Connecting through Information

Design and Data to foster Democracy

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Master thesis
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From the past two years I have learnt to really appreciate the sun. But I also know now, vitamin D and having you around does the trick. Thank you for sharing a bit of you for the past two years.

Enjoy the read!

Executive Summary

The present graduation project started with the task to use design methods to foster participation and develop data literacy skills. During the research phase I take a closer look into the context of Delfshaven in the city of Rotterdam, Netherlands, chosen to develop the present project for its active citizens and population diversity. After going through theory around Data literacy, Infrastructuring, Information Ecosystems and Transitions, the scope of the project was narrowed down to answering a research question; How might a participatory tool enable citizen initiatives to map their Information Ecosystem and their role in it?

The project takes on a Research through design approach, combined with three iterative design cycles. During the Cycles, I designed, prototyped, and tested three iterations of the Connecting through Information Participatory Tool coming to a final design validated with citizen initiatives in Delfshaven.

The development of the cycles was incremental, as the requirements reinforced the design with every iteration and cycles built upon each other. From the Research through design perspective, it is through the requirements I used to evaluate the tool, that I could gain insights of the use of Information Ecosystems as a tool integrating a systemic approach at a hyperlocal level. The final result, the Connecting through Information Participatory Tool still has opportunities for improvement, and research as it acts in a space between citizen initiatives and government structures that is not connected yet.

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1. Introduction to the project

With a rising presence of far-right parties and populism, countries around the world are undergoing a decline in democracy. The growing gap between polarized groups weakens collective action and reduces social inclusion. Inequalities keep getting wider and social and political instability are a reality in developed and underdeveloped countries. An example of this instability and the response to population discomfort is the Yellow Vest movement. What started in France against fuel taxes, quickly found its way to neighbouring countries from Europe including the Netherlands. Although their demands are now not clear, they have spread into a global movement. Similar actions can be found at a hyper-local scale in cities and neighbourhoods. While passive discontent citizens are oftentimes not willing to participate constructively, citizen initiatives often fail to articulate a clear message in order to contribute in a constructive way to today's society.

At the same time, new technologies keep emerging, producing a great amount of data without significantly helping the global situation. The city of Rotterdam in the Netherlands is not an exception. Rotterdam is a large connected city with a technological platform reaching most of its services. But sometimes this connectivity is not the answer to local problems. It is then that citizens turn to their trust networks to bring better solutions. A great example of this takes place in Delfshaven, an area of Rotterdam with a diverse population and the one with the highest concentration of citizen initiatives. Dakpark for example, is a 1km roof park, part of the Green Belt of Delfshaven. This park is not only self managed, but neighbours were involved in its ideation, planning, and construction. According to their website, Dakpark Foundation was established in 2013 by citizens as a way to keep citizen influence in the park maintenance. They have a board and an offline and online network of partners and volunteers involved in all kinds of activities to bring neighbours together inside the park (Dakpark Rotterdam). Some of these green initiatives are the Green groups which do gardening around Delfshaven. When a more diverse and inclusive group of people engage with their neighbourhood through action, they are representing a larger sector of Rotterdam´s citizens. When they are active, initiatives can communicate the specific needs of those often overlooked citizens.

The prevailing challenges also create great opportunities. In the present graduation project I will explore the link between data and participation, as well as the role of designers in social innovation. "Current challenges need a new way to approach problems in all their complexity" (Dorst, 2015) and citizens prepared to face them, it can not be built only by organizations top- down. As the citizens of Delfshaven show, it needs to include a diversity of perspectives from bottom-up initiatives. Citizens need to be better equipped to not only survive the current uncertainty, but to be active participants in shaping their dynamic surroundings.

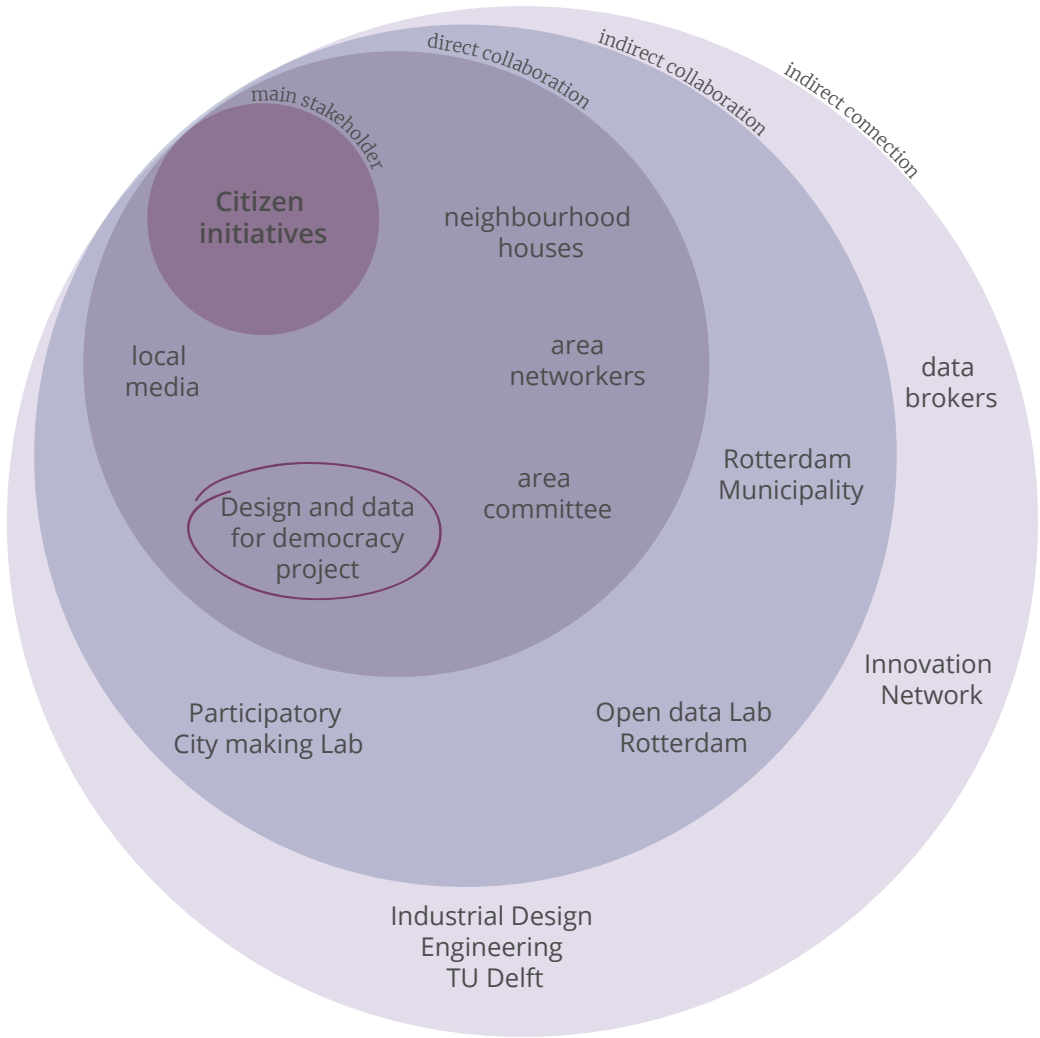Societal issues need both a systemic overview as well as hyper local attention. The next section details the context, presenting the stakeholders involved in the project. The present chapter 1 later presents the project objective, which is tailored to the context of the city of Rotterdam, Netherlands. The specific context to develop the research and validation of this project is the Delfshaven area mentioned in the example before.

1.1 Context

Choosing a specific context is key for the development of design and research projects to have an adequate focus on factors affecting the proposal. In the case of the present project, selecting a neighbourhood in Rotterdam allows me to pay attention to details specific to the place such as social organization, participation dynamics, and communication networks. The specific hyper-local details nourish the research and its outcome, as they are unique to the setting, and therefore can have a relevant impact. As mentioned before, the intended users for the project are citizen initiatives in Delfshaven, due to its diversity and stronger presence in the neighbourhood than other areas in the city. Graduation projects from the Industrial Design Engineering Faculty at TU Delft have already been successfully developed with Delfshaven neighbours, including some of them as part of the Open4citizens project. Figure 1 shows a map of the stakeholders and their proximity to each other and the project. These stakeholders are taken into account to gain a better understanding of the neighbourhood and are further addressed in this section.

>

Figure 1. The relevant stakeholders for the development of this graduation project are mapped, showing their relationship in the real context through proximity. The closest circle shows stakeholders who collaborate closely with citizen initiatives, the second one shows indirect collaborations through other stakeholders, while the last one shows stakeholders who are connected to them but do not collaborate.

main stakeholder

direct collaboration

indirect collaboration

indirect connection

Citizen initiatives

neighbourhood houses

local media

area networkers

Design and data for democracy project

area committee

Rotterdam Municipality

data brokers

Participatory City making Lab

Open data Lab Rotterdam

Innovation Network

Industrial Design Engineering TU Delft

Delfshaven area

Delfshaven, area highlighted in Figure 2, has a rich historical background, from growing as the port of Delft to standing the bombing of the city in 1940. Nowadays Delfshaven has eight thriving neighbourhoods; Bospolder, Delfshaven, Middelland, New West, Oud Mathenesse, Schiemond, Spangen, and Tussendijken. It has more than 75,000 inhabitants from diverse backgrounds and since the '90s has developed a strong synergy between residents and municipality, leading to a reduction of issues and increased citizen participation (Gemeente Rotterdam).

Citizen initiatives

Delfshaven has a strong network of active residents and grassroots organizations. This network interacts with the different government initiatives creating a healthy synergy between institutions and citizens. A good example of initiatives working together is the Green belt of Delfshaven, going through parks and gardens in the neighbourhood. Delfshaven also has an established structure of local media partners who help with communication of activities in the area, such as wmo radar and wijkplatform. Citizen initiatives can apply for local budget, approved by the area committee to develop projects which improve the neighbourhood. Two initiatives cooperated with this project in the validation phase; Zorgvrijstaat (Figure 3) who focus their efforts in the better use of community networks to support healthcare, and the Buurt Bestuurt or Neighbourhood Management from Coolhaven who meet with professionals and government officials to improve the neighbourhood.

Neighbourhood houses

The neighbourhood houses are a network of buildings managed by municipality workers locally. Their objective is to be a gathering point for neighbours, initiatives, and organizations through all kinds of activities, from language courses to cooking together. The municipality encourages self- managed houses, operated by neighbours themselves. Delfshaven has one of this self managed houses, which is an example of active citizens in the area participating and willing to take on responsibility.

<
Figure 2. Map of Rotterdam with Delfshaven area highlighted. (Google)

>
Figure 3. A summer initiative from Zorgvrijstaat,a volunteer walks around a park to answer questions about the city and neighbourhood. (Zorgvrijstaat,2018)

Area committee

Delfshaven is one of the areas of Rotterdam exploring a drawn area committee, which is meant to open opportunities for residents to influence what happens in their neighbourhoods. The role of the area committee is to give solicited or unsolicited advice to the City Council according to the interests of the area residents and engage more neighbours in planning for a better neighbourhood (Gemeente Rotterdam).

Rotterdam Municipality

There are different elements in the structure of Rotterdam Municipality (Figure 4) which work as touchpoints with citizens. As population grows, problems are more localized and context specific, so there is a growing interest to involve citizens in shaping the city. It is important to get to know the government perspective for the development of the project so that it can be built in the gap to connect them to bottom-up initiatives.

> *Figure 4. Dakpark is a successful citizen initiative from Delfshaven in collaboration with Rotterdam Municipality.*
(De Fotovlieger, 2016)

Area Networkers

They are the municipality's monitors and points of contact, connecting with neighbours daily, ensuring a good living environment. Their knowledge of the day to day in the neighbourhood is important to carry the vision of the municipality at a street level.

Innovation Network

The job of the Innovation Network inside Rotterdam Municipality is to build a collaboration network inside the structure of the organization, which already sums 15,000 participants. Their efforts concentrate around transitioning from an exploit model of governance to an explore model, which includes trying different solutions to problems (Figure 5). Part of the explore approach means the office has a strong interest in implementing participatory tools to build a more adaptive and resilient city. The approach shows a clear interest from an office at the municipality to expand their collaboration into the neighbourhoods. Involving neighbours in city activities would help the Municipality to try out new solutions and learning from experimentation in context.

> *Figure 5. Contrast between explore and exploit model.*
(AlexOsterwalder)
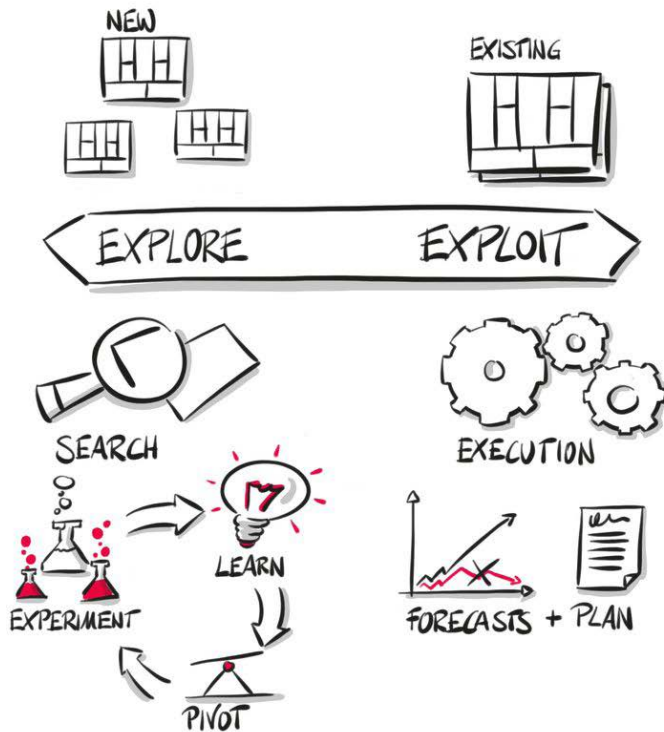
Data Brokers

Rotterdam Municipality has available resources for consulting inside the organization, and data brokers are the experts to go to consult them. The expertise of data brokers is in navigating the databases available to the municipality. Rotterdam city employees can make data requests through them. A big part of the available resources are also Open Data, so it is available for citizens to consult, but they get only a few requests every week. There is an opportunity to fill data gaps from initiatives through this official channel, building a bridge for collaboration between citizens and government.

TUDelft

Participatory City Making Lab (PCM Lab)

(https://delftdesignlabs.org/)

The project is part of the PCM Lab at Industrial Design Engineering Faculty at TU Delft. This lab houses graduation projects focused on exploring the interaction between grassroots initiatives and public administration. Being part of a Lab allows the project to grow within a network of students and researchers interested in participatory design.

Open data lab Rotterdam (ODL Rotterdam)

(http://open4citizens.eu/)

The Open data lab Rotterdam is a pilot for the Open4Citizens project focused on the self- management of public parks supported by open data. Students and researchers from TU Delft have been involved in both projects, which are also important support networks for this graduation project.

The connections and relations of the presented network are complicated, nuanced and dynamic, which makes it difficult to have a static overview of all the participants and their specific interactions. The current section has presented, I present a clear panorama of the hyper-local context for the extent of the present graduation project including the stakeholders involved, and how they interact between them. Now that the context has been examined, the objective of the project is specified in the next section.

1.2 Assignment

As mentioned in the previous context section, in the city of Rotterdam there is a clear push from the Municipality to involve citizens in city management tasks. There is also a pull from active citizens to bring a diversity of voices to activities in Delfshaven. Both parties act and interact through different touchpoints. Sill, the gap between the systemic approach of the Municipality and the hyper-local actions of citizen initiatives is too wide. The challenge for both sides is to build more and stronger connections to bridge the existing gap. It is then that they can achieve a common perspective and continue to build together. Citizen initiatives struggle to communicate the relevance of their activities around the area, especially with citizens who might not be as involved in bottom-up activities. At the same time, Rotterdam keeps evolving as a more connected smart city, which creates both challenges and opportunities for citizens and the government. Here lays the opportunity and objective for the current project project to:

Design a space to foster citizen participation, developing data literacies through design methods.

Taking into account diffuse design skills, data literacy and citizen participation, the specific focus of the project is in adapting a data literacy framework with a systemic approach, into a hyper-local participatory tool for citizen initiatives. The concepts intertwined form a picture of social innovation in which designers can engage. Chapter one presented the assignment and context in detail. Next, the second chapter will review the theory, where the relationship between data literacy skills, design skills and civic participation are established.

2. Conceptual framework

Chapter 2 presents the relevant literature for the development of the project. In the context of a growing connected city like Rotterdam. Within a neighbourhood with many active citizens such as Delfshaven, design methods can play a role in generating a space to foster citizen participation. Being the target users for this graduation project, citizen initiatives are the starting point for the theoretical background. With them at the center, all the themes are related to each other in a network.

The main topics are *infrastructuring, data literacy, information ecosystems, and transitions,* highlighted in color at the center of the circle in Figure 6. From those main themes, the research touched upon other concepts which influenced the development of the project. The selection of topics displays an organic flow during the research phase, always keeping in mind the role of design for citizen participation. It is the role of citizen initiatives and the goal to empower them through participation that unites the different topics. That is how infrastructuring comes to the surface as an important theme to explore in the field of social innovation. Data literacy is integrated early on as a way of having a current approach to cities, obvious from the technological advances present in daily life. Then, transitions emerge as an approach to the state of the world today. Information Ecosystems complement the research as a link between data literacy and the urgency of diffusing skills for transitions.

>
Figure 6. Network of themes presented as conceptual framework with the main topics highlighted in color at the centre of the network. All of them relate to each other, always keeping citizen initiatives and participation at the center, bringing them together .

frameworks
toolkits

city resilience
resilience policy

systems theory   commons

resilience

**information
ecosystems**

transitions publics

civic skills   trust

data literacy

citizen initiatives

infrastructuring

data inclusion

empowerment
through participation

technology

perception

participatory
design skills

power dynamics

transparency
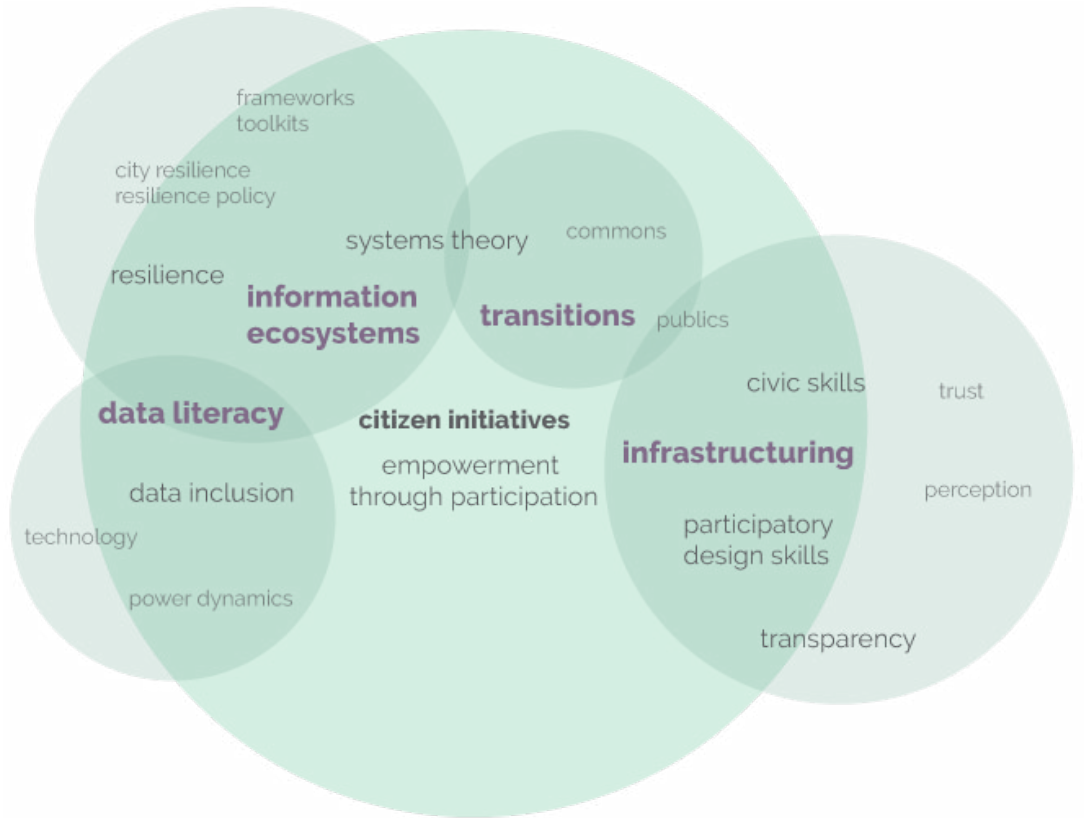
2.1 Infrastructuring

In his book Design when everybody designs Ezio Manzini (2015), expert theorist in sustainable design and social innovation, proposes design for infrastructuring as a new role for designers to "create spaces for citizen participation". Infrastructuring is included in the present chapter 2 as the link between design skills and citizen initiatives, elaborating on the call Manzini and Margolin (2017) made upon expert designers to "focus on what role design can play in building skills for citizen participation".

Challenges in the current world demand innovation processes that can adapt to the connected and dynamic context. Infrastructuring means designing to connect and take into account all the relevant stakeholders through time, and not only at a specific point, responding to the dynamism and building upon existing solutions in every step. Design for infrastructuring also means open-ended design, so that it can be built upon later.

The same as with information, infrastructure needs to be considered as fluid, to keep adapting and changing with the community it serves. Relevant to infrastructuring and Participatory design is the concept of publics as a "plurality of voices, opinions and positions". (Dantec & Di Salvo) Infrastructuring as an ongoing process to support publics needs diffusing civic, data, and design skills to have a major role in keeping organizations in contact with real community needs. The role of participatory design in diffusing skills can be a step towards the formation of new publics in a community, keeping the structures and social alignments as dynamic. This would help to keep the 'strategic looseness' needed for infrastructure to grow (Susman-Peña, Funk, Mesich 2014).

Participation and civic skills

Citizens have the agency to address local issues relevant to them and which the government is not attending. When citizens realize they can solve problems within their community together, they might acquire ownership of them. This would allow them to act on it, as they would be actively contributing to personally meaningful problems

(Fischer, 2011). More participation also means more voices heard through their actions. When participation is also inclusive, it leads to a healthy and plural community with diverse active citizens. Diversity and plurality are not only relevant for the specific groups which are being represented. For a system, in this case, a city, to be healthy and resilient, diversity is a core characteristic. In democratic systems, the presence of a plurality of publics allows a critical view of probable imbalances in governance.

Participatory tools and Participatory Design

In current democratic systems, the complexity and dynamism of the composition calls for more than only top- down solutions and decision making. The use of technology has allowed a shift in power structures, giving citizens more knowledge, agency and desire to participate in shaping the places they live on. Born in technology companies experimenting this same power shifts (Kensing & Blomberg,1998), Participatory Design encourages more people to participate in an infrastructuring process. It is not only an expert designer creating solutions for users, but people engaged in different parts of the design process to appropriate the tools and methods of design.

In a social context, this approach is important so that citizens come up with their unique specific approach towards the issues they experience and know better. This practice of diffusing design skills through Participatory Design is necessary for infrastructuring, as it will encourage an ongoing process through time. The use of participatory tools in neighbourhood activities and decisions strengthens ownership of actions and ideas and diffuses design skills through outcomes significant for active citizens, having "users as designers" (Bollier, 2016). As "participation is not enough for the formation of new publics" (Dantec &DiSalvo, 2013) diffusing design skills involves citizens so that they can develop ownership of not only the solutions but the process they go through to build in their neighbourhoods, as they had a structure with their "emotions beliefs and desires attached" (Dantec &DiSalvo, 2013). Designing participatory tools which follow the cognitive processes common to design work, can also be useful to "reduce the cognitive

load of citizens trying to create within complexity" (Vassao, 2017).

Citizen initiatives work as concentrations of active citizens from a community, and engaging in collaborative processes of "social creativity" (Bollier, 2016) encourages transdisciplinary work. They are willing to participate actively in their neighbourhood, which shows their existing civil skills. Participatory design can be the set of complementary skills to take full advantage of their civic and democratic potential through participatory tools. These skills would increase ownership of their impact in society and strengthen their bonds as publics and with collaborators. The design of this tool was conceptualized from the beginning as a participatory tool for infrastructuring because of its intention to facilitate a space for citizen participation (Manzini, 2015), finding its place in the existing structures from government and citizens and working on data literacy.

2.2 Data literacy

Relevant to connected and smart cities, is data literacy, as it is also data skills that possess an increasing relevance to engage with activities in their neighbourhood. The reach and definition of the term are explained in detail in this section, to make a clear connection with the social relevance of developing civic skills and participatory design skills.
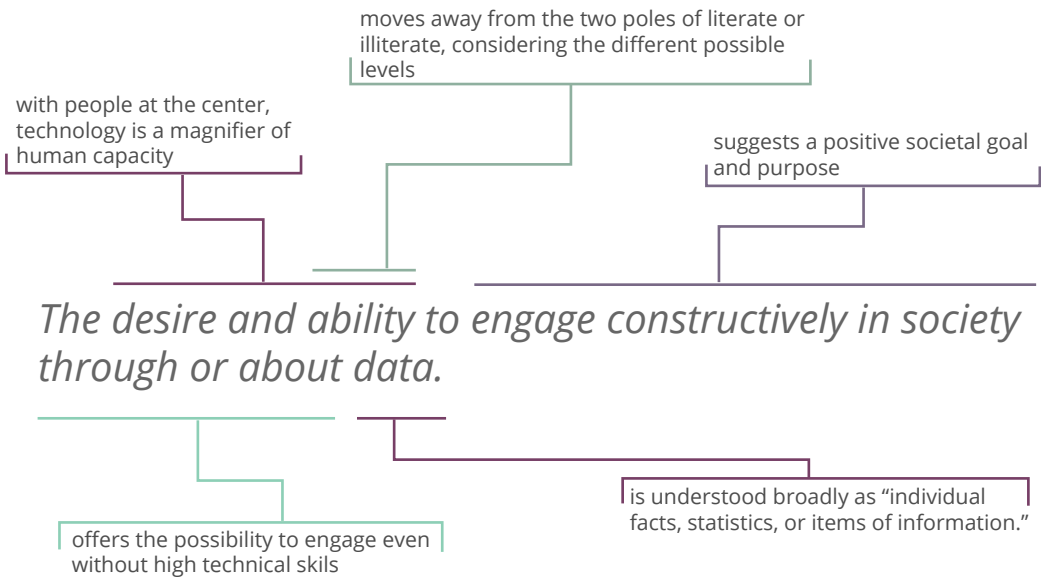
Different data literacy definitions exist, each of them focusing on specific media or use, different skills and levels of engagement. For the purpose of this research, the definition of data literacy was selected because of its broad and inclusive nature, as it crosses the boundaries of digital media and technology into a practical application of the term. This definition is focused on the social relevance of data literacy, which fits the systemic and participatory intentions of the project.

Figure 7 shows the definition of data literacy provided by the Data- Pop Alliance , which is considered as follows; *"The desire and ability to engage constructively in society through or about data".* The previous definition includes various other subcategories of data literacy like computational literacy, media literacy, and scientific literacy, which cover an interdisciplinary practice. Looking at the specifics of this definition, the authors tackle the

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Figure 7. The definition provided by the Data- Pop Alliance focuses on the human capacity and social potential of data.

(own image based on Data- Pop Alliance, 2015)

moves away from the two poles of literate or illiterate, considering the different possible levels

with people at the center, technology is a magnifier of human capacity

suggests a positive societal goal and purpose

The desire and ability to engage constructively in society through or about data.

offers the possibility to engage even without high technical skils

is understood broadly as "individual facts, statistics, or items of information."

social potential of data literacy. *The desire and ability* place people at the center, points to technology as magnifier of human capacity. Considering the different possible levels, they include *ability.* When they mention *engage constructively in society,* it suggests a positive societal goal and purpose. *Through or about* offers the possibility to engage even without high technical skills. Finally, *data* is understood broadly as "individual facts, statistics, or items of information" (Data-Pop Alliance, 2015).

They highlight technology as an entity complementing the human capacity, leaving people with the freedom and responsibility to act on it and with it. This added capacity opens possibilities to improve the current human state with technology, giving it a purpose that goes beyond only the ability to read a dataset. Under this capacity, data literacy activates and empowers people to decrease their dependency on external mediation (Susman- Peña, 2015).

Data Inclusion

The potential of data literacy as a capacity for citizens to develop has an increasing societal relevance as technology becomes more present in daily life more seamlessly. Citizens as data consumers have the opportunity to actively support their community through bottom up innovation. Data inclusion means enabling citizens to make better use of data available and empowering them to understand and solve local problems "while holding the government accountable" (Data- Pop Alliance, 2015). The importance of data inclusion for participation lays on the changing ways of communication and innovation. If society can not include every citizen in the new networks and interactions, more people will be left out of the conversation, missing on the opportunity to engage with publics. Participatory design can provide skills for citizens to understand and participate actively in the new smart city dynamics.

Data inclusion is closely related to infrastructuring as it can also encourage the formation of publics, taking infrastructuring as a "set of relations instead of only a resource" (Gray, Gerlitz & Bounegru). To achieve this, existing infrastructures need to be reimagined to keep up with the dynamic, networked society. Data literacy should consider inclusion to provide people with different skills and capacities to interact within its complex system. The close connection between an informed, empowered population to access and participation with data makes data inclusion a "significant metric for social inclusion" (Data- Pop Alliance, 2015).

2.3 Information Ecosystems

As part of the data literacy skills, understanding information and how it flows in a local community is important to act within it. The term Information Ecosystems (IE) was initially coined in environmental studies. For the purpose of this project, the definition used by Internews (Susman–Peña, 2015) applies:

"How local communities exist and evolve within particular information and communication systems."

This definition considers Information as complex adaptive systems which are evolving and changing, and not discrete, hence including many scales (ie. global, national, local). Two relevant attributes of this kind of systems are that the behaviour of the system is directly tied to its structure and that "patterns at higher levels can grow from localized interactions" (Susman-Peña, Funk, Mesich 2014). IE are then formed by sets of complex relationships, so it is crucial to understand them to understand its behaviour. This means that the complexity and diversity of the ecosystem needs attention at a hyper- local level as well as a broader perspective in a community. Important to manage these complex adaptive systems, are the elements of "trust, cooperation, and the establishment of risk sharing rules", according to Levin (1998).

There are distinguished elements from IE such as information, infrastructure, tools, media, producers, consumers, curators, and sharers, all interacting and affecting the structure and behaviour. This is how the system structure allows information to move and transform in flows. The significance of having this definition is that it again considers the complexity of society and its dynamism. From this perspective, the relevance of participation and inclusion for systems of information is clear, as information is considered an activity where "it has to move or it ceases to be of value" (Susman- Peña, 2015). It is also relevant to keep in mind that "if information does not promote empowered decision making, it will not actually foster the development of a more empowered or enlightened citizenry" (Susman–Peña, 2015).

Information ecosystems as a framework for resilience

The research work behind Why Information Matters (Susman- Peña, 2015), Internews Center for Innovation and Learning (Internews) focuses on creating a framework to measure the health of an Information Ecosystem in a community. They developed a tool to determine the state of an IE, in which a healthier IE means a more resilient community. Their hypothesis can be summarized as better information flows in a system result in quicker responses to disruptions. When researchers or authorities map the IE, they can design effective interventions to enhance it, especially for those sectors of a city which are deprived.

Internews developed an IE framework with the dynamic, complex, fluid, systems in mind, which matches the state of current society. The vision of Internews researchers is that people should be able to take responsibility in their role for resilience of their community, for which they need to be empowered by "fostering their capabilities, reducing their dependency on institutional intervention" (Susman- Peña, 2015). Internews successfully tested their framework in Pakistan, Japan, Myanmar and Indonesia, with different kinds of disruption. The analysis concluded with recommendations for authorities to further develop and improve the IE and their resilience to disturbances.

Eight critical dimensions of Information Ecosystems

An important part of Internews' framework are the eight critical dimensions of Information Ecosystems, which they then operationalized into a tool for researchers to map IE. The dimensions are "interconnected, interdependent and non-hierarchical", described in Figure 8.

>

Figure 8. Summary of the 8 Critical dimension of Information Ecosystems by Internews (own image bases on Susman- Peña, 2015) .

Dimension	Definition	General principles related to participation
Information Needs	Information needs across different segments of the population, and how they change over time.	- Inclusive and relevant information against sensationalized agendas. - Without locally relevant and actionable information, communities are left disempowered, helpless, and frustrated.
Information Landscape	The physical and institutional infrastructure that supports information production and flow.	- Ensures that information is matched with the most appropriate and resonant way to communicate it for impact. - Hyperlocal community level information landscape is the backbone of a healthy ecosystem. Influencers are key.
Production and movement	The types of information available in a community. Information providers and information flows.	- It is not only about new tools. - Impact of information as storytelling. - Strengthening information flow is also about redundancy and coordination. - There is a need to leverage existing information practices
Dynamic of access	The environment in which information flows and the factors that influence information access.	- Demographic and group patterns have to be taken into account. - The more technology reliant an ecosystem is, the less resilient it becomes. - Understanding environmental factors, - Power dynamics and context on the ground to build a nuanced picture.
Information Use	How information is processed, used and applied.	- Information needs to be trusted and validated before it can inspire action. - Factors influencing information relevance to people. - Whether and how information is used.
Impact of Information	Relationship between information, knowledge and behaviour change.	- Relevant, compelling, and accessible information has a positive impact on people's lives in terms of their agency and overall well-being. - Information needs to resonate with needs and interests to foster agency and action. - It needs to address hyperlocal social and development challenges to be relevant.
Social Trust	Influence of trust networks on the flow and use of information.	- Trust networks, and trust building in sources, medium and content. - Healthy ecosystem when individuals have the ability to validate and verify information through their established trust networks. - Influenced by a community's social dynamics and sociopolitical events.
Influencers	The people, organizations, and institutions that shape information flows.	- They act like bridges connecting social groups that have weak ties. - People, organizations and institutions, builders of trust Change influence over time. - The democratization of information and communication technologies leads to unpredictable control over production and flows of information .

2.4 Transitions

The present graduation project is executed during a phase of socio- economic uncertainty worldwide, as part of a quick changing, unstable society. The result of this project is meant to encourage bottom- up participation in Delfshaven as part of a state of change to a more democratic, stable, and sustainable city. The term transitions and its connection to the previously presented topics in chapter 2 are also explained below.

Technology allows immediate access to information while generating a large amount of data. This is accelerating the pace for exchange of ideas for people who have access, but also widening the gap with people who are not connected to their Information Ecosystem due to different factors. Advances in technology together with political and social instability create a global state of uncertainty. On top of this, evidence of a need for ecological sustainability is present in daily life, such as the elevated temperatures in the poles and all over the world. Efforts from institutions, industry, and citizens are pushing forward a discussion about bigger global measurements for a sustainable future. This period of instability can be addressed as a transition period, from the current social, political and economic establishment, to a world where the "limited resources of the planet are recognized, transforming them into opportunities for a better life for all" (Manzini, 2015). Technology and information might be useful tools, and together with design skills, everyone could contribute to sustainable solutions. A systemic approach to transitions is important, but always recognizing the specificity and diversity of realities.

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Figure 9. Summary of the graduation project's objective integrating the topics presented in chapter 2.

2.5 Conclusions

In the ongoing transition period, citizens have the opportunity and responsibility to act on shaping their communities, and could use tools to have relevant social impact. This is where designers can help and engage in infrastructuring. In big connected cities like Rotterdam, it is especially important for citizens to acquire data literacy skills for data inclusion. With frameworks such as the Information Ecosystems, active citizens like the participants of initiatives in Delfshaven, could gain an understanding of the systemic level of complexity while taking into account the details of their own personal experiences. Through infrastructuring, designers can create spaces to foster inclusive and relevant participation.
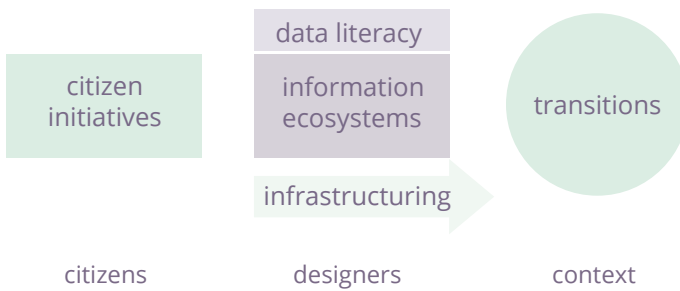
Figure 9 summarizes the objective of the present graduation project integrating the theoretical background. I will explore the connections within the presented network of themes, using design for infrastructuring to encourage citizen participation through a framework of data literacy called Information Ecosystems, useful for citizen initiatives to navigate the current transition stage. The approach for this exploration will be presented in the next chapter.

3. Approach

As presented in chapter 1, the goal of the present graduation project is to foster citizen participation and data literacies through design methods. Chapter 2 presented the relevant concepts and the theory behind the assignment and objective. In chapter 3, I describe how the project will be developed, presenting a convergence of the selected methods to form a specific approach for the execution of the objective. To guide the process and start with a defined focus, the first part presents the research question. Later the researcher presents how the process follows a research through design approach, a double diamond design frame, as well as an iterative design process.

3.1 Research question

The focus of the present project is to answer the following research question.

How might a participatory tool enable citizen initiatives to map their Information Ecosystem and their role in it?

This question helps narrowing down the original objective, specifying the terms. Citizen participation is established as citizen initiatives, which is a good target to try a new approach on participation, as they are already organized and motivated. A specific approach for data literacies is also selected, choosing to work with Information Ecosystems as a starting framework. The fit to the project was explained previously in chapter 2, where the relevance of information flows in a connected world was established. A design method is also selected to deliver the objective in the form of a participatory tool. This selection is related to design for infrastructure; a participatory tool offers a space for citizens to get acquainted with design skills, making the relevance evident for them through a relatable outcome. The next section presents the requirements used in combination with the research questions to guide the process, which will be used at the end of each cycle to evaluate the design iterations.

3.2 Design requirements

Each cycle seeks to answer its own research questions, together with a set of design requirements. I established the requirements based on Susman– Peña's (2015) field research findings and recommendations. The design requirements presented in this section will be used to evaluate the design iterations, ensuring an answer to the initial research question and as a reflection of the conceptual framework throughout the iterative design process.

Requirement 1 Effective

Based on answering the research question How might a participatory tool enable citizen initiatives to map their Information Ecosystem and their role in it? (chapter 3.1), the design needs to guide citizens into a conversation covering the five key factors of participation I establish next in the present section. I developed these factors based on the intersection I found between Internews' approach to resilience through Information Ecosystems, and literature on participation consulted during the research stage to establish the conceptual framework. The factors are explained first with my definition, then referring to relevant literature, and finally illustrated by a quote from Internews' insights.

Trust relations.- Nodes in the ecosystem (people or institutions) who are trusted as information producers or sharers by others and their social networks. It is through this trust networks that people share and information they deem relevant to the group. For participation, this relations can evolve into collaborations and formation of publics, when the group ensures that "issues are dealt with" (Dantec & DiSalvo, 2013).

"People need to hear the information from the government and the media, and then verify it through friends and families."
(Susman- Peña, 2015)

Power dynamics.- The impact of power distance and connections in how information flows in the local IE. Power dynamics are also a crucial element playing in participation, as decision making is commonly left to groups with more power (economic or political) than citizens. Le Dantec and Di Salvo consider Participatory Design as a "means for engaging with power structures and marginalization" (Dantec &DiSalvo, 2013).

"Local influencers are key, as they are best able to discern what information is valuable and capitalize on trusting relationships to disseminate it."
(Susman- Peña, 2015)

Diversity and inclusion.- Socio-economical and political factors which influence the involvement of citizens in the information flow. Relevant in a similar level of power dynamics, Fischer (2011) mentions how "increasing social creativity requires diversity" meaning people with unique perspectives.

"What communities really wanted was information to help navigate instability, build livelihoods, and achieve aspirations."
(Susman- Peña, 2015)

Communication barriers and platforms.- How tools, infrastructure, and media influence the flow of information. This factor is related to accessibility, as it is not only important for information flows, but it also has relevant implications for participation. When talking about enabling solutions for participation, Manzini (2015) describes them as "instruments that increase people's capacities to achieve a result they value."

"At a community level it is important to tailor messages to be easily remembered and repeated."
(Susman- Peña, 2015)

Perception of relevance.- The importance people give to the information they receive, consume, and share. The same applies for participation for people to get involved. Bollier (2016) talks about it as a failure when people are not provided with "human scale alternatives" to foster innovation and citizen participation.

"Information must resonate with people's needs and interests in order to foster agency and action."
(Susman- Peña, 2015)

The presence of these five factors will ensure the immersion into citizens' Information Ecosystem, thus acquiring data literacy skills. Effectiveness will be evaluated through the presence of the key factors during the discussion. The quotes are taken from Internews' (Susman-Peña, 2015) insights on how IE matter for resilience.

Requirement 2.- Engaging

Citizens need to feel "ownership of problems" (Fisher, 2011) to start thinking about "human scale solutions" (Bollier, 2016) . For citizens to value and use the proposed tool, they need to feel engaged with it, as Internews learnt in their on site research cases, so that "agency and action can be encouraged" (Susman– Peña, 2015) Evaluated through:

Relevance to the citizens' needs and context to understand their motivation behind their behaviour (Susman– Peña, 2015).

Generated dialogue between citizens and also with other stakeholders (ie. initiatives, NGO's, municipality), as infrastructuring builds "continuous relations with different actors" (Manzini 2015).

Requirement 3.- Actionable

The design needs to fit into clear existing processes to create value for citizens. With this tool I intent to use infrastructuring to engage citizens in action. To achieve this, I need to to consider existing structures (ie. Neighbourhood houses and networkers) and treat them as "ongoing infrastructure" (Bollier, 2016). This means shifting to be open for change and feedback to improve. Evaluated through:

Visible captured process of dialogue and conclusions to revisit and keep adding to it when necessary. Internews found that information needs to resonate with the community's needs and interests so that they would act on it .

Concrete outcome coming out of the design for citizens to be encouraged to participate further. According to Manzini (2015) "citizens are more willing to participate actively when they see tangible and visible solutions from initiatives".

In the following section, I will describe the process followed to answer the research question.

3.3 Integrated research and design approach

The present section presents and explains the different methods and the decisions behind integrating the specific approach for the present project, selected to cover the assignment and give an answer to the research question. Figure 10 shows the structure of the process following the chapters of this report, and the methods used throughout, *Research through Design, Incremental Iterative Process and Double Diamond Design process.*

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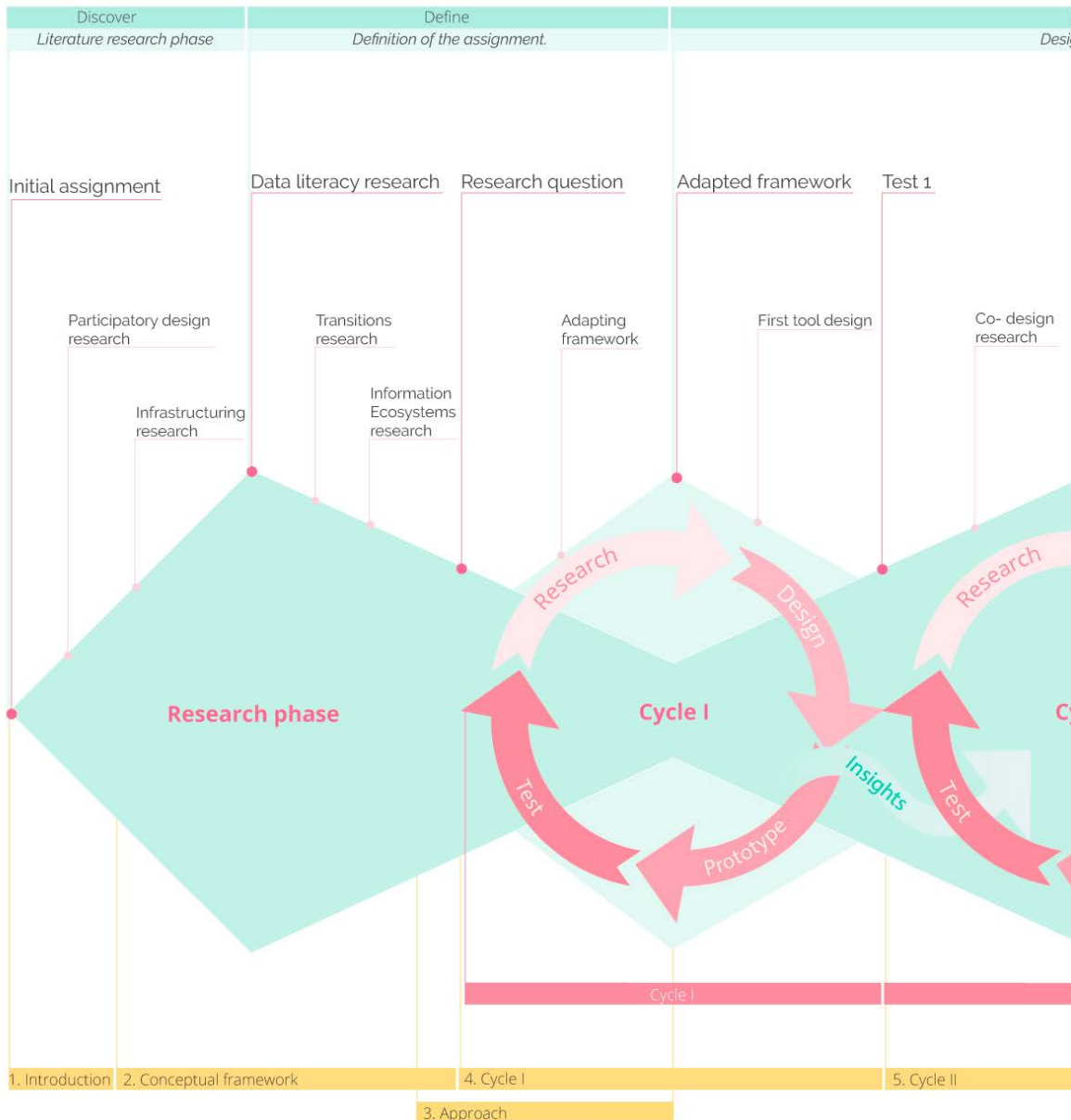
Figure 10. Integrated design and research approach followed in this project. The Double Diamond process is shown in green. The Incremental Iterative design process is shown in pink, including project milestones and main developments at the top. The structure of this report is shown in the yellow bar at the bottom.

| Design | | Deliver | | Double Diamond |
| gn iterations | | *Prototyping and validation* | | Design process |

Adjusting framework | Test 2 | Adjusting tool | Test 3 | Final Participatory Tool

Integrating a meta story | Expert interviews | Final tool and session design

Researach

Design · Design

ycle II | Cycle III

Insights

Test

Prototype · Prototype

| Cycle II | Cycle III | Incremental iterative design process |

| 6. Cycle III | 7. Discussion | Report chapters |

In this project the outcome of the design process builds knowledge, making it a *Research through Design* approach, where cycles (design iterations) have a research purpose. My role as an interaction designer in the project is to take an existing theoretical framework, Information Ecosystems, fed by field data, through the in field experience of the Internews Center for Innovation and Learning, add my technical skills on design for infrastructuring, and translating it into a practical participatory tool. The process follows Zimmerman, Forlizzi & Evenson's (2007) model of interaction design research. The approach is suitable for the present graduation project because the main part of the development is taking existing knowledge on Information Ecosystems and translating it through design into a concrete tool for citizens, which includes transforming knowledge.

Along the process, each cycle will bring more detailed valuable information to answer the research question. At the same time, insights gained in the cycles are integrated into the next one, making the process an *Incremental Iterative Design process.* The three cycles go through four stages; Research, Design, Prototype and Test. Establishing three incremental iterative cycles from the beginning of the project was decided to bring a better focus to each iteration from the start. The first iteration integrates the basic requirements, and through the second and third iteration I add and implement features based on insights to reach a final design at the end of the third iteration (Alshamrani & Bahattab, 2015).

To organize the structure, I follow the *Double Diamond Design process* from the UK Design Council, Discover, Define, Design, and Deliver. The first diamond in this case considers diverging to explore the initial assignment of using design methods to foster citizen participation while developing data literacies (chapter 1.2), into the literature research done, presented in chapter 2, reaching a converging point with the research question on citizens mapping their local IE supported by a participatory tool (chapter 3.2). The second diamond is integrated by the three cycles, refining ideas and their implementation.

In this section I presented the big picture. The next section goes into the details of the methods behind the iterative design process.

3.4 Methodology

The methods used along the process were repeated from cycle to cycle. The selection and its fit to the present graduation project will be explained in this section.

Concept Prototyping

Developing a prototype for the evaluation of the concept in each Cycle of the Incremental Iterative Design process is essential, as the goal of the design iterations is to get "positive revisions for the next increment." (Alshamrani & Bahattab 2015). Also as part of the Research through Design approach to the project, the insights from participants interacting with a physical prototype of the tool during a test session will provide learnings and insights, answering the research questions and showing the knowledge gaps and weaknesses in the development of the project.

Participatory Test Sessions

The project will explore the design of a participatory tool, to be used by citizen initiatives during a participatory session. As it has been explained in chapter 2.1, the main value of a participatory design approach is that citizens can take ownership of the process they go through during the session, and not only the outcome. It is important to test the iteration prototypes in a setting as close as possible to the real context to understand the effects of the tool on people and being able to analyse the captured data to enrich the final outcome. The Participatory Test Sessions to be carried on in the three iterative design cycles could also be considered experiential prototypes, as their purpose is to "explore what it might be like to engage with the product, space or system we are designing." (Buchenau & Suri, 2000). Participants during the test sessions should also feel engaged and take ownership of their process. The session setting is especially relevant during the Incremental Iterative Design test phase for understanding the deeper layer of "tacit and latent knowledge" of participants, as they get the tools to express what they "know, feel and dream" (Sanders &Stappers, 2012).

Data collection

The methods for data collection were selected to complement each other, to have a holistic picture of the test results.

Observation
During the test session, I will take notes on what people do, and how they use the provided tools, aided by a previously established observation sheet to keep focus on specific details providing insights.

Recording
For every test session I will record video or audio with participants' consent. The material will allow me to go back to certain points of the test that might be relevant to the learnings of the specific cycle, which were not captured in the observation sheet.

Interview and Feedback sheets
Having notes on what people know, feel and dream through the participatory test session, how they use the prototype through recording and observation, interviews complement the insights getting to know what participants explicitly express. Through interviews and feedback sheets, I can listen to what participants say about the tool and the session, also being able to contrast and complement participants' expressed opinions with my observations.

3.5 Theoretical framework

This section presents the theoretical framework developed to guide the iterative design process. The proposition of this project is to use the existing framework from Information Ecosystems to empower citizens to be more active participants in their neighbourhoods through infrastructuring. An important insight from the Internews research was that "what communities really wanted was information to help navigate instability, build livelihoods and achieve aspirations" (Susman– Peña, 2015). Using the Eight Critical Dimensions of Information Ecosystems as a starting point for infrastructuring could be used to promote citizen dialogue with diverse publics. According

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Figure 11. The five key factors of participation are based on literature on participation and Internews' findings applying the IE framework in Pakistan, Myanmar, Japan and Indonesia
(Susman– Peña, 2015).

to Manzini (2015) diversity is directly related to a system's resilience, making it indispensable for a plurality of citizens to participate in the neighbourhood to increase the strength and resistance of the system. This is why the systemic approach of the framework, adaptable and integrating the complexity of the context in cities today was selected to develop this project.

I analyzed the eight critical dimensions of Information Ecosystems for its relevance to citizen participation. (Appendix A). The analysis was done through the five key factors of participation (Trust Relations, Power dynamics, Diversity and Inclusion, Communication and Perception of Relevance) explained in chapter 3.2 and again in Figure 11. As explained in detail in chapter 3.2, these key factors of participation are based on literature related to participation and Internews' (Susman– Peña, 2015) field research applying the IE framework in Pakistan, Myanmar, Japan and Indonesia .

F1) Trust Relations
Nodes in the ecosystem (people or institutions) who are trusted as information producers or sharers by others and their social networks.

F2) Power dynamics
The impact of power distance and connections in how information flows in the local IE.

F3) Diversity and inclusion
Socio-economical and political factors which influence the involvement of citizens in the information flow.

F4) Communication
How tools, infrastructure, and media influence the flow of information.

F5) Perception of relevance
The importance people give to the information they receive, consume, and share.

The four selected dimensions have the highest concentration of content related to the five key factors of participation (highlighted in Figure 12) out of the eight critical dimensions of Information Ecosystems, so they were selected to establish an *Information Ecosystems for Citizen Participation Framework.*

>
Figure 12. Four dimensions selected to establish a framework of Information Ecosystems for citizen participation, highlighting its relevance to the five key factors of participation.

Dimension	Definition	General principles related to participation
Dynamic of access	The environment in which information flows and the factors that influence information access.	**Demographic and group patterns** have to be taken into account. The more **technology reliant** an ecosystem is, the less resilient it becomes. Understanding **environmental factors**, **Power dynamics** and context on the ground to build a nuanced picture.
Information Use	How information is processed, used and applied.	Information needs to be **trusted and validated** before it can **inspire action.** Factors influencing **information relevance** to people. **Whether and how** information is used.
Impact of Information	Relationship between information, knowledge and behaviour change.	Relevant, compelling, and accessible information has a **positive impact on people's lives in terms of their agency** and overall well-being. Information needs to resonate with needs and interests to **foster agency and action.** It needs to address **hyperlocal social and development challenges** to be relevant.
Social Trust	Influence of trust networks on the flow and use of information.	**Trust networks**, and trust building in sources, medium and content. Healthy ecosystem when individuals have the ability to validate and verify information through their **established trust networks.** Influenced by a **community's social dynamics** and sociopolitical events.

Once the four most relevant dimensions were selected through the analysis presented in the previous paragraphs, questions from the original tool *Mapping Information Ecosystems to Support Resilience* from Internews (Appendix B) were adapted for a non-expert public to use in a participatory tool. The comparison of the original questions and the adapted questions can be seen next in Figure 13.

Dynamic of Access *original framework*	How do political, socioeconomic and geographic factors affect access? How and what power relationships shape community access to information? Through what channels do people access information (eg. radio, mobile, TV)? What are the intracommunity dynamics that impact access and use of information? What are the key factors and details impacting access at the hyperlocal level?
* *adapted framework*	Channels we use to access information: Factors that affect our access to information [Social/ Political/ Economic/ Geographic]: The key factors for us to access RELEVANT information: Important relationships for our access to information: Why? The process within our community to access information: Other communities might have a different experience, such as: ** Questions used for Dynamic of acces in Cycle I are different and will be specified in chapter 4.1*
Information Use *original framework*	What do people do before using information? What factors influence the relevance of information to people? How does the format of information affect its use? Is information perceived to be relevant? What do people do with information? How is information processed, disseminated and applied?
adapted framework	Information is relevant for us because: Before we use information we: The most relevant information for us: Why? What we do with this information: Why? How we share information: How we process information: Formats we use: What we do with these formats: How we apply information:

Impact of Information *original framework*	Could information have unintended impacts? How can you identify and monitor them? How do political socioeconomic and geographic factors affect impact? What are previous communication failures could undermine future efforts? What are the short and long term impacts on how people use information? How does information inform community members decision making? How does information inform government, NGOs and other responder agencies decision making?
adapted framework	Unexpected impacts information could have: Factors that impact the information we use [political/ social/ economic/ geographic]: Communication failures that affect us [before/ currently]: The impact of information on our actions [short term/ long term]: We use information to decide on: Other organism use information to decide on:
Social Trust *original framework*	How do you protect the most trusted networks from disruption? What are the greatest threats to trust? What are the most trusted information sources? How does this change during disruption? What are the factors that affect change in trust over time? What are the dynamics of trust within communities? How does trust nurture participation? How does the lack of trust impede participation? What are the challenges around trusting disruption related information?
adapted framework	Sources we trust: Sources we have worked with in the past: Sources we trust will help us: Why?: Threats to our trust: Sources which lost our trust: How?: Sources which could damage us: How?:

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Figure 13. Questions from the original framework compared to the questions for the adapted tool.

With the adapted questions ready, I conducted the same factor analysis again to make sure the dimensions selected covered the five key factors of participation (Trust relations, Power dynamics, Diversity and inclusion, Communication barriers and platforms, and perception of relevance). Figure 14 Shows the concentration of every key factor for each dimension, making evident the high relevance of these four dimensions for participation.

>
Figure 14. Questions from the original framework compared to the questions for the adapted tool.

Dimension	Questions to map dimension	Key factors of participation
Access	Channels we use to access information: Factors that affect our access to information [Social/ Political/ Economic/ Geographic]: The key factors for us to access RELEVANT information: Important relationships for our access to information: why? The process within our community to access information: Other communities might have a different experience:	Trust relations ■; Power dynamics ■; Diversity and Inclusion ■■; Communication barriers & platforms ■■■; Perception of relevance ■
Use	Information is relevant for us because: Before we use information we: The most relevant information for us: Why? What we do with this information: Why? How we share information: How we process information: Formats we use: What we do with these formats: How we apply information:	Trust relations ■; Power dynamics ■■■; Communication barriers & platforms ■■■■■; Perception of relevance ■■
Impact	Unexpected impacts information could have: Factors that impact the information we use [political/ social/ economic/geographic]: Communication failures that affect us [before/ currently]: The impact of information on our actions [short/ long term]: We use information to decide on: Other organism use information to decide on:	Trust relations ■; Power dynamics ■; Diversity and Inclusion ■■; Communication barriers & platforms ■; Perception of relevance ■■■
Trust	Sources we trust: Sources we have worked with in the past: Sources we trust will help us: Why?: Threats to our trust: Sources which lost our trust: How?: Sources which could damage us: How?:	Trust relations ■■■■■■; Power dynamics ■■■■; Diversity and Inclusion ■; Communication barriers & platforms ■■■■; Perception of relevance ■■■■

Chart key

■ *Trust relations*

■ *Power dynamics*

■ *Diversity and Inclusion*

■ *Communication barriers & platforms*

■ *Perception of relevance*

4. Cycle I

After looking at the approach and methods followed during the project, the next three chapters 4, 5 and 6 cover the details of the process followed in the Incremental Iterative Design Process. The chapters are divided into research, methodology, discussion, and refelction. Chapter 4 presents the design process for the first iteration of the tool.

4.1 Research

Research question

A research question will be determined at the beginning of each chapter to clarify the ambitions of the cycle and have a better view of the progression of the design process. Each question includes specifications, which will be used besides the requirements (Effective, engaging, and actionable) presented in chapter 3.2, to evaluate the design later in the cycle.

Research Question Cycle I .– Is the operationalization of the Information Ecosystems for citizen participation framework adequate for a non–expert participatory tool?

–Does the tool prompt deep and detailed dialogue on the local information ecosystem?

–Is the structure of the tool suitable for a participatory session?

–Is the language used accessible?

>
Figure 15. Questions from the original framework (Susman– Peña, 2015) of the Access dimension contrasted with the questions used to develop Cycle 1.

Approach specifications

To allow the test session to be short while giving answers to the cycle goals, I selected the first dimension from the Information Ecosystems for citizen participation framework, Access to develop and test the first iteration. This would also allow me to focus on the details of the tool, such as participants' interaction and roles, and the depth of the dialogue. The questions used are not the ones used for the final framework (Chapter 3.5, Figure 14), but a first version to test. I present the questions used for the development of this first cycle in Figure 15, contrasted to the ones in the original framework (Chapter 3.5, Figure 13).

Access *original framework*	How do political, socioeconomic and geographic factors affect access? How and what power relationships shape community access to information? Through what channels do people access information (eg. radio, mobile, TV)? What are the intracommunity dynamics that impact access and use of information? What are the key factors and details impacting access at the hyperlocal level?
Cycle I tool	Through what tools/ media/ infrastructure do you access information? Through what producer/ sharers/ consumers do you access information? How do producers/ sharers/ consumers affect access to information? How do tools/ media/ infrastructure affect access to information? What are the tools/ media/ infrastructure that impact access and use of information? What are the producers/ sharers/ consumers that impact access and use of information? What are the key factors and details impacting access? How uniform are these experiences within communities?

4.2 Methodology

As presented in chapter 3.4, the methods used in this cycle are mentioned bellow. Each of them is detailed in the next pages through the presentation of Tool concept 1.

Concept Prototyping	▷	Sensitizing booklets	▷	Participatory Test Session	▷ Observation ▷ Recording ▷ Feedback interviews

Tool Concept 1

Pages in purple will present the designed concept through the methods used during Cycle I (prototype and test session), detailing them through the activities. The full outline of the session can be found in Appendix C. Pictures of the prototype and filled in material can be found in Appendix D.

Session: 45 minutes + 15minutes feedback interview
*No. of participants:*4
Participant profile: Designers focused on Participatory Design

Participants

The session revolves around finding solutions to issues inside a community initiative. All the participants are members of the IDE master community, so this was the context for the session. Participants are well acquainted with the context, as members of a citizen initiative would be. The test session was carried out at the IDE faculty of the TU Delft for participants to be comfortable and in their own environment. More details of their profiles can be found in Figure 16.

>
Figure 16. Four designers with knowledge of Participatory Design were invited as participants to concept 1 test session to get expert feedback.

	Gerneral Profile	*Expertise*
Participant 1	Active member of student association of DFI	Design for Interaction with a strong interest in social innovation. Has developed projects using Participatory Design tools.
Participant 2	Working on Participatory Design graduation Project	Strategic Product Design with a strong interest in social innovation. Has developed projects using Participatory Design tools.
Participant 3	Honours student	Design for Interaction with a strong interest in social innovation. Has developed projects using Participatory Design tools.
Participant 4	Working on Strategic Corporate Development Graduation Project	Strategic Product Design with a strong interest in social innovation. Has developed projects using Participatory Design tools.

Activity 1.- Identifying the problem

Prototype: The main canvas for the session is an A1 white paper divided in four. The upper left side is the area marked and designated for Activity 1. The section of the canvas only shows a drawn square to stick their final outcome of the discussion. Sticky notes and markers were provided for participants to write. Using sticky notes makes it easy for participants to move their answers around, group them, or align them. Each participant had a different color to identify the individual answers in the later analysis.

Session: During this activity, participants wrote their concerns and together decided in which one to focus the rest of the session. This participatory tool is based on finding a solution to a specific problem as an outcome for the session. Based on the initial design requirement of engagement (chapter 3.2), the main concern was how to make the tool relevant for citizen initiatives.The problem– solution frame seemed fit to test out first, as the solution could be seen as a concrete valuable outcome of a participatory session using the tool.

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Figure 17. Participants during Activity 1 of the test session

Activity 2.- Mapping Access

Prototype: The upper right side of the main A1 canvas is used for answers of this Activity 2. Three purple answer boxes and three blue answer boxes are drawn, indicating the space to answer the provided questions on A7 printed colored cards. The six cards show components of the first draft of the Information Ecosystems for participation framework. (chapter 3.5, Figure 14). The questions in the cards are:

Through what tools/ media/ infrastructure do you access information?
Through what producer/ sharers/ consumers do you access information?
How do producers/ sharers/ consumers affect access to information?
How do tools/ media/ infrastructure affect access to information?
What are the tools/ media/ infrastructure that impact access and use of information?
What are the producers/ sharers/ consumers that impact access and use of information?

and answered six questions about their Information Ecosystem (IE). The language used in the tool was adapted to plain language, but still some concepts are used and introduced during the session, aiming for adoption of the terms when referring to them during and ideally also after the session. These concepts are introduced in Activity 2 and Activity 3. For Activity 2, Mapping access, participants found the questions confusing due to language, as terminology was repeated and the difference from one to the other was not specified or clear enough.

Activity 3.- Group reflection

Prototype: This Activity 3 uses the lower left side of the A1 canvas to provide space for answers. Three drawn squares show space to answer each question. A set of three A7 white printed cards have the following questions of the Information Ecosystems for participation framework. (chapter 3.5, Figure 14) to answer and discuss:

What are the key factors and details impacting access?
How uniform are these experiences within communities?
An opportunity for the future on access to information would be:

Session: Three questions are provided to trigger discussion and reflection. Participants highlighted Activity 3 as the most interesting one. The questions were effective as conversation starters and allowed a dynamic and engaged discussion. Although participants enjoyed the activity, they left no track of their discussion in the tool, making it hard for them to go back to it at a later point if they wanted to.

Activity 4.- Individual Reflection

Prototype: An A5 printed white card is given to each participant to answer individually from 1 to 5, 1 being the lowest and 5 the highest.

I am an active part of the information flow
I have control over the information I consume
The current conditions nurture access to information
The current conditions impede access to information
The current conditions encourage top-down decision making
The current conditions encourage bottom-up decision making
A clear opportunity for access to information in the future would be:

Session: As a strategy for engagement during the session, the tool includes variety in activities going from group discussion and reflection, to individual reflection, keeping participants focused and interested. Through a set of questions written on individual cards, this individual introspection exercise is meant to give participants of the session a time to reflect on their own and come up with their own ideas on the topic. For the individual reflection of Activity 4, participants appreciated the introspection, but they felt it broke the flow of the session, especially after having a motivated discussion in the previous activity.

Activity 5.- Opportunities discussion

Prototype: The lower right section of the canvas is provided to answer this Activity 5. The canvas shows a drawn section with the statement The future of our participation. An A5 printed white card is provided with the following questions to consider for reflection before writing their final statement:

How do you feel about your role in the information flow in the IDE master community?
How do these insights help you solve the problem? Write it down.
What actions would you take individually to solve the problem?
What actions would you take as a group to solve the problem?
Write down the future of your participation.

Session: A set of questions is given to prompt discussion on possible solutions to problems mentioned in previous activities.The discussion on Activity 5 about opportunities was fed by some of the questions from the individual form, especially concerning the perception of relevance of the information they consume, the control they have over this information and their role in the information flow. This contributed to Activity 5 being the richest and deepest discussion, which helped in bringing conclusions to the session. The conclusions though were not focused on giving a solution to the problem they identified at the beginning, so the final statement *"Write down the future of your participation"* did not come up as organically as intended when designing the tool.

Sensitizing booklets

To prompt participants before the session, a sensitizing booklet was created with questions and activities revolving around their perception of information and the problems they identified in their surroundings. Immersion into the session should be quicker when prompted on the topic. The sensitizing booklets were given out to participants to fill one week before the session.

Data Collection

To collect data from the participatory session, other than the prototype (Figure 18) I used an observation sheet and recording during the session, and a feedback interview after the session. This tools will be described next.

Observation

An observation sheet was used to take notes during the session. This sheet helped me focus on the fit to requirements and research questions. The results were later analyzed through quotes to identify mainly what key factors of participation were present during the session's discussion.
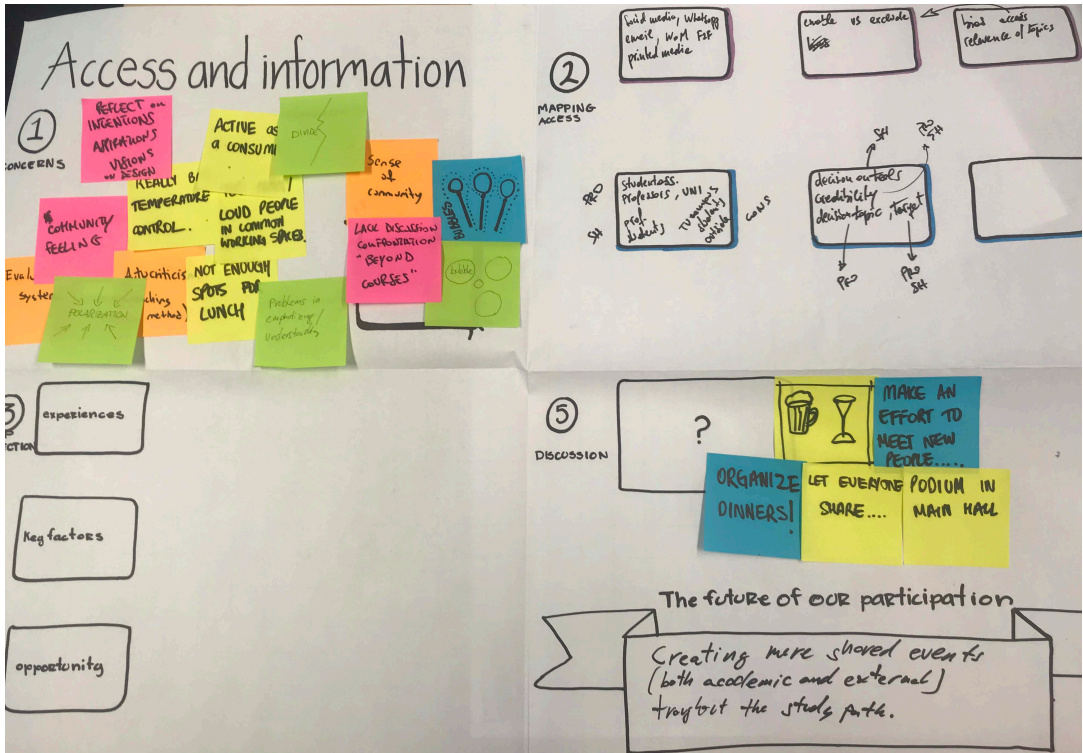
Recording

The session was video recorded with participants consent (signed forms in Appendix E).

Feedback interview

After the session, an interview was conducted with the four participants to gain their expert feedback and their inputs as participants following the session.

>
Figure 18. Filled in A1 canvas from the participatory test session.

Results

The next pages present the findings captured through the prototyped tool, sensitizing booklets and participatory test session. Detailed pictures of the materials answered by participants can be found in Appendix D. It is relevant at this point to remember the session and the conversation of the participants revolves around the information flow in the IDE master community at the Industrial Design Engineering faculty at TU Delft. In the next two pages Figure 19 shows the degree to which each activity achieves the requirements. Purple blocks is not achieved, blue blocks mean somehow achieved, and green blocks mean achieved. The cells contains a quote from participants to exemplify the content of the dialogue in each activity.

> *Figure 19. Data collected through observation, material, and recording from the test session.*

Activity	Requirement 1 (Effective)		
	Trust Relations	Power Dynamics	Diversity and Inclusion
Activity 1 Identifying the problem	*"Sometimes there is a big divide between opinions... there are a lot of problems empathizing" P1*		
Activity 2 Mapping Access	*"The student associations, are community leaders" P1*	*"Professors are producing the information" P1*	*"They enable and limit the access" P3*
Activity 3 Group Reflection	*"I feel like we are very few people doing that (sharing information)" P1*	*"The sharers decide where to share and if someone is not there, they're cut out" P1 "If you want to try to include more people there are limitations" P1*	*"Depends on what community you are part of right? What masters" P4 "If you feel like you want to do something different, there are more limitations than advantages to do it" P1*
Activity 4 Individual Reflection			
Activity 5 Opportunities Discussion	*"I know from other faculties they don't meet the dutch students and do twenty projects with the same people" P2*	*"Whose responsibility it is to create a community?" P2*	*"That's a chance to meet different people that have something different to contribute to your life." P2*

Communication	Perception of relevance	Requirement 2 Engaging	Requirement 3 Actionable
"There are smalls groups and a lack of discussion" P3		*(Silent and writing during 2 minutes)*	*Clustered some ideas "I like the sense of community and it goes together with communication" P2*
"The feedback from professors to students" P4	*"The outcome is not well communicated" P1*	*Clustered some ideas "I like the sense of community and it goes together with communication" P2*	
Sometimes if you are on social media you feel like you are on the know of whats happening" P2 "I really don't care for the newsletter but just because it is really far from my interests" P3	*"Just the information itself does not create the community... its the content" P4 "I try to make the information reliable as much as possible but I don't feel the guilt for not improving it (the sharing system)" P1*	*"The best experience I had was when I had the chance to talk to them" P3*	*"Of course you need a starting point" P3 "I think we need more of that, something that is more appropriating the space of the university" P3 "Organize dinners" P4*
"Many times we don't talk to each other... because we just dont havve time" P3	*"There are so many interesting things that I would like to take part of but I have to look for them."P2*	*"When you talk about information, that to me could be anything" P3*	*Ideas were not grounded, but more a general brainstorming. "Creating more plenary moments together" P1 " As a community we can do a lot to keep buildng the community" P1*

4.3 Discussion

Results from the participatory session were analyzed through on the wall process (Appendix F). In this section, I present the results and learnings. Once the data relevant to the research questions were identified, the results were clustered to get insights and learnings from the session.

