

Inculcating a sense of stewardship and responsibility towards urban trees amongst citizens

*Using i-tree technology as a means to facilitate active
participation of local communities in urban forestry*

MSc. Graduation Project

Deeksha Ramchandani
Strategic Product Design, TU Delft
February 2022

Title

Inculcating a sense of stewardship and responsibility
towards urban trees amongst citizens

*Using i-tree technology as a means to facilitate active
participation of local communities in urban forestry*

Author

Deeksha Ramchandani
5194032

Project

Master's Graduation Project
February 2022, Delft

Programme

MSc. Strategic Product Design
Faculty of Industrial Design Engineering
Delft University of Technology

Chair

Dr. Rebecca Price
*Assistant Professor, Transition Design
Department of Design Organisation, and Strategy*

Mentor

Prof. ir. Jeroen van Erp
*Professor of Concept Design
Department of Human-Centered Design*

External mentor

Prof. J.R.T van der Velde
*Associate Professor, Landscape Architecture
BK, TU Delft*

**"The climate emergency requires radical change
but we have to start from where we are. It is not a
problem we can "solve" but rather a predicament we
must navigate with responsibility and urgency."**

*– Jon Ardern
Co-Founder, Superflux*

ACKNOWLEDGEMENT

This Graduation Project marks the end of my Master's journey in TU Delft. I started studying Strategic Product Design in February 2020, a few weeks before COVID forced us in our student rooms for months on end. These two years were nothing short of an adventure. Adjusting to life in Netherlands and life in COVID all while chasing deadlines was a roller coaster ride. But the highs on this ride made all the lows worth going through. I have met the most amazing people here, without whom this project wouldn't have been possible.

I would like to thank my supervisory team—Rebecca, Jeroen and René for being so encouraging and inspiring no matter what.

To Rebecca, thank you for being the most kind, sensitive and appreciative teacher I have ever had. My respect and admiration for you has only grown since the beginning of the project. I am so grateful for all your support.

Thank you Jeroen, for constantly challenging me and pushing me to do better. Your insights have always made me go that extra mile for improvement. Thank you for all your ideas and advice that never cease to amaze me.

To Tanu, Mumma, Papa and Daksh, thank you for being the reason behind my happiness. Everything I do is to make you all feel proud. You all are my strength, my inspiration and literally my whole world. I love you!

Raunaq, you are my rock! I cannot imagine this journey without you. I am always in awe of your hard work, resilience and intellect. Thank you for being the most patient listener and the best confidant.

I want to thank my whole family back in Udaipur, Rajkot, Toronto and USA. Your faith in me makes me want to work harder.

To all my friends in India and in Delft who supported me, gave me feedback and helped me in small and big ways throughout the project, I am so grateful for you all.

I want to express my deepest gratitude to all the interviewees, residents of Tiny House, Dordrecht and the respondