/max participants) i.e., this makes sense for CJM (individual) or Focus Groups (groups)
Goal of the tool		Define the main goal of the method
Description	What is it	What is the method about?
	When to use it	When can the method be used?
	Flexibility	Can the tool be adapted to different settings and select different responses for time, etc. in these different settings?
Process (steps)		Possible procedure numbered by steps, to give an overview of it. Remember that if the tool is implemented, users should use ‘guidelines’ for details.

Outcomes	Main outcomes	Which are the main outcomes that can be expected? (i.e., databases, qualitative data about user perception, workshop minutes…) Added value - this tool specifically provides (qualitative/quantitative data…)
	Tips / Remarks / Suggestions	What suggests you: 'think about this when using the tool' i.e., the tool relation with other tools, kind of 'testimony' from the tool responsible (or maybe a pilot?) with a golden tip about this tool/method
	Limitations of the method	Are there any limitations detected? (Considering management expectations) (i.e., costs, COVID restrictions, time, resources)
Supporting files	Guidelines and supporting files	Generalised guidelines document (improved and more general guidelines with feedback from evaluation). Are there any supporting files for the tool implementation? (Templates, worksheets, etc.)
	Other related content	Is there any literature, case studies, links or references or other content? Do you have any relevant quotes/literals, pictures to highlight and show how the tool has been used?

Page 1.2. Decision Support Scheme

The Decision Support Scheme (DSS) is a tool thought to be implemented in the DIGNITY toolkit. This specific tool has been developed by Breda University of Applied Science, as a DIGNITY partner responsible for this task. To access to this function, a button in the home page will be placed, and it will also be possible to go through the sitemap.

A DSS is a catch-all term for information systems that support decision-making activities. Its function is to help individuals with making 'better' decisions. DSS come in all shapes and sizes. In many cases, these schemes are very different, but the underlying idea is often the same. The logic under these models is built on the principle of a decision tree (Magee, 1964).

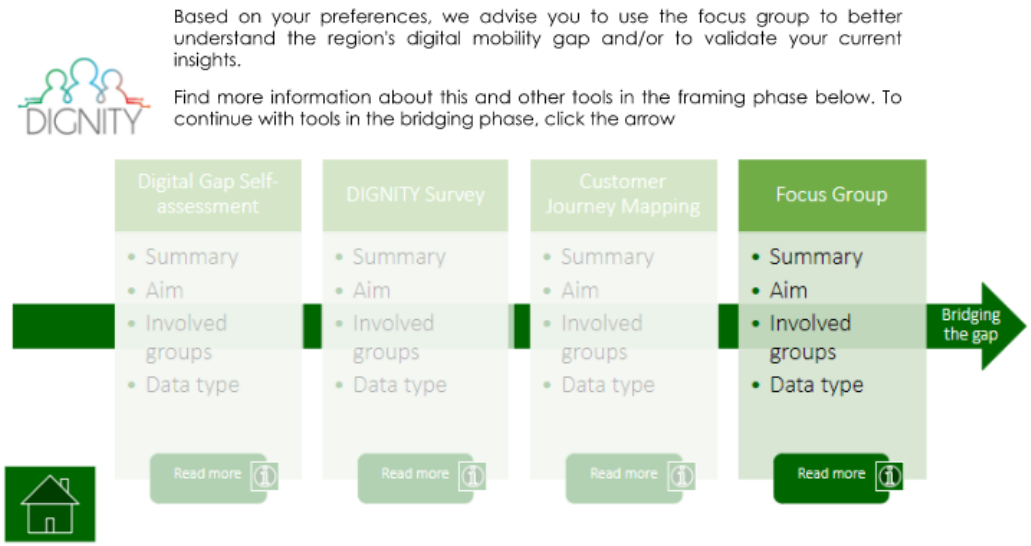


Figure 25. Prototype of one of the possible outcomes of the DSS (BUAS, 2022)

Page 2. About

Subpage 2.1. Video

Figure 26. Video illustration (Antevenio, 2021)

To introduce the DIGNITY Toolkit in a didactical way, it is proposed to include a short video with visual content to explain what the toolkit is, and how it works.

The specific video content has still to be co-created with DIGNITY stakeholders. Some suggestions were to introduce the topic with relevant and visual data to dimension the problem and create urgency to act and promote an inclusive mobility system.

To ensure inclusivity, some good practices that W3C Web Accessibility Initiative (WAI) suggests regarding video and content are:

- Add subtitles and transcripts of the content
- Option to change velocity - slower/faster
- Provide an alternative to the video (text transcript with description of visuals)
- If there are people, make sure to consider representativity of ages, races, abilities, gender and other relevant factors

Subpage 2.2. About the toolkit

A text describing the toolkit can complement the video. An example, with further details to be completed, could be:

> The DIGNITY Inclusive Mobility Toolbox contains tools helping policy makers, mobility service providers and transport operators for designing an inclusive digital transport ecosystem.

Subpage 2.3. About the DIGNITY project

This subpage could overlap with the DIGNITY project website content, but it is important to contextualise where does the toolkit come from.

Subpage 2.4. Feedback survey

The feedback survey proposed in section 6.3 would be placed in this subpage. It has to be determined if the questionnaire would be integrated into the website or as an external platform.

Page 3. Resources

Subpage 3.1. Case studies

Each process of replicability of the DIGNITY approach will be different, but the idea is to provide a platform to share end-users experiences (how did they use a specific tool) as case studies.

Table 19. Case study template proposal.

Topic	Case study
Tool	Which tool was implemented?
Location	Region, city, neighbourhood…
Leader of the tool implementation	Who led the activity?
Main stakeholders involved	Who else was involved in the process?
Target group	Who was the target group?
Summary	Could you summarise how the activity went?
Main challenges	Which were the main challenges?
Results	Which were the main results?

Subpage 3.2. Glossary of terms

A list of terminology related to the digital gap and inclusive mobility will be provided. Some of these terms could be:

- Co-creation
- Digital gap
- Digital performance
- End-user
- Gender gap
- Inclusive Design
- Vulnerable-to-exclusion

Subpage 3.3. Literature review

One of the Deliverables published by the DIGNITY project is D1.1 Literature review - Effects of digitalization in mobility in society (Hoeke et al., 2020). This literature review can be shared or integrated in the toolkit as it can provide an interesting background and state of the art for end-users, as it was identified during the co-creation process. Other DIGNITY publications that have been published during the project and other relevant literature can also be included.

Subpage 3.4. Sitemap

A sitemap will help to access any page on the DIGNITY Toolkit site from there and access sub-pages. It helps the user to understand the structure of content (Fig. 27) and improves the website accessibility since it helps to find the content more easily.

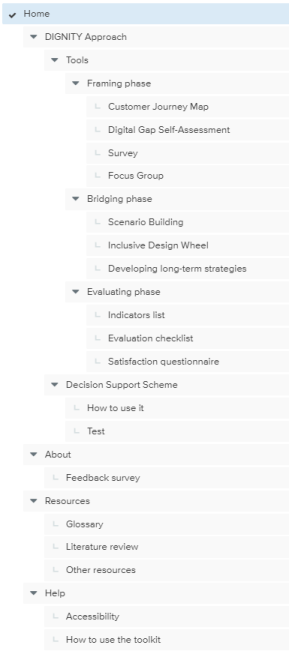


Figure 27. Sitemap of the DIGNITY Toolkit.

Page 4. Help

Subpage 4.1. Accessibility

Since the website will be designed inclusively, it is proposed to add a section sharing which standards will be followed, and some specific guidelines regarding how to access to the content (i.e., how to change the size text or how to turn off the 'aesthetic' design for facilitate the reading).

Subpage 4.2. How to use the toolkit

Another proposal, noticed as a good practice in some toolkits benchmarked, is to provide a page or a PDF about how to use the toolkit, with visual support of what content it includes and how this is organized.