For the overall session, participants mentioned their main learning point was on the opinions and points of view of others, which they had not considered before. This was clear during the session discussions when participants complemented each others' ideas, even adding information to the same post it or clustering similar observations. It also shows depth on the conversation, as there was space for learning from each other.
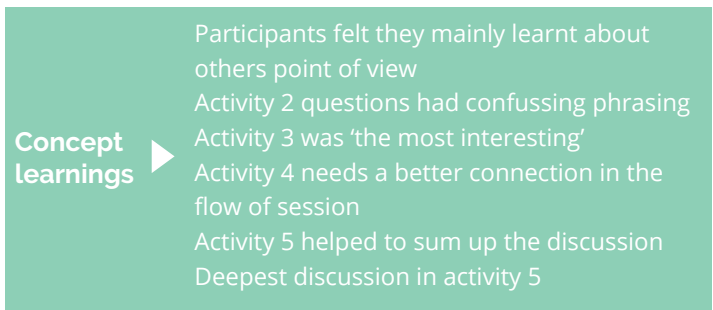
Fit to Requirements

Evidence of the five key factors was found during the session, being Communication the most talked about and trust relations the less discussed, as it was only present during Activity 2 and 3. Overall, requirement 1 was covered as the tool was found to be **effective.** Participant 4 rounds up the content of the discussion when he mentions: *"I try to make the information reliable as much as possible but I don't feel the guilt for not improving it (the sharing system)".* For requirement 2, **engagement**, the discussion between participants was satisfying although a strong conclusion was not reached, making it more difficult to communicate with other stakeholders outside the participants of the session. Also involving engagement, participants could not clearly understand the relevance of the session to their needs as part of a community, as participant 3 states: *"When you talk about information, that to me could be anything".* The tool from concept 1 then only achieves low engagement. Requirement 3, **actionable**, needs the process to be adequately captured to go back to the tool and add information when necessary. Together with a weak conclusion which Participant 1 point out: *"As a community we can do a lot to keep building the IDE community" , the concept does not achieve an actionable result.*

Answer to Cycle I Research Questions

The test session was successful in providing answers to the research questions posed at the beginning of the cycle (chapter 4.1), although not all the answers were positive. The tool was really successful in generating useful insights for the next iteration. The framework proved to be useful to design a participatory tool, even when specific activities need to be more **effective.** This is shown with the content of the framework translated into questions were excellent prompts to generate dialogue around the participant's IE. A good example is the following quote from Participant 4: *"Just the information itself does not create the community... it's the content".* The second question was also answered, as it was given as specific feedback during the interview that the connection between Information Ecosystems and participation was not clear for the participants of the session. The outcome of the next iteration needs to be better at communicating the close relationship between Information Ecosystems and participation for the tool to be useful for citizens.

The depth and detail of the conversation during the whole session was enough to provide good insights for participants on their IE. The structure of the tool was not entirely successful because of the interruption for introspection and the lack of prompts to keep a better track of the discussion. Although some of the questions were confusing, it was more about the repetition of terms than the use of language. Figure 20 shows a summary of the learnings from the test.

Concept learnings ▶
Participants felt they mainly learnt about others point of view
Activity 2 questions had confussing phrasing
Activity 3 was 'the most interesting'
Activity 4 needs a better connection in the flow of session
Activity 5 helped to sum up the discussion
Deepest discussion in activity 5

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Figure 20. Summary of main learnings from test session.

Recommendations for prototype and test

Based on learnings from the session, I present in this section recommendations on the session organization and the session flow. For the organization of the test session more details need to be included. Instructions, roles during the sessions, numbering the questions and specifying an answer space are all relevant to include for the next iteration in Cycle II. For the flow of the session, a detailed guideline for the facilitator is needed to avoid mistakes like not presenting the complete agenda at the beginning of the session.

Observations on the prototype and test setup were summarized in Figure 21. These learnings will be taken into account for the execution of the next cycles' prototypes and test sessions.

>

Figure 21. Test session learnings summarized.

Session organization ▶ Think about a 'whole day' structure
Better care for diversity in the session
More detailed instructions needed

{ number questions
pre determined spaces to answer
writing role
time keeping
'bring the tools when needed' 'when to use what'

Session Flow ▶ Facilitators guide
Present session agenda
Sensatizing booklet helped and they liked it
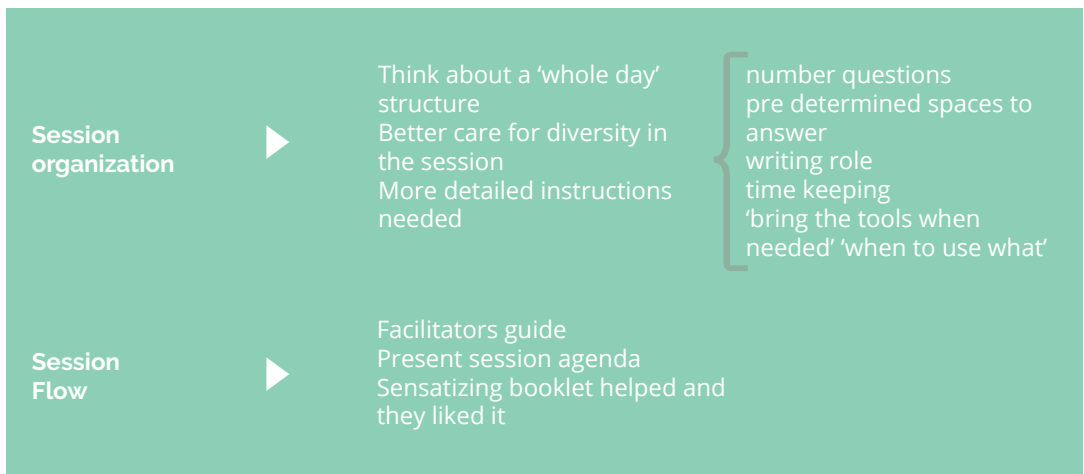
4.4 Reflection
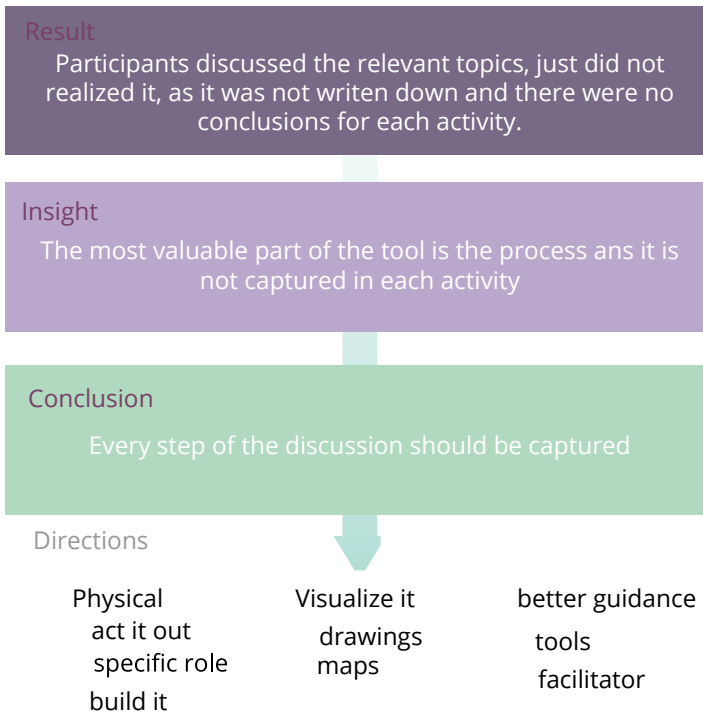
Besides the previous learnings from each activity, the observations and notes from the test resulted in two main insights, useful as main takeaways for the next cycle.

For the most successful part of the test session, the detail and depth of the discussion is enough to cover the five key factors of IE for participation(Trust Relations, Power dynamics, Diversity and Inclusion, Communication, and Perception of relevance). The potential of a tool using the framework was evident and the variety of activities in the provided time kept participants focused and interested.

There are clear improvements to be done for the next iteration. Language used in the tool is understandable, but some of the phrasing of questions was not clear enough. This also impacted in some instructions not being detailed enough, which also has to be taken into account. An important addition to instructions could be having an official writer to keep better track of the insights from the conversation.

∨

Figure 22. Summary of insight1.

Result
Participants discussed the relevant topics, just did not realized it, as it was not writen down and there were no conclusions for each activity.

Insight
The most valuable part of the tool is the process ans it is not captured in each activity

Conclusion
Every step of the discussion should be captured

Directions

Physical
act it out
specific role
build it

Visualize it
drawings
maps

better guidance
tools
facilitator

Insight 1.– The most valuable part of the tool is the process and it is not captured in each activity. Participants go through a process of reflection, introspection and discussion, and dialogue is the most important, but the tool failed in capturing all of the relevant reflections held during the conversation. (Figure 22).

The main weakness of the concept is that it is not accionable, which is directly related to both of the main insights from the session. The lack of better tracking of the conversation impacts in having a concrete outcome at the end of the session. The depth of the discussion does not show in the solutions presented at the end of the session, which were abstract and impersonal, generating a general and detached outcome that would not encourage further action from participants. The main action to be taken for the next iteration then is to make sure that the details from discussion during the session is properly captured in the tool. This will generate a more actionable outcome from the session, which citizens can engage with and take further into action. The analysis and evaluation of concept 1 show clear opportunities and directions to iterate the tool.

Along Cycle I, the *design space for the project was identified to be in the tension of getting the conversation into a tangible comprehensible outcome from the abstract to a concrete actionable conversation.* Next chapter presents the second design iteration, where these insights and conclusions will be the starting point, feeding the design decisions.
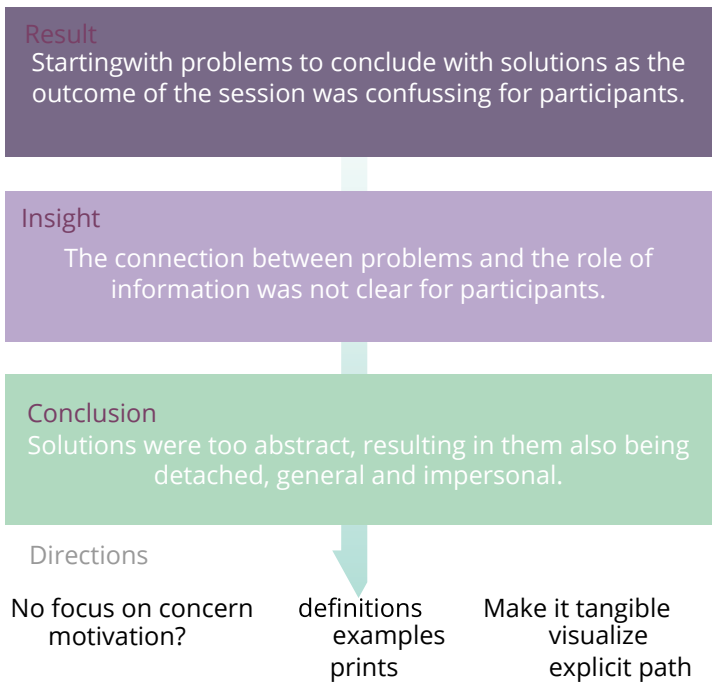
∨

Figure 23. Summary of insight2.

Insight 2.–Connection between problems and the role of information was not clear for participants. Although the topic of discussion was a problem related to information, and the tool guided participants into exploring their Information Ecosystem, the relation between both concepts was not clear during the session. The approach was not successful in translating the concept into useful and practical tools for participants, as this process has to be conscious so it can be relevant and engaging. (Figure 23)

Result
Startingwith problems to conclude with solutions as the outcome of the session was confussing for participants.

Insight
The connection between problems and the role of information was not clear for participants.

Conclusion
Solutions were too abstract, resulting in them also being detached, general and impersonal.

Directions

No focus on concern motivation?

definitions
examples
prints

Make it tangible
visualize
explicit path

5. Cycle II

According to the insights and conclusions from the previous chapter, the second cycle of the project starts from the realization that the designed tool should provide a tangible and comprehensible outcome for citizens at the end, to go from an abstract discussion into a concrete actionable conversation. Cycle I demonstrated that a tool designed around Information Ecosystems helped to shape a relevant discussion and reflection for citizens on participation. This chapter shows the steps taken on a second iteration to reach an optimal tool.

5.1 Research

Research questions

The aim of this cycle II is to strengthen the opportunities found in the first concept. There are both new and pending questions from cycle I, so the following are a combination of new directions and reinforcement from the previous cycle:

Research Question Cycle II.- How might we apply successful strategies to achieve an actionable tool, capturing the process and having a concrete outcome?
-Is language in activities clear enough for citizens to engage with it?
-How could the value of the tool be more apparent to session participants?

Approach specifications

This iteration was also developed for the Access dimension of the framework only (Chapter 3.5). From the insights of the previous iteration, the language of the framework was modified and adapted. Figure 24 shows the changes from the original framework, then to the questions used in Cycle I, and the new adapted questions for Cycle II. Simplifying the terminology from questions should create an effortless flow in the session, for participants to concentrate more in the discussion and reflection and not on understanding what is asked.

>

Figure 24. Evolution of the Access dimension from the original Information Ecosystems for Resilience Framework, to the adaptation for Cycle I, and finally the iteration to Cycle II.

|	
Access *original framework*	How do political, socioeconomic and geographic factors affect access? How and what power relationships shape community access to information? Through what channels do people access information (eg. radio, mobile, TV)? What are the intracommunity dynamics that impact access and use of information? What are the key factors and details impacting access at the hyperlocal level?
Cycle I tool	Through what tools/ media/ infrastructure do you access information? Through what producer/ sharers/ consumers do you access information? How do producers/ sharers/ consumers affect access to information? How do tools/ media/ infrastructure affect access to information? What are the tools/ media/ infrastructure that impact access and use of information? What are the producers/ sharers/ consumers that impact access and use of information? What are the key factors and details impacting access? How uniform are these experiences within communities?
Cycle II tool	Channels we use to access information: Factors that affect our access to information [Social/ Political/ Economic/ Geographic]: The key factors for us to access RELEVANT information: Important relationships for our access to information: Why? The process within our community to access information: Other communities might have a different experience, such as:

Research on co-design

With the tool designed during the first iteration, it was difficult to get from a theoretical stance on information to a solution for a community problem. Through research on co-creation tools, different strategies were identified to reach the desired result during the session. The research was focused on making the discussion tangible and having a specific outcome for the session which could empower citizens, serving as the first step towards action.

The concepts of mapping and scenario creation were considered appropriate to integrate into the tool as generative techniques. Visualizing through a diagram and creating future scenarios would help people communicate complex ideas, integrating a vision and motivation behind it. It was then identified that the tool would serve as a "conversation prompt to analyse the current situation and look at possible alternatives" (Manzini, 2015), as its purpose is to empower action. This is why depth in conversation should not go into the concepts of the Information Ecosystem, but into their experience and role within it.

From research on generative tools, the importance of providing tools not only for reflection and discussion but also for projection was also considered as a guideline for the design. The path of expression acreoss the timeline of experience (Sanders &Stappers, 2012) shown in Figure 25 was also integrated into the flow of the session, going from current activities, to earlier experiences as evocative triggers, to later go into possibilities for the future expressed in a generative activity.

>
Figure 25. Path of expression across the timeline of experience
(Own image besed on Sanders & Stappers, 2012)

1. Observe the present

4. Create the future

2. Recall the past

3. Reflect on the past
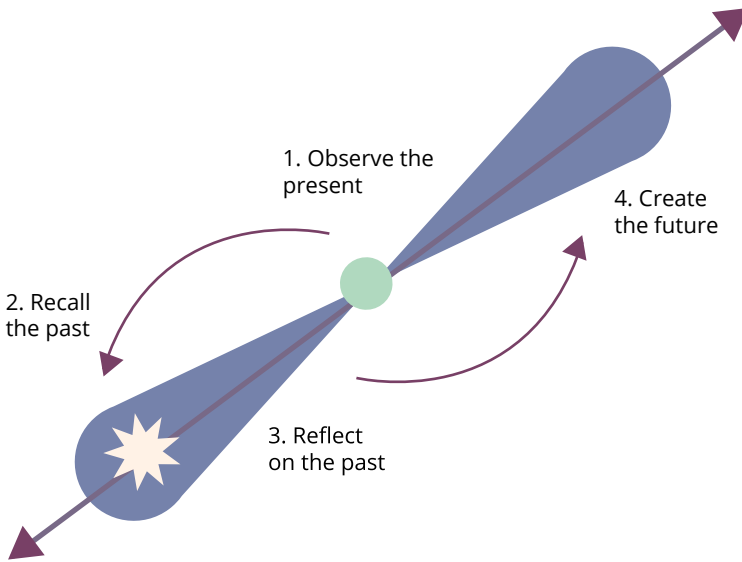
5.2 Methodology

Bellow I show the overview of the methods used during the present Cycle II, which will be further explained in the next pages.

| Concept Prototyping | ▶ | Participatory Test Session | ▶ | Observation
Recording
Feedback interviews |

Tool concept 2

This section explains each of the elements corresponding to the prototype and activities of the tool through the methods used. The setting was not a controlled environment this time, so that the participants would feel more immersed in their regular environment. The number of activities was reduced to fit the Path of Expression model (Sanders & Stappers, 2012). Pictures of the prototype and filled in material can be found in Appendix G.

Session: 45 minutes + 15minutes feedback interview
*No. of participants:*2
Participant profile: Citizens of the Design for Interaction Master community at Industrial Design Engineering.

Participants

For this session, I decided to test again at the Industrial Design Engineering Faculty. I recruited two members of the Design for Interaction Master Community, so the context of the session is that community specifically. The focus of this cycle is to test with regular IDE students, as a parallel of regular neighbourhood citizens. The decision to test again with students was taken to try out the second iteration in a more controlled environment and recognize the gaps that might still be there before testing with citizens in context. This would be the last opportunity to identify concrete details to fix before going to the context to test. Figure 26 shows the profile of the recruited participants.

|	Personal Profile
Participant 1	Female international student Design for interaction community member
Participant 2	Male dutch student Design for interaction community member

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Figure 26. Participant profile for Cycle II test session

Activity 1.- Mapping Access

Prototype:An A1 canvas with the title of Mapping Access displays the questions in sticky notes. Each question is provided with a blue A5 answer card so that participants can move them around. The corners of the A4 have one section called Our role and another one called Data Gaps, with sticky notes to use for writing and adding them to the map.