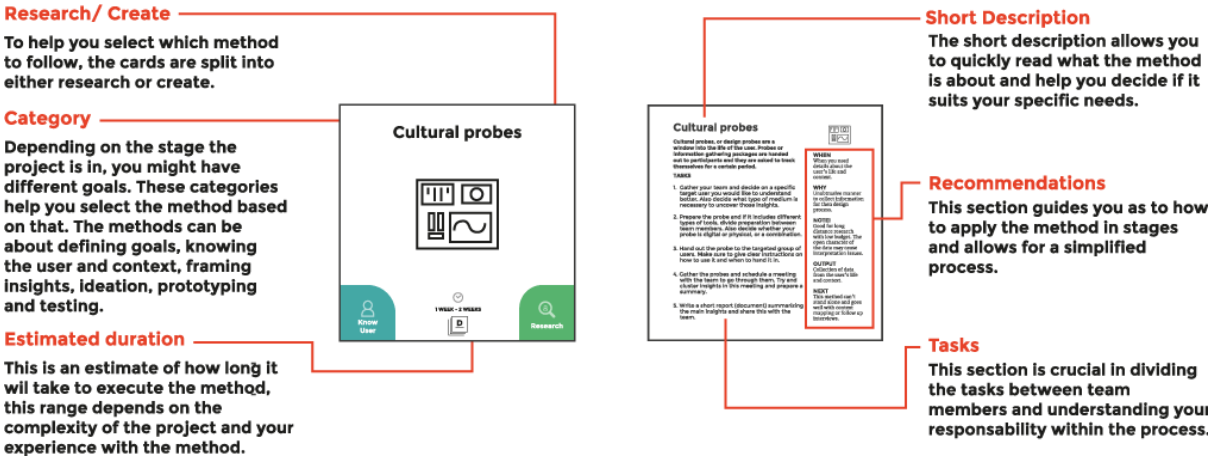


Figure 28. Design method toolkit guid (Design Society School, n.d.)

6. Proposal of the Evaluation Phase

6.1. Accessibility evaluation

During the co-creation workshop it was suggested to check W3C Web Accessibility Initiative (WAI) guidelines to ensure that the DIGNITY Toolkit is accessible for everyone. It is essential that a toolkit that promotes inclusive ecosystems follows these guidelines and standards.

According to the WAI (2022), when developing a website, it is essential to evaluate accessibility early and throughout the development process to identify accessibility problems early, when it is easier to address them. Currently many sites are developed with accessibility barriers, making them difficult or impossible for some people to use. Ensuring accessibility products and services work better for more people, with or without any disabilities. WAI provides tools and a methodology that help with the evaluation process.

Another good reference to perform this evaluation is the Inclusive Design Toolkit (University of Cambridge Engineering Design Centre, n.d.), which includes activities within the Evaluate phase of the design cycle. They examine how well the product criteria are met, taking the needs of all the stakeholders and target users in account.

It is also part of this proposal to interview an inclusive design expert to get some deeper insights and ensure that the requirements and users' needs are addressed regarding accessibility.

Following Accessibility Evaluation by WAI, some recommendations to be applied in the DIGNITY Toolkit evaluation are:

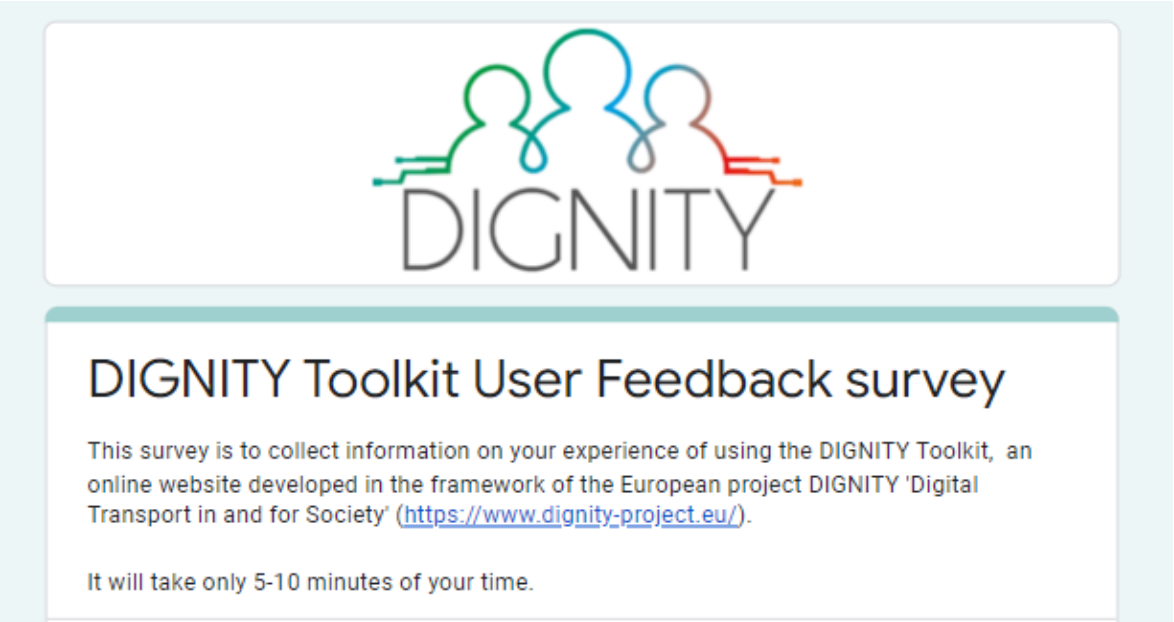
- Start with WAI Easy Checks - a first review, step-by-step instructions of accessibility
- More assessment by professionals is needed for a definitive and comprehensive evaluation: proposal to interview an inclusive design expert to get some deeper insights and ensure that the requirements and users' needs are addressed regarding accessibility.
- It's important to complement using evaluation tools with real-life experience of website users
- The interactive wheel was a requirement by some stakeholders, but it should be provided an accessible alternative of the content
- Allow transcripts and subtitles for audio/video and alternative text for images

6.2. Review workshop

To showcase the results of the project, and to discuss outcomes and further exploitation, a DIGNITY final conference is expected to be held. The conference will bring together policy makers, transport operators, digital mobility product and service providers, and representatives of user associations.

The idea is to organise a workshop, dedicated to presenting the DIGNITY Toolkit and to test it and get insights and feedback about it. Here, they would be able to experiment with these outputs, brainstorming how they might be applied in various environments.

6.3. Feedback survey



As part of the evaluation process and to improve the toolkit usage experience, the benchmarking tool helped to identify as a good practice to introduce a questionnaire to collect user comments and feedback.

In this case, it is proposed to add a questionnaire with a series of questions about the user, their preferences, and their experience. The specific format will depend on the web designer and programmer. This will allow end-users to provide their feedback and share their experience using the toolkit.

Questions of the Feedback Survey

About the user

1. What best defines your category?
    a. Public administration
    b. Expert/Academic
    c. Mobility provider
    d. End-user of mobility services
    e. Other

2. Could you please briefly describe your interest to use the DIGNITY Toolkit?
    a. Personal interest in the topic
    b. Professional interest in the topic
    c. Other

3. How did you find out about the DIGNITY Toolkit?
    a. DIGNITY Website
    b. Web search engine
    c. Social media
    d. Other

4. Which of the following devices did you use to access the toolkit?
    a. Laptop
    b. Desktop computer
    c. Smartphone
    d. Tablet
    e. Other

5. How experienced were you with inclusivity and the digital gap in the mobility ecosystem before using the DIGNITY Toolkit?
    a. Rate 1-5

6. Do you usually need any specific assistance on a website?

About the toolkit

7. How would you rate the DIGNITY Toolkit? Please rate the following statements: (1-5, strongly agree to strongly disagree)
    a. The design and format is visual and easy to use.
    b. The content is well organised.
    c. I understood what the DIGNITY approach is.
    d. There is enough depth of information.

8. Did you find any difficulty or problem while using the DIGNITY Toolkit?

9. Do you have any further comments or suggestions?

7. Discussion and conclusions

This research project has followed a three-phase process (framing, bridging, and evaluating), including a set of user-centred design tools to identify and analyse the state of the art of toolkits and identify how the DIGNITY toolkit should be, considering end-users needs. These phases have followed the same concepts as the DIGNITY approach but using different tools for each phase.