Session: Mapping access consists of ten questions about access to information for participants to answer from the Connecting through information developed framework (chapter 3.5). The cards spread over an A1 had its own space to answer, which participants could take down and move around (Figure 27). The questions are meant to start a dialogue between both participants to engage in the session and reflect on access to information in their community. This is also the first step in the Path of experience model, observing their present status. While answering questions, participants were also asked to identify Data gaps that they may encounter in their discussion and their individual roles in the community.

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Figure 27. Participants during activity 1 of test session at IDE.
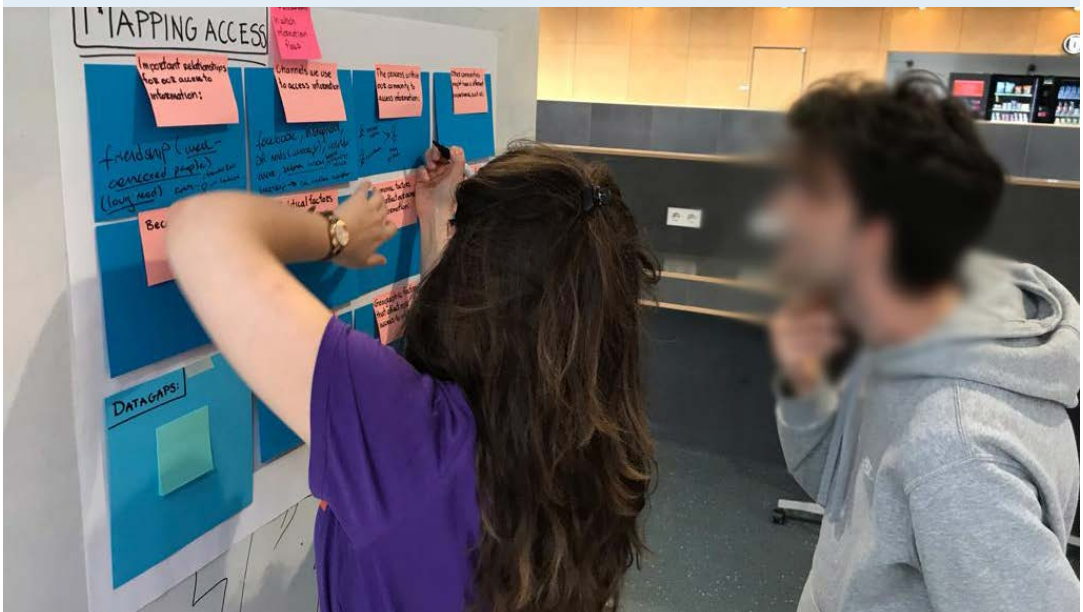
Activity 2.- Past positive experiences and opportunities for growth

Prototype: Two A3 size white paper canvases only state the name of the activity, for participants to write and draw on as they recall and discuss their positive and negative experiences.

Session: This activity worked as the second step for the Path of expression model as recalling the past to create "evocative triggers" (Sanders & Stappers,2012) . The instruction was to identify and write down past positive experiences inside their community and possible opportunities for improvement. The material included two blank A3 canvases which participants could use to write and draw freely. The goal of this exercise is to increase the personal relevance and engagement of participants, as well as recognizing possible paths of action during the sharing of their experiences. Through generative tools like this, participants can make a leap connecting the present to the future, as they give "deeper interpretations of the past" (Sanders & Stappers, 2012) which makes it easier to imagine the future.

Activity 3.- The future of my participation

Prototype: One A3 size white paper canvas was provided to participants with the title of the activity. A set of sixty pictures and sixty icons was printed in five A3 size white canvases to use as probes for the activity.

Session: The third activity is the exercise with most generative tools influence, so that it is easier for participants to express their aspirations for the future. Participants have to find pictures in the set of probes provided or draw the roles they identify themselves with, and talk about what else they could do for their community for access of information in the future. The format of this activity also allows the participants to add both practical and emotional content, touching both the cognitive and the expressive side of their answers (Sanders & Stappers, 2012). The answers are expected

to bring more concrete individual actions for the future. Figure 28 shows participants interacting with the prototype and discussing during this activity.

Data Collection

The details of data collection tools used for this cycle are described in this section.

Observation

Once again, an observation sheet was used to take notes during the session to help keep the focus on requirements and research questions during the session. The results were later analyzed through quotes, identifying the tool´s fit to requirements and insights on the session through the activities.

Recording

The session was video recorded with participants consent (Appendix H).

∨

Figure 28. Participants interacting with the prototype and probes for Activity 3

Feedback session interviews

I conducted an interview with both participants at the end of the session to get to know their inputs as participants following the session. The interview was recorded for later reference.

Results

This section presents quotes to be analyzed, captured during the participatory test session. More detailed pictures of the prototype answered (Figure 29) by participants can be found in Appendix G. Participants for the session in Cycle II also discussed the information flow in the IDE master community at the Industrial Design Engineering faculty at TU Delft. On the next pages, Figure 30 shows quotes related to the requirements in the order of the activities carried on the session and their relevance. Color shows the degree to which each activity achieves the requirements; purple blocks mean not achieved, blue blocks mean somehow achieved, and green blocks mean achieved Each cell contains a quote from participants to exemplify the content of the dialogue in each activity. Data from the test can be found in Appendix I.

>
Figure 29. Activity 1, Mapping Access material answered by participants.

Activity	Requirement 1 (Effective)		
	Trust Relations	Power Dynamics	Diversity and Inclusion
Activity 1 Mapping Access	*"I think friendship. Most times I get some sort of information through my friends, or social media." P1*	*"For me it goes from someone from the study associations or master communities." P1*	*"What I was thinking is that there probably is also difference in the experience of (..) non european ones, european ones and dutch ones. For example, if you want to do an internship..." P1*
Activity 2 Past positive experiences and opportunities	*"For example one time Dennis told me about an interesting concert..." P2*	*"I'm sure there have been times when things from a course were supposed to be properly announced and then it only arrived via people." P2*	*"I didn't feel so confident about Uni or about my life" P1*
Activity 3 The future of my participation	*"I think I could try to get know what other people want to know more, because I do pass on information but I dont know if I am passing it on to all the right people or just the people that I know of. I can probably try to ask more people about their interests." P2*		*"I feel like maybe Im letting down my international friends because I dont know that much about the technicalities of living here in the NL when I could, cause I have the means to learn these things." P2*

Communication	Perception of relevance	Requirement 2 Engaging	Requirement 3 Actionable
"At least for me its Facebook, sometimes Instagram. For example last year I heard about the line up for IO Festival through Instagram. " P1	*"You are in the whatsapp group as well right? There are things posted in there but I don't know if I would say it is a place to access information because often times the information is not that relevant for me." P2*	*"Yeah but when I dog et the information I try to tell other people that might also like it" P2*	
"It was a nice experience for me to know about the business fair beforehand so that I could sign up for Speed dates" P1	*"Sometimes people tell me interesting things which are not related to IO" P2*	*"I didn't feel so confident about Uni or about my life" P1*	*"I think a kind of filter would be better to save some time." P1*
"At one point there was always something going on and there was less space here to work. It would be grate to know that kind of stuff before hand." P1	*"I feel like I dont want to take responsibility"P2*	*"What I did was mentoring students, to share knowledge , so I can do it again if there is an extensive mentoring programme" P1*	*"Because it would be nice for me to learn about others in a more professional sense."P2*

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Figure 30. Data collected during Cycle II test session.

5.3 Discussion

The data collected through observation, recording and interviews was analyzed through participant's quotes. The present section shows the learnings from the analysis.

This second iteration of the participatory tool was successful in bridging the Information Ecosystem approach with actionable conversation from participants. This is evident when analyzing the progression of the conversation between the participants through the activities, from generic comments and ideas in the first activity, to specific and concrete actions to take in the future during the last activity. The progress made from the previous iteration of the tool in Cycle I, can be attributed to the implementation of the path of expression for the flow of the activities, asi it is the references to previous experiences what allowed participants to visualize specific solutions to the opportunities found in the past. Together with the integration of a more projectual activity, collaging with the probes provided, the tool goes full circle into present past and future in a smooth way.

Fit to requirements

As it can be identified in the results section through specific participant's quotes, the dialogue held during the test session went **deep into the five key factors of participation (Trust relations, Power Dynamics, Diversity and Inclusion, Communication barriers and platforms, and Perception of Relevance).** The integration of all of the factors lead to an intricate conversation. As an example towards the end of the session, participant two identifies his role as an information sharer, while addressing his trusted relations in the ecosystem and also the perception of the relevance of information he is sharing. *" I think I could try to get to know what other people want to know more, because I do pass on information but I don't know if I am passing it on to all the right people or just the people that I know of. I can probably try to ask more people about their interests."* Participants reflect on the key factors, which are essential data literacy elements. This is why the tool covers the effective requirement.

I found that the requirements of **engagement and actionable** were very closely related during the test session

in the present cycle II. The elements on the design of the tool which deliver the two requirements are the same, so one could not happen without the other. The progression of activities from present to past, and then future, together with a generative activity, collaging, set the ground for an engaging dialogue which lead to an actionable conversation. Projecting a future scenario helps in taking the leap from the map of access (data literacy) to what concrete actions they can take in the future (participation). To illustrate the close relation between the structure of the activities (present, past, future) and the format (generative activities) , I will refer to an example of the dialogue from the test session. During activity one, Mapping Access, participant 1 mentioned the following as a sociopolitical factor affecting access to information: *"Sometimes it can be embarrassing to ask for information, because you are supposed to know it already, but then you don't"*. During the third activity, The future of my participation, the participant mentioned her past experience and what she could do in the future: *"What I did was mentoring students, to share knowledge , so I can do it again if there is an extensive mentoring programme"*. This quotes from participant one show the progression and flow of the conversation, but also the relevance of identifying the roles she plays inside the IE. It is the individual experiences shared through the activities which increases the personal relevance of the discussion.

The **personal relevance** also grows when thinking about the specific roles, recognizing themselves in the map, and writing them in the cards during activity one. Writing the cards and using them for the subsequent activities allows for a more clear connection between the activities and a visible captured path in the flow of the session. Having a visible captured process is also part of the tool's success in being actionable. The concrete data data gap cards helped in obtaining specific questions to be transformed in data inquiries, which also helps to have specific actionable answers in activity three, The future of your participation. I designed the activities to be diverse and increasingly projectual to maintain engagement throughout the session. As participant two pointed out, *"I think step by step we were having more freedom in the activities"* they kept interest in the conversation throughout the session.

Answer to Cycle II Research Questions

In contrast with Cycle I, the tool in the present Cycle II iteration did not have issues with understanding the language. I can say then that the framework is now understandable and participants did not have problems with the terms. The adjustments needed now are on the level of the details of the activities and the format of the tool. Participant two pointed out: *"When I first read this one it felt a bit overwhelming. But doing it step by step was pretty doable."* The participant thought the material provided was too much too answer in the time given and made activity one, Mapping access to look more complicated than it really was.

When looking at the value that participants gave to the tool, their reflections and gains from the conversation are clear and relevant to their lives, as participant one made clear in the following quotes during the feedback interview: *"I think you learn more things from each other." "I just realized that I am not sharing info a lot."* The learnings from the tool were evident for both of them.

The design of the tool activities for the present Cycle II creates an integrated flow from beginning to end of the session, while capturing the process and obtaining a concrete actionable outcome. The session divided in the path of expression, guides the flow, complemented by the role cards and data gap cards, which encourages participants to focus on their knowledge, not on the gaps or IE terminology. Participant two gave an answer which highlights this finding during the feedback interview: *"I can certainly do more to spread or provide it (information). I can also decide to be the person who spreads the information".* Figure 31 integrates the findings from Cycle II test session.

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Figure 31. Summary of main learnings from Cycle II test session.

Concept learnings ▶ Integrating the path of expression to the tool gives the session a continuous flow.
Activity 1 Mapping Access had an overwhelming display.
Activities are diverse and increasingly projectual.
 Organization of the material and details of instructions needs to be improved.
Role cards and data gap cards are an engaging element of the tool.
Generative activities were successful in obtaining specific concrete answers.

Recommendations

There are remaining improvements to be done to the execution of the test sessions, according to observation during the test session in Cycle II and the interview to participants after the session. Instructions were given verbally to participants, but having them written down on paper in each activity might help participants keep the objective and focus in mind. Verbal instructions should also be more detailed, as the freedom given to participants during the session can be confusing, slowing down the reaction during the session. Organization of the material can be improved by giving the necessary material only when needed in each activity. By handing out only the material needed in each step, participants can also avoid feeling overwhelmed by the amount of questions during the activities. The session could also have better connection between activities, so that not only the discussion is continuous following the path of expression, but the materials and activities also highlight continuity. To prompt a quicker response from participants to questions, example answers can be provided beforehand.

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Figure 32. Summarized recommendations for test session according to findings on Cycle II.

Session organization ▶	Answer sheets with specific lines or space to answer Clear detailed instructions given by facilitator, minimize the role. Instruction details must be given in the material for better guidance. Consider making individual collages or future scenarios and then comunal ones. (Might not be necessary in the context of an initiative thinking as a group during the session) Overwhelming the participants might be avoided by giving the cards one by one and then adding them to the "map" Organization of the material can be improved.
Session Flow ▶	Keep present, past, future structure. Better connection of the activities. Examples might be needed as prompts during the first activity. Give specific roles to participants

5.4 Reflection

From the insights gained in the present Cycle II, there are some clear directions to take forward in the next iteration. This section will present the two insights which will guide the next Cycle III in chapter 6.

The path of expression model was the unifying factor to guide participants through the activities. Talking about present action, past experience and future vision generated the desired engagement in the session, catalyzed an effective dialogue, and prompted actionable outcomes, fitting all the requirements needed. The tool developed in the next Cycle III should keep this guiding elements, although there is room for improvement. The opportunity regarding this insight is to tie together the three activities to follow the path of expression too. This means having better continuity from one activity to the next one in regards to the content. The outcomes of the first activity should facilitate the beginning for the second one, and the same should happen for the third activity. Figure 33 Summarizes the conclusions from insight1.

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Figure 33. Summary of Insight 1 from Cycle II

Result
In this iteration of the tool, participants were more engaged, had a deeper discussion which lead to more concrete outcomes for actionable ideas.

Insight
The format following the path of expression is more successful to cover the three requirements during the session.

Conclusion
The flow of activities going from present, through past and future, should be kept in the next iteration.

Directions
Tie the activities better between them so that the instructions and materials strengthen the continuous flow of the session given by the activities.

Insight 1.- The path of expression model was successfully applied in the tool to guide participants in an engaging process, with an effective dialogue and for an actionable outcome.

Now that the framework was applied and successful in covering the requirements (effective, engaging and actionable), and the flow of the session is adequate, the details of the tool should highlight the requirements and leave them clear to participants. Participants mentioned they felt overwhelmed at different points of the session. They attributed it to the large amount of materials presented. Together with the fact that as a facilitator I had to intervene continuously to clarify the instructions, the conclusion is that the organization of the materials and instructions during the session should be more clear. The details in the tool can potentially reaffirm the covered requirements, while now the lack of details is damaging to the process participants go through during the session. At this stage I identified two clear directions to solve this concern; having a printed version of the instructions directly on the material, and formatting the materials used in the different activities so that they can be handed out only when needed. This directions will be applied on the tool iteration of the next Cycle.

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Figure 34. Summary of Insight 2 from Cycle II

Result
Verbal instructions were not enough to communicate the direction of the activities.

Insight
Participants mentioned feeling overwhelmed at times while answering the activities.

Conclusion
The balance between freedom in the session and detailed organization and instructions needs to improve.

Directions

Written instructions need to be printed in the material.
Handing out the material step by step when needed.

Insight 2.– The flow of the session was interrupted when participants were not certain of how to use the materials or follow the instructions. Together with looking at all the material provided for the session, participants said they felt overwhelmed by the activities at times.

6. Cycle III

During the past Cycle II, the test session demonstrated how the tool was successful in generating dialogue and reflection on future roles and opportunities for active participation. The design requirements (effective, engaging, and actionable) were covered to an extent. For the present Cycle III, the challenge is in creating a better connection between activities, so that the consistent flow of the dialogue held by participants during the session is reinforced by the tool materials.

6.1 Research

For the present Cycle III, I needed to get a deeper understanding of how to ensure the third iteration of the tool covered the design requirements in context.

Research questions

Integrating the complete Information Ecosystems for Citizen Participation framework in the tool is , the goal of the present Cycle III. To make sure the integration is successful in covering the design requirements (effective, engaging, and actionable) the focus of the process was in answering the following question:

> **Research question Cycle III.-** Would a session following the path of expression be as successful covering the requirements (Effective, Engaging, and Actionable) when integrating the four dimensions of the IE for citizen Participation Framework (Access, Impact, Use, and Trust) in a participatory session?
> –Which is the ideal setting for such participatory session?
> –Is the value of the tool aparent for citizens in context?
> –Does the tool cover the design requirements in context?

Approach specifications

For the development of a third iteration of the tool, the complete framework of IE for Citizen Participation needs to be addressed in the test session, to ensure its fit to the participatory session format. Figure# shows the questions that need to be integrated to the tool during this Cycle III.

>
Figure 35. Questions to map the four dimensions of the Information Ecosystem for Citizen Participation

6.2 Methodology

During Cycle III, I again used a prototype during a participatory session to get insights. For this stage, I conducted a pilot test session in context with a Delfshaven citizen initiative, which helped me adjust final details for the third and final participatory test session. As data collection methods I added a feedback form at the end of the session to the observation, recording and interviews.