The framing phase consisted in getting a better understanding about the digital gap and what a toolkit is. This has been done using literature review to define the most relevant concepts, creating a stakeholder map to identify all the stakeholders and their needs, doing a benchmarking of relevant toolkits related to this research and interviewing key informants and potential end-users.

The bridging phase, orientated to build the solution, included a co-creation workshop with relevant DIGNITY stakeholders to start co-designing the DIGNITY Toolkit. This also fed with the information that was missing from the framing phase. With the previous insights collected, the web architecture and some first prototypes of the toolkit website were co-created. A list of requirements was also done to make sure all requirements and needs were taken into consideration.

The evaluating phase has been proposed since the toolkit is still under construction, following the co-creation process. The final output of this project is a proposal, so the final product will be developed in the following months and finished with the co-creation results by a web designer and a programmer. Therefore, a proposal of tools can be found in aiming to carry out this evaluating phase, consisting of an accessibility evaluation to ensure that the website follows accessible standards, a validation workshop with stakeholders and a feedback survey to be incorporated in the DIGNITY toolkit to allow end-users provide feedback about their experience.

The **research question** of this project is *if co-creation processes and user-centred design tools did help to design a resource as the DIGNITY toolkit*. To address this research question, it has to be considered the fact that the process is not over (the toolkit as final deliverable of the DIGNITY project is expected for the end of 2022) and, at this specific point, there are not final results to be evaluated, so objectively it is difficult to verify if the co-creation currently has helped to design the DIGNITY toolkit but other experiences have showed before the benefits of these kind of processes, as Mironcika et al. (2008) also highlight. It will be discussed **if co-creation and UCD tools used have been successful to address the design process of the DIGNITY toolkit.** They have been useful so far, since it has helped to establish a process that matches with the aim of the project.

Some benefits observed during the process are that co-creation opens a wide range of voices and experiences that would normally never be involved, and probably who matter the most. Co-creation seems to be an appropriate model to ensure the inclusion of diversity, focusing on ‘vulnerable-to-exclusion’ groups, during the design process and to take into account their needs and perspective. The University of Cambridge Engineering Design Centre (http://www.inclusivedesigntoolkit.com/) have created the Inclusive Design Toolkit, after many years leading the research on Inclusive Design, also applying this kind of methodologies and tools.

Also, societal challenges, such as climate change, establish the need for setting participation on the political agenda. This way, promoting inclusivity in mobility and making public transport more accessible, considering that transport is one of the sectors that most contribute to energy

consumption and greenhouse gas emissions. Also, co-creation and UCD tools also help to improve products and services based on end-user needs and desires, so this ensures well-targeted outputs.

These and other benefits can be observed in other cases as in LIVIN: Living Innovation (https://www.living-innovation.net/explore), an EU-funded project Horizon 2020 which has also designed a Co-Creation Toolkit, evidencing the need of this tools and processes to ensure citizen engagement, and addressing policies that embed the needs of both entrepreneurs and users.

The knowledge in this project is provided by local pilots and experiences in a specific context. Each tool should try to be general, not focusing on detail, but on specific categories that are more relevant. This brings up a relevant consideration: representativity and how to adapt co-creation to a broad and general context. It is relevant to ensure a balance here, not just from a fair and inclusive perspective, but also in terms of resources and replicability. This balance is what DIGNITY tried to promote identifying the needs and creating tools for different levels (micro/meso/macro). This helps us to consider detailed and user-specific levels, but to translate into a broader perspective to address general policies, considering all possible particular needs of the different groups.

Additionally, costs and time were identified as limitations of co-creation processes. Specifically, EU public funding of the DIGNITY project has facilitated the contribution of economic resources to apply co-creation and UCD tools, allowing to implement all tools in different pilots and contexts. In other projects without specific funding allocated, outputs and expectations of these methods and tools are not always clear, and those human and material resources are not always available to have a detailed and contextualised research as the DIGNITY approach has reached.

Another factor related to this is time - as well as cost, it is a limiting factor and co-creative processes depending on the project plan management. Co-creation is expected to have many iterations during the design, development process and evaluation of a product/service, and this takes time. This depends on each end-user and each context: research and experts might be flexible with these limitations, but it becomes more challenging for technical and political implications.

There are some improvements and further research that should be done. Due to limitations of time and resources, the user research has been centred on policymakers (since the Decision Support Scheme user research provided was targeted to policymakers). Addressing this research to policymakers had a purpose: they are one of the most relevant stakeholders due their impact on the policy agenda and actions. Besides that, mobility providers and public transport operators are also key and relevant for further research from an end-user perspective.

Overall, from a process perspective, following a co-creative process has definitely facilitated the design of the toolkit, including the insights and feedback provided or those design proposals validated by stakeholders. So overall, co-creation processes have been useful and have favoured the inclusion of not just end-users, but different stakeholders. Furthermore, co-creation goes deeper than user-centred design, but they’re both complementary to each other.

Bibliography

Barcelona Mobile World Capital. (2016). *The Digital Divide in Barcelona*. www.mobileworldcapital.com/escletxa-digital

Boeijen, A. van, Daalhuizen, J., Zijlstra, J., Schoor, R. van der, & Technische Universiteit Delft. Faculteit van het Industrieel Ontwerpen. (2014). *Delft Design Guide: Design Strategies and Methods* (B. B. V. Uitgeverij (ed.); 2nd ed.). https://books.google.com/books/about/Delft_Design_Guide.html?hl=es&id=qIcmngEACAAJ

Bosetti, S., Bruhova Foltynova, H., Jordova, R., & Malgieri, P. (2014). Policy recommendations : for EU sustainable mobility concepts based on CIVITAS experience. In *CIVITAS*. ICLEI Europe. https://www.researchgate.net/publication/332383752_Policy_recommendations_for_EU_Sustainable_Mobility_Concepts_based_on_CIVITAS_experience

British Standards Institute. (2005). *Design management systems - Managing inclusive design. Guide*. https://shop.bsigroup.com/products/design-management-systems-managing-inclusive-design-guide/standard/preview

De Koning, J. I. J. C., Crul, M. R. ., & Wever, R. (2016). Models of co-creation. *Fifth Service Design and Innovation Conference*. https://d1wqtxts1xzle7.cloudfront.net/55012757/ecp16125022_small-with-cover-page-v2.pdf?Expires=1646314694&Signature=FCa2RvgT9XIUIRMqudyBm6h5VSRfu2PwuPNbE9afG0yw8DoO0K~lyAZr4XCnYbsNZssglUgZ3j2IB3hb0BbomkvF1x2Xj-FObs4Bme2IvzYnbvHcY5CvzFo~VonW2ktzrEi~aq2BAA

Design Society School, & Amsterdam University of Applied Science. (n.d.). *Using the toolkit - Design Method Toolkit* . Retrieved May 26, 2022, from https://toolkits.dss.cloud/design/using-the-toolkit/

DIGNITY. (2020). *DIGNITY approach – About*. https://www.dignity-project.eu/dignity-approach/

European Comission. (2022). *Policy areas - Reform Support*. https://ec.europa.eu/reform-support/what-we-do_en

Garcia-Lopez, C., Mor, E., & Tesconi, S. (2020). Human-centered design as an approach to create open educational resources. *Sustainability (Switzerland)*, *12*(18). https://doi.org/10.3390/SU12187397

Garcia-Lopez, C., Tesconi, S., & Mor, E. (2019). Designing Design Resources: From Contents to Tools. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *11566 LNCS*, 87–100. https://doi.org/10.1007/978-3-030-22646-6_7/FIGURES/5

Goodman-Deane, J., Kluge, J., Roca Bosch, E., Nesterova, N., Bradley, M., & Clarkson, P. J. (2022). *Digital mobility services: A population perspective*.