Dimension	Questions to map dimension
Access	Channels we use to access information: Factors that affect our access to information [Social/ Political/ Economic/ Geographic]: The key factors for us to access RELEVANT information: Important relationships for our access to information: why? The process within our community to access information: Other communities might have a different experience:
Use	Information is relevant for us because: Before we use information we: The most relevant information for us: Why? What we do with this information: Why? How we share information: How we process information: Formats we use: What we do with these formats: How we apply information:
Impact	Unexpected impacts information could have: Factors that impact the information we use [political/ social/ economic/geographic]: Communication failures that affect us [before/ currently]: The impact of information on our actions [short/ long term]: We use information to decide on: Other organism use information to decide on:
Trust	Sources we trust: Sources we have worked with in the past: Sources we trust will help us: Why?: Threats to our trust: Sources which lost our trust: How?: Sources which could damage us: How?:

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Figure 36. Methods used throughout Cycle III.

Concept Prototyping ▸ Pilot Test Session ▸ Participatory Test Session ▸ Observation Recording Feedback forms

Tool concept 3 Connecting Through Information

The prototype of the present Cycle III iteration has a polished printed design. Through the next pages I explain each of the elements corresponding to the prototype and activities of the tool through the methods used for a final validation participatory session. A special marked section is dedicated to the pilot test at the end.The complete session outline can be found in Appendix K.

Session: 90 minutes + 15minutes feedback from filling
No. of participants: 6
Participant profile: Members of citizen initiatives in Delfshaven.

Recruitment

Recruitment process to find participants who were neighbours involved in citizen initiatives was done both through the Delfshaven community network online and offline. I created a one page presentation of the project for the purpose of recruiting participants (Appendix J), and an image designed to share on social media (Figure 37). Both materials were translated for distribution. In both online and offline cases, the Delfshaven community of active citizens was open and helpful. The only barrier for some individuals was language, as it was a requirement for the session to have good communication skills in English.

I visited key places in Delfshaven such as neighbourhood houses and citizen organizations. This way I met people willing to help with the test session. In the self managed house in Delfshaven I met a volunteer from Zorgvrijstaat who was interested in the tool I developed and also in participating in a test session. This way I agreed on the pilot test session with members of Zorgvrijstaat.

>
Figure 37. Recruitment social media post

Considering the network I researched for the project, I contacted a number of organizations with online presence. From my online messaging, I had an answer from two Neighbourhood Networkers, whom I met in the Delfshaven office. Through their local network, they helped me getting in contact with neighbours online and offline again. It was through meetings with the neighbour community in Coolhaven that I recruited participants for the test session of Cycle III.

Calling citizen initiative members!

Do you want more people to know about your initiative and what you do for your neighbourhood?

Would you like to know how communication and data can help your initiative?

We have a tool for you! The Design and Data for Democracy team is looking for a citizen initiative to try it out.

You will get to explore how information flows in your community and what kind of data can help your initiative.

Come with your team of three to five members for a three hour workshop.
(coffee breaks included)

First weeks of august
(day and time depending on your availability)
in Delfshaven, Rotterdam

Participants

Six participants joined this final validation session. Two of them are referred to as professionals, as they do not live in the area, but their work is focused in Delfshaven. All of them are active participants of different initiatives in the neighbourhood, coming together in the Neighbourhood Management meetings, or Buurt Bestuurt, which was the focus of the session.

Activity 1.- Information Map

Prototype

Main map

Four A2 size white paper canvases with the printed guide for the Mapping Information Ecosystem Activity, the title and number of the activity, and instructions. Each A2 size canvas has the questions to map one of the four dimensions of IE for citizen participation framework (Access, Use, Impact, and Trust). I decided to split the Map in four to address the participant's concern of the materials being overwhelming. With this format, each dimension can be presented one at a time, and the complete map can be arranged together at the end of the session. When the four A4 size papers are arranged together to form an A1 size canvas, they connect and form the complete Map of IE. Dividing the map also makes it easier to split the activity into different groups if needed for the session (ie. if there are many participants during the session). The graphics designed for the map consists of a network with nodes, using a different color for each dimension, green for Access, yellow for Use, pink for Impact, and green for Trust. The font sizes and typography used are big enough for a team to work on the same canvas at the same time.

>
Figure 38. Participants interacting with the prototype and probes for Activity 3

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Figure 39. Detail of the Mapping Information material; A2 canvas for Impact dimension.

	Gerneral Profile	*Expertise*
Participant 1 (Group 1)	Professional working in Delfshaven	Neighbourhood Networker
Participant 2 (Group 1)	Experienced involved citizen	Lives in the neighbourhood and participates actively in citizen initiatives
Participant 3 (Group 1)	Experienced involved citizen	Lives in the neighbourhood and participates actively in citizen initiatives
Participant 4 (Group 2)	Experienced involved citizen	Board member of a local media outlet, wijkconnect.
Participant 3 (Group 2)	Professional working in Delfshaven	Social Worker
Participant 4 (Group 2)	Experienced involved citizen	Neighbourhood Governor (Head of Neighbourhood Management)
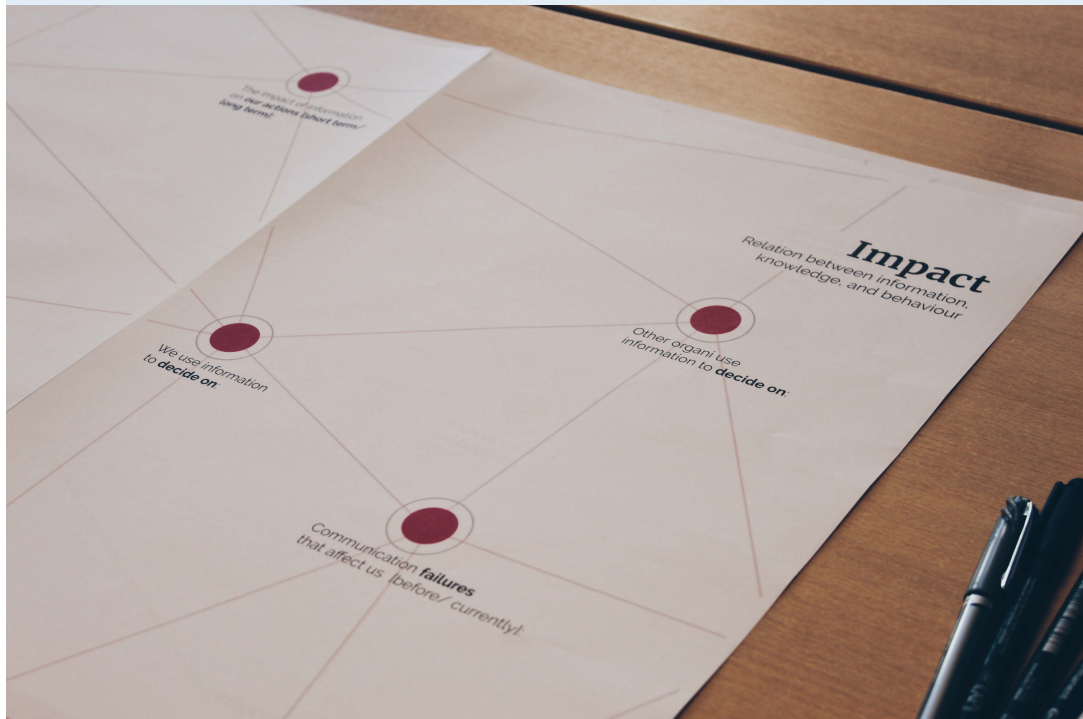
My Role cards
Twenty four A7 size yellow cards printed from both sides. The cards have the title My Role on one side and the title My Story on the other. The size is enough to write, but restrictive so that participants can not expand too much. I decided to create separate cards for it so that participants can move them around and interact with them through different activities.

Gaps of information cards
Twenty four A7 green cards printed from both size. The cards have the title We need data on (Gaps of information): The format is the same as My Role cards, also to have short answers written down and individual cards to move them around through the different canvases in other activities.

Answer sticky notes
A set of coloured sticky notes was provided for participants to answer the questions. This notes were chosen because they allow participants to move their answers around, more than one participant to write at the same time, and to add multiple answers to one question.

Session: This activity integrates the four dimensions of the IE for Citizen ParticipationFramework (Access, Use, Trust and Impact). The instruction reads: Answer the questions and complete the statements according to your experience. Participants need to answer six questions related to the corresponding dimensions. Each question has a space to answer with sticky notes so that they can be moved around. The questions are meant to start a dialogue between participants to discuss and reflect on their own Information Ecosystem. When details of the session were explained, each participant took a task to write the answer to the questions, write their identified roles in the yellow My Role cards, or write the data gaps in the green We need data on: cards. The information map covers the first step on the Path of Expression model, the current situation.

>
Figure 40. Participants from group 1 discussing the My Role cards during Activity 1, Mapping Access.

Activity 2. Our stories from the past

Prototype: *Answer canvas* One A2 size white paper canvas printed with the colored network background used in the first activity for the map and the names of the four dimensions (Access, Use, Trust, Impact). The print also includes the title and number of the activity, and the instructions. The size is enough for participants to add the My role cards. The My Role yellow cards described in Information Map (Activity 1) are also used in Our stories from the past (Activity 2).

Session: Connecting to Mapping Information (Activity 1), participants need to use the reverse side of the My role cards to write and share the story behind that role. The instruction reads: Write the story behind your experience, share them with the group and collect them here. This activity prompts personal experience to increase engagement with the session and make the content of the discussion relevant to each of the participants. Our stories from the past (Activity 2) is the second step of the Path of Expression model, past experiences.

Activity 3.- Our contribution for the future

Prototype

Answer Canvas
One A2 size white paper canvas printed with a network pattern in the background, the title and number of the activity, and the instructions of the activity. The Gaps of information cards described in Information Map (Activity1) are also used in Our contribution for the future (Activity 3).

> *Figure 41. Participant presenting collage results from Activity 3*

Set of probes
A set of sixty pictures and sixty icons was printed in five A3 size white canvases to use as probes for the activity.

Session: For Activity 3, the printed instruction reads: What will you do in the future with the data you get?
Find images to represent your ideas and create a collage. This activity integrates a generative tool, collaging with the given printed probes. Participants have to use the green We need data on: cards they filled in Activity to discuss what possible actions could they take if they had the information missing. Then, they have to choose images from the probes to explain and present their ideas in a collage. The intention behind integrating a generative tool is to bridge cognition and expression of participants, taking abstract ideas into actionable steps for the future.

Data Collection

Observation
An observation sheet was used to take notes during the session to help keep the focus on requirements and research questions during the session. The results were later analyzed through quotes, identifying the tool´s fit to requirements and insights on the session through the activities.

Recording
The session was audio recorded with participants consent (Appendix L). A colleague helped documenting the session through pictures, aslo with participant's consent.

Feedback forms
In contrast with previous sessions in Cycle I and Cycle II, having a larger group of participants made it easier to collect their feedback through feedback forms (Appendix M). Filling the forms also prompted a short closing discussion for the session.

Pilot Session

I conducted a first pilot session in context with members of a citizen initiative to be able to make adjustments before a final test session. I expected adjustments to be related to the participants' profile, the unknown environment setting for the session and facilitating for a dutch speaking community. The pilot participatory session was conducted with members of Zorgvrijstaat in their office in Delfshaven. Zorgvrijstaat works to strengthen neighbourhood networks through diverse activities ranging from healthcare to cleaning and handywork. During the session, the three participants answered the activities as a group. Three active members of Zorgvrijstaat were invited as participants to this test.

Participant 1	Organization founder. Social Work, Pedagogy and Public Administration
Participant 2	Organization participant. Innovation for the neighbourhood.
Participant 3	Organization participant. Active participant of the organization

Changes made from the pilot test to the final validation test were made on the facilitation level. For the final validation session I recruited an IDE master student to help with documenting, time keeping and handing out material during the session, which I was lacking in the pilot session and helped in dealing with a group twice as large in the final validation session. During the pilot session I had a translated version of the tool, which I made available to participants. This might have prompted a discussion in dutch. For the final version I had the translation available, but I did not give it to participants. From the pilot test, I had to condense Activity 2, helping with the My Role yellow cards. For the final validation session I made sure to divide tasks so that My role cards and We need data on: cards were filled in, and helped with filling in some example cards at the beginning of the Information map activity 1. The findings of this pilot session will be included and clearly identified together with the final validation session findings in the discussion section of the present chapter 6.

Results

The present section first shows a chart with results from the session through participant's quotes captured during observation, feedback forms (Appendix M) and through the recordings of both groups of participants (Figure 42). Figure 43 shows quotes from participants to exemplify the content of the dialogue in each activity and their relevance to requirements. Color shows the degree to which each activity achieves the requirements; purple means not achieved, blue blocks mean mildly achieved, and green blocks mean achieved.

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Figure 42. The two groups of participants of the final validation test session with citizens from Delfshaven.

Activity	Requirement 1 (Effective)		
	Trust Relations	**Power Dynamics**	**Diversity and Inclusion**
Activity 1 Mapping Access	*"If you don't have a person from who you listen to the news, you don't know anything... it's like a chain reaction." P3 "We need a personal proved connection". P5*	*"People don't understand the difficult language from the municipality." P1 "The values vary household to household, especially in this neighbourhood". P5.*	*"(Meetings) It's only for a few people, you reach out to those people who stay at home, so how do we reach those people? Door to door?" P3*
Activity 2 Past positive experiences and opportunities	*"The more interested you are in your neighbours the more social control and the safer you feel." P2*	*"You feel like oh they cut the tree, but what is it going to be next?" P2 "If not everyone gets invited, then some people can feel left out." P5*	*"But you are getting their problems too." P2 "Due to formal communication, some people don't understand government letters". P1*
Activity 3 The future of my participation	*"I'm sure that here there is also a lot of people who could benefit and who could help each other." P3*	*"There are also people who are lonely who will be glad to share their knowledge." P3*	*"But it has to be a mix, old young... you need to have the vision from all kinds of people." P3 "Maybe for teenage girls we can organize a makeup workshop." P3 "We have to look at people as a holistic being, to respect also their negative sides." P3*

Communication	Perception of relevance	Requirement 2 Engaging	Requirement 3 Actionable
"Information boards by the garbage bins because that's where everyone goes, or at least they should." P2 *"I have a source and I will try it and if it works I share it with others." P4*	*"In other neighbourhoods, people are connected, they talk to each other." P3* *"Information can make your subconscious conscious." P4*	*"You learn to meet people in a different way" P1* *"We love our neighbourhood, and without information we can't improve it, and we care about our neighbours." P1, P2, P3*	*"But how many times do you invite your neighbours to the meeting?" P2* *"If we would give her (the hairdresser) more information, she could help us. She's kind of a neighbour." P2*
"Everytime someone comes to live, I go to the people, with how many people you live here, cause when we have a fire… " P3	*"One time I had a fire, I didn't know the people there." P3* *"If you find a way to activate the neighbourhood, you can change it." P6*	*"I'm too tired…I still have my children here, Im fighting for them" P3* *"I'm just ashamed that I'm not doing enough to get them involved." P2* *"How can we make that these people commit to the neighbourhood?" P6*	*"This is something we need to talk more about in the next meetings, to have a workshop… how to involve people more" P2* *"To have a vision and shared values we will prosper the cohesion between each other and eventually the group." P4*
"How people (fellow participants) think about communication sent to them (by government, etc)" P4 *"Try to communicate with each other, not through devices." P5*	*"We are thinking about what people want in the neighbourhood, so we thought students could go around the neighbourhood and find what older people want." P3*	*"Also because we have to cooperate, making things together." P6*	*"Children who live here, they have a fresh clear look at the surroundings and they see no obstacles. P1 it is very human. As human you talk to each other without our mask of formality." P4*

6.3 Discussion

The content of the present section displays the analysis from the final validation session, done through quotes, evaluating their fit to requirements and giving answers to the research questions from the present Cycle III.

  In contrast to the previous Cycles I and II, having the final validation session in the real context highlighted all the positive and negative aspects of the designed tool. Reflection and discussion were intense and profound due to years of knowledge on the matter from participants and their genuine interest in the conversation that the tool initiated. The engagement in dialogue and with the tool was also evident, and ideas for future action were also plenty as I will further explain in the Fit to requirements section. The progress made from the past Cycle II to this final validation test was especially evident during the feedback session, where participants express the value they found in using the tool and in the outcomes they had.

Fit to requirements

Effective
The first requirement to analyse is *Effective,* through the five key factors of participation. From the answers on the feedback forms, most participants found that Our stories from the past (Activity 2) was the one to generate more discussion on the key factor *Trust Relations.* The answer matches with the analysis of the recordings, as it was during Activity 2 that participants shared more intricate details of their stories, which for the most part involved their personal trust networks. Participant five made it very clear when he mentioned *"We need a personal proved connection"*.

  For the key factor of *Power Dynamics,* it was the one with the weakest presence during the session, but it was still addressed during the three activities. During a dialogue about the municipality cutting trees in the neighbourhood Participant 1 said *"Being part of the government, we felt very responsible for that "*.

  Participants reported talking the most about it during Activity 1, Information map. *Diversity and inclusion* was one of the most frequent topics of conversation during

the session, so it is the most talked about key factor. Diversity and inclusion was mentioned heavily during the three activities, which matches with what participants reported. A great quote from participant three on this key factor is: *"But it has to be a mix, old, young... you need to have the vision from all kinds of people."*

For the key factor of *Communication*, most participants wrote Activity 3, Our contribution for the future was the moment when they talked about it the most. Participant five says during activity three: *"We should try to communicate with each other, not through devices".*

Addressing the last key factor, *Perception of Relevance*, Participant five said during Activity 1: *"Information can make your subconscious conscious."*, which shows participants discussed the importance of information in their community.

As the voice of participants shows through the presented quotes, the effectiveness of the tool is a covered requirement throughout the session. The discussion covering the four dimensions went into personal experiential details of the participants' involvement in the neighbourhood. Covering the four key factors of participation (Trust relations, Power dynamics, Diversity and inclusion, Communication, and Perception of Relevance) all along through the validation session took participants to explore, discuss and analyse their Information Ecosystem effectively.

Engagement

I will now analyse if the requirement of *Engagement* was covered during the final validation session. As explained in chapter 3.2, the evaluation of *Engagement* is conducted through evidence during the session on relevance to their (participants') needs and context, and the generated dialogue during the session. Evidence of relevance includes a discussion involving personal and group connections and participating with other individuals and organizations (ie. government, media, other neighbourhood groups.)

The feedback forms (Appendix M) also included questions on engagement. Participant 3 mentions in the form *"(the most relevant content for her was) to think about how to communicate with people who are different than you and how to get everyone to connect and work at one goal".* Most participants had similar responses, which means the

relevance and purpose of the tool was clear enough so that they could articulate it. When looking for quotes during the discussion, personal and group connections were evident since the beginning of Activity 1, Information map. The best example of it, I found in group one, when participants built the following phrase together: *"We love our neighbourhood, and without information we can't improve it, and we care about our neighbours."*

Proof of *personal and group connection* while answering the activities were heavier during the discussion of activity one, but the focus on working together for their neighbourhood was clear for all participants through the complete session. Nevertheless, there was one moment during Activity 3 when participants on group 2 where in complete silence, looking at the image probes provided for collaging. This moment of personal creation was not planned, and is the one moment of weakest group engagement. At the end, it was countered balanced by the sharing of the images on the provided canvas, where the three participants built upon each others image selection. From group one, Participant three was skeptical about the session. When questioned by other participants on her attendance to the meetings she expressed: *"I'm too tired...I still have my children here, Im fighting for them."*

Actionable

The aim of the project to work as design for infrastructuring is evaluated through this requirement. The designed participatory tool needs to fit in existing processes and structures which citizens are already interacting with, in order to generate active involvement. To evaluate this requirement, I looked for evidence in the dialogue on *concrete conclusions and actions for the future*. As intended when designing the Cycle III tool, Activity 3 was the one with more *actionable* dialogue. Having talked about personal stories for Activity 2, Our stories from the past, participants started from there to come up with ideas to implement in the future. A great example of this happened in group 1 when participant 2 started talking about an even they went to that same week, she mentioned: *"At those parties, talk to the people who are coming over and tell them about our existence (...) I don't think anybody came over and said (...) maybe you are interested to join us, if you are, please give us your email*

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Figure 44. Test session closing, showing participants all their hard work with the tool.

here and we will send the information of our next meeting (...) that would be good.” Participant 1 then translated: *“To use these moments when people come together in a natural way to tell them and exchange information and ask for their details.”*

The *captured process* is also part of the evaluation of the *Actionable* requirement. The reason is that the process to reach the session's outcomes and conclusion should be available to be consulted at a later stage. This way, citizens can also keep adding new stories and insights, as the context is dynamic and ever changing. Participants from the final validation session gave a written answer to all the questions from Activity 1 Information Map, and wrote at least one card to capture each of the stories and topics discussed for Activities 2 and 3. Figure 44 shows all the filled in materials displayed for the session closing. Yet, the discussion was richer and broader than what the captured content shows. The variety of themes covered in the session can be seen, and the details in some of the stories show the granularity of the conversation, but this element of the *Actionable* requirement can definitely be improved, so that the evidence and the path of the session is clear enough for citizens who were not part of the session and for participants of the session to consult at a later opportunity if needed.

Answer to research questions

To give answer to the session questions after analysis, I will also use quotes from participants through this section as evidence of the learnings.

As shown in the previous section Fit to requirements, according to the analysis of the final validation session, the tool is successful in covering the requirements of *Effective, Engaging and Actionable*. The weakest element of the tool is Capturing the process, as the captured material is not enough to display the depth and complexity of the discussion held during the session. The My story cards help to get some more insight behind the general answers from Activity 1. A possibility is that if participants do not feel time restrained, they can go further into detail while writing. The tool itself can have improvements in the material to help with it. For example in the answer space provided. For a concrete example, group 1 went through a detailed conversation on what they have done to involve more people in their meetings during the three activities, and the post it mentioning the conversation says: *"Share with others to involve them"*.

The tool was tested in a final validation session of two hours, with six participants, one facilitator, and one assisting colleague. The setting of the session held worked as a validation session, but for a session without an expert facilitator there are still some changes and suggestions to be presented in the recommendation section of chapter 7.2. Some of these recommendations include having a co-facilitator, more rigorous time keeping and instruction constraints during the session, and extending the duration of the activity.

The value that participants saw in the tool, was specifically expressed in the short discussion after the session and through the feedback forms.
From the point of view of a participatory tool, participants found value in how the tool guided them to have an open conversation between equals. Related to this found equality in dialogue Participant 4 mentions: *"Communication between people is different, it is more equal than it would normally be in a meeting:"* The significance of applying design methods with the intention of diffusing design skills was also mentioned as a feedback when Participant 5 says: *"You learn to meet people in a different way, also because we*

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Figure 45. Summary of learnings from Cycle III.

have to cooperate, making things together". This is also closely related to the process of social creativity which encourages participation and collaboration. Participants also identified the value of mapping their IE and in consequence discussing it. When asked about the personal relevance of the session, Participant 4 answered: *"How to connect with people in the neighbourhood, because I want to try to activate more people".* The discussion surrounding their roles related to information initiated personal stories, and conclusions about their actions within their existing roles are evidence of them identifying their roles. Skeptical Participant 3 sums it up in one sentence: *"To know each other"*, while Participant 4 answered in a more metaphorical way: *"It's like a small mirror".*

Figure 45 shows a summary of the learnings explained earlier in this section. I can conclude that the value of the tool as a participatory tool, as a map of their hyper‐ local Information Ecosystem and as a tool to identify their role in it (their IE.) was well communicated throughout the flow of the final validation session and understood by participants.

Concept learnings ▶ Weakest requirement is Actionable, as the captured process is not enough to show the richness of the discussion.
Recommendations are needed for better results without an expert facilitator.
Participants could clearly identify their role in their hyper‐ local Information Ecosystem through their individual stories during the three activities.
The value of the participatory tool was clear for participants.

Recommendations

From the final validation session, details related to the participants in context can still be enhanced. Members of citizen initiatives are experts on their context. In the specific case of the present Cycle III validation session, all of the participants had many stories and experiences to share, which sometimes made them lose focus of the instructions of the activities in the session. My assumption is that the same will happen with other groups and initiatives, so modifications through the session can be implemented to keep the effectivity and engagement while using the tool in context. Details that also have to be adjusted are presented in Figure 46.

Session organization	▶	The closing for the final validation session was around feedback about the tool. The session needs a stronger closing activity or way to conclude Activity 3. On Activity 1, answer notes can be divided to prompt more written details to the answer. Emphasize group sharing and engagement during the generative step of Activity 3 to keep engagement. Divide the canvases of activities 2 and 3 for each group to have a part and then share it.
Session Flow	▶	Timekeeping should be more rigorous with a larger group. Having a co- facilitator to pay closer attention to each group during the session would help keeping focus on instructions and relevant dialogue. Participants had to be reminded of filling out the My Role and We need information on cards as they were too concentrated in each other's stories. Facilitator should encourage more writing during discussion.

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Figure 46. Summary of lrecommendation

6.4 Reflection

According to the results and analysis of the final validation session, the tool developed for this Cycle III covers the requirements. Still, there are some details which can be enhanced to ensure the same success when using the tool in context by a non expert.

Result
Participants tend to keep discussing about a question or answer of their interest and run over the time to answer without finishing the activity.

Insight
Participants active in a citizen initiative have an abundance of knowledge and experience to share about the context.

Insight 1.- Participants who are active citizens can get lost in discussion at moments, forgetting the tool. (Figure 47)

Conclusion
Closer guidance is needed when the tool is used in context with a large group to keep the discussion relevant and finishing the tool use.

Directions

Recommendation is to have a co-facilitator when the session is divided into groups to give closer guidance and attention to each team.

Participants had many interests and experiences in common, as well as a lot of knowledge they wanted to share during the session. Although all questions were answered and activities completed, having a closer guidance for each of the teams during the session would keep participants focused on the tool to get the most out of it.

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Figure 47. Summary of Insight 1

Although the discussion and reflection went into depth and detail throughout the final validation session, some of the answers lacked the specifics and only had a general conclusion on the discussion. While it is not a bad outcome, the best would be to have an accurate portrait of the session captured in the written answers. This would help participants when consulting the materials after the session, remembering the depth of their conversation.

Result
Conversation went into details and rich reflection, but the final canvases did not have all of these details.

Insight
The richness of the discussion is not completely conveyed through the written answers of participants through the activities.

Conclusion
There is still opportunity for the tool design to guide participants into capturing more details from their discussion.

Directions
Answer cards can ask for more details in each answer.

Insight2.- The discussion generated through the development of the session is richer than the captured process on the written materials. (Figure 48)

The Incremental Iterative design process comes to an end at this point, leaving the next chapter 7 for the conclusions of the project.

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Figure 48. Summary of Insight 2

7. Discussion and reflection

Before presenting the final insights, project limitations and recommendations for the future regarding the project in the present chapter, I will present an overview of the project up to this point. The present graduation project started with the task to use design methods to foster participation and develop data literacy skills, presented in chapter one. During the research phase I took a closer look into the context of Delfshaven in the city of Rotterdam, Netherlands, chosen to develop the present project for its active citizens and population diversity. After going through theory around Data literacy, Infrastructuring, Information Ecosystems and Transitions, presented in chapter 2, the scope of the project was narrowed down to answering a research question; *How might a participatory tool enable citizen initiatives to map their Information Ecosystem and their role in it?* In chapter 3 I presented the integrated research and design approach, which developed through Chapters 4, 5 and 6. I also introduced the Information Ecosystems for Citizen Participation Framework I worked on as a base to develop the participatory design. During the Cycles, I designed, prototyped, and tested three iterations of the Connecting through Information Participatory Tool coming to a final design validated in chapter 6. The development of the cycles was incremental, as the requirements reinforced the design with every iteration and cycles built upon each other. The final result, the Connecting through Information Participatory Tool still has opportunities for improvement, which will be addressed in the recommendation section further in the present chapter.

The final design of the *Connecting through Information Participatory Tool* covered the initial requirements of Effective, Engaging and Actionable. While developing the requirements to evaluate the design iterations of the Connecting through Information Participatory Tool, literature from Data literacy, Participatory Design and Information Ecosystems agreed that personal and social relevance was essential for citizens to engage with any kind of tool, media or channel. This is how engagement became a driver during the project and the main answer for the research question. Engagement is how the Connecting through Information Participatory Tool might empower citizens. Information Ecosystems and identifying their roles give citizens the personal and social relevance needed to identify

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Figure 49. The design outcome interacting with the context. Participants go through this process when using the Connecting through Information Participatory Tool.

the potential for action of the generated conversation. Engagement is also how data literacies and design skills are diffused through the Connecting through Information Participatory Tool, integrating them in a relevant form to citizens' hyper-local context. The Effective requirement makes sure that participants engage in conversation relevant to develop data literacies through the session, taking about the Five Key factors of participation; Trust Relations, Power Dynamics, Diversity and Inclusion, Communication, and Perception of Relevance. The Actionable requirement incorporates the intended infrastructuring approach to the tool. The successful fit to the requirements of Connecting through Information Participatory Tool as result of the project, cover the initial assignment of Designing a space to foster citizen participation, developing literacies through design methods.

7.1 Insights

On the tool

The final outcome for the Connecting through Information Participatory Tool, is a demonstration of the possibilities to bridge theory for citizen participation through practical and tangible projects. The translation of the theory was done through design requirements to end up with a conversation starter. Connecting through Information Participatory Tool, is a micro Infrastructuring step to empower citizen initiatives to keep building from bottom- up.
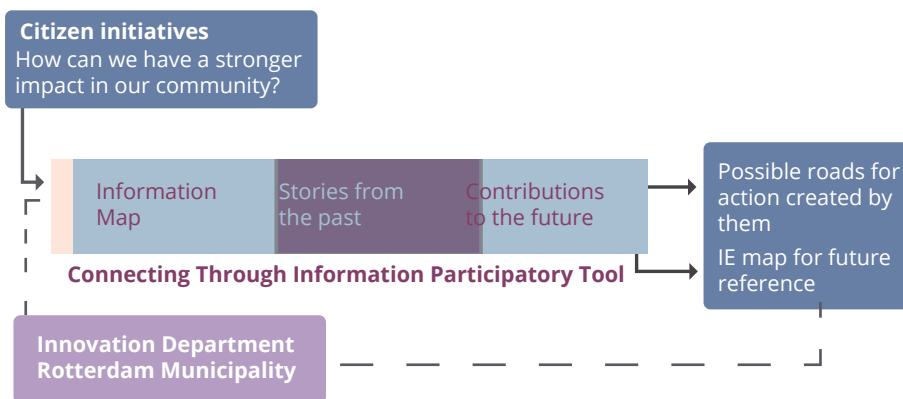
The impact of the tool is shown in Figure 49, where Citizen initiatives wonder how to have a stronger impact in their community. They then experience the Connecting through Information Participatory Tool, to end up with concrete roads of action and a map of their IE for future reference.

On the context

My greatest insight on the context throughout the project was that I was underestimating the gap between citizen initiatives and the municipality. There are a series of official infrastructure efforts to bridge this gap, like the area committees, neighbourhood networkers, and neighbourhood houses, but they are not enough. The main struggle I identified in that the existing infrastructure is not attending the actual needs of citizens or initiatives. *There is no clear understanding between top- down and bottom- up organizations due to the lack of communication and a shared vision.* A bridge can not be built if it is built top down going somewhere and bottom up going some other way. The systemic approach of the municipality does not allow for a hyper- local focus, and the hyper- focused action of citizen initiatives can not pull from the existing government infrastructure when it is not attending to their relevant needs. I believe there is a real opportunity for Participatory Design, Infrastructuring and Diffuse Design to frame and develop a common vision.

On the research

Working at a different gap, the one between design research and design practice is also a challenge. Through the development of the present graduation project I realized that designers (especially at TU Delft) are skilled to work in this space. This sometimes leaves us floating in the middle of nowhere, but with enough knowledge and training to find our way out and taking people with us.

I believe there is enough research on the value of social inclusion, relational goods, and social innovation for cities to backup the investment of time and resources in such projects. *Designers should use their skills and training then, to make these arguments tangible.*

7.2 Limitations and recommendations

Limitations on approach

The Research through Design approach was initiated from a theoretical stance, as well as the design iterations during the three cycles. Although cycles were designed to apply the theory and get insights, *the whole process could have been benefited of a more participatory approach to the research phase too*, and not only testing for validation. Assumptions could have been confirmed or contested by citizens from cycle I research in context was conducted earlier, and the development of the tool could have gone further in the available period of time.

Limitations on outcome

The Connecting through Information Participatory Tool was designed for citizen initiatives to engage with their Information Ecosystem. The value of the tool becomes apparent to participants through the discussion triggered by the tool during the session. During the pilot test with expert citizens, participants appreciated the tool as a way to record and organize their thoughts too. It is unclear if the tool provides a valuable outcome to participants outside from citizen initiatives, as it was not tested. The final validation test session helps in the understanding of the outcome with citizen initiatives, which covers the design requirements, but *results outside the intended users is still unclear.* The same happens with the context of use. The development was focused on the hyper– local context of Delfshaven. The Connecting through Information Participatory Tool *must be tested and adapted if it is to be used in a different context.*

Recommendations for use in context

The ideal number of participants for a session to use the Connecting through Information Participatory Tool is six citizens divided in two groups. This number can be adjusted, while paying attention to the time provided for each activity, participants' profile (ie experts, new to the initiative, inexperienced volunteers) to have a good balance so that

discussion is detailed and deep enough for the tool to cover the requirements (Effective, Engaging and Actionable).

There are some more details which can be adjusted during a participatory session with the Connecting through Information Participatory Tool. The presence of a co-facilitator to give closer attention to both groups would help keep the focus on the tool for the optimal results of the session. Keeping stricter time constraints might also help participants stay more focused on the activities. The overall time for the session can be extended, so that participants go into detail in their stories.

Further research

To continue with research on the Connecting through Information Participatory Tool, a cycle of test sessions could be done with participants to apply the found recommendations and to get their feedback, evaluating if it could be integrated to improve the outcome of the tool for citizen initiatives. Testing with different group sizes, expertices, involving more age diverse participants is suggested and could bring different new insights to the table.

7.3 Contribution to design knowledge and practice

During the present project, the starting point for the iterative design process was a developed Framework of Information Ecosystems for Citizen Participation. This framework is an adaptation from a framework for researchers on resilience. After getting to a framework, a set of design requirements was established from theory to evaluate the successful application of the framework into a participatory tool. The Framework of Information Ecosystems for Citizen Participation and the design requirements for successfully applying them in a participatory tool are the main contributions to design knowledge, which allowed me to go from theory to a tangible outcome.

For design practice, I explored an approach to close the gap between citizens' empowerment and government infrastructure for citizen participation. I believe much more can be done to build a stronger network for participation and citizen empowerment, so I hope to be a small piece of a growing interest of designers to explore the possibilities in this space.

The Framework of Information Ecosystems for Citizen Participation applied as a tool to develop data literacy is also an example of how designers and other professionals can tackle societal issues in a relevant hyper- local way to engage citizens.

8. Personal reflection

I can say I enjoyed the whole process of my graduation project. Getting to read and learn so much theory behind what I enjoy the most of design was inspiring and fulfilling. I missed contact with people in context at the beginning of the project because I was so immersed in my literature research. This is something I would change if I had the chance. Executing a participatory research from the start would have been a bigger challenge with worthy rewards.

I am convinced of the value of Participator Design and the role of designers in social innovation. What I was not sure about was how much real interaction and influence I could have as a designer in addressing societal issues in the current context of the city, especially in the public sector. I am very pleased with the personal insights I take from the development of my project. I can now identify the skills and spaces that I have as a designer interested in social innovation to act and propose on. I have finally found a professional area that fits with my personal interests and ambitions.

Carrying out a large project by myself is something I knew I could do, but I did it in a way which I am satisfied with, and which got me to try new methods and approaches. It was tough to not have a project partner to bounce ideas with the whole time, because I could talk about the topics I researched for days. But the opportunity of attending the Communities and Technologies conference in Vienna, gave me the chance to exchange ideas with researchers on data literacies, communities and technologies. I had many insights from that exchange which definitely had a direct impact on my project and its development. It was also rewarding to feel that I had valuable knowledge to share, and questions similar to the ones expressed by other researchers.

There are a great number of gaps which I think Design for Interaction graduates can act upon, bridging from theory to practice, from concept to implementation, from government to citizens. We have the skills, training and methods to connect these voids. Strategic design is doing it for business, we need to do it for society too. This way we can be smart citizens in smart cities.

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