Hoeke, L., Noteborn, C., Goncalves, M. P., & Nesterova, N. (2020). *Deliverable D1.1 Literature review: Effects of digitalization in mobility in society*. https://www.dignity-project.eu/wp-content/uploads/2020/10/200519-D1.1-Literature-Review-Final.pdf

IDEO. (n.d.). *Design Kit - Co-Creation Session*. Design Kit. Retrieved April 2, 2022, from https://www.designkit.org/methods/co-creation-session

Interaction Design Foundation. (n.d.). *What is User Centered Design?* Retrieved May 30, 2022, from https://www.interaction-design.org/literature/topics/user-centered-design

Justinmind. (2018, June 8). UCD vs UX: What's the difference? *UX Planet*. https://uxplanet.org/ucd-vs-ux-whats-the-difference-255443efa5f

Kuhn, R., Konrad, W., Wist, S.-K., & Witzel, B. (2021). *LIV IN Co-Creation Toolkit*. https://www.living-innovation.net

Martin, B., & Hanington, B. (2012). *Universal methods of design : 100 ways to research complex problems, develop innovative ideas, and design effective solutions*. Rockport Publishers. https://books.google.com/books/about/Universal_Methods_of_Design.html?hl=es&id=uZ8uzWAcdxEC

Mironcika, S., Hupfeld, A., Frens, J., Asjes, J., & Wensveen, S. (2008). Co-creation and the new landscapes of design. *Https://Doi.Org/10.1080/15710880701875068*, 799–809. https://doi.org/10.1080/15710880701875068

Ramaswamy, V., & Ozcan, K. (2018). What is co-creation? An interactional creation framework and its implications for value creation. *Journal of Business Research*, *84*, 196–205. https://doi.org/10.1016/J.JBUSRES.2017.11.027

Rill, B. R., & Hämäläinen, M. M. (2018). *The Art of Co-Creation: A Guidebook for Practitioners*. https://books.google.es/books?hl=es&lr=&id=3F5qDwAAQBAJ&oi=fnd&pg=PR5&dq=co-creation+human+centered+design&ots=zBP9HOOPJ7&sig=6WnGrP6kGPXnasANn-Sw-kpMplU&redir_esc=y#v=onepage&q=co-creation human centered design&f=false

The World Cafe. (2022). *World Cafe Method*. http://theworldcafe.com/key-concepts-resources/world-cafe-method/

United Nations. (2015). *Transforming our World: The 2030 Agenda for Sustainable Development*. https://sdgs.un.org/sites/default/files/publications/21252030 Agenda for Sustainable Development web.pdf

Universitat Oberta de Catalunya. (n.d.-a). *Design Toolkit*. Retrieved March 8, 2022, from http://design-toolkit.recursos.uoc.edu/es/

Universitat Oberta de Catalunya. (n.d.-b). *Design Toolkit | Arquitectura de la información*. Retrieved April 15, 2022, from http://design-toolkit.recursos.uoc.edu/es/guia/arquitectura-de-la-informacion/

Universitat Oberta de Catalunya. (n.d.-c). *Design Toolkit | Benchmarking*. Retrieved April 5, 2022, from http://design-toolkit.uoc.edu/es/guia/benchmarking/

Universitat Oberta de Catalunya. (n.d.-d). *Design Toolkit | Human-centred design*. Retrieved May 20, 2022, from http://design-toolkit.recursos.uoc.edu/es/diseno-centrado-en-las-personas/

Universitat Oberta de Catalunya. (n.d.-e). *Design Toolkit | Prototipado*. Retrieved May 27, 2022, from http://design-toolkit.recursos.uoc.edu/es/guia/prototipado/

University of Cambridge Engineering Design Centre. (n.d.). *Evaluate - Inclusive Design Toolkit*. Retrieved May 17, 2022, from https://www.inclusivedesigntoolkit.com/GS_evaluate/evaluate.html

Web Accessibility Initiative. (2022, February 2). *Evaluating Web Accessibility Overview*. https://www.w3.org/WAI/test-evaluate/

YALSA - American Library Association. (n.d.). *Toolkit Creation Guide*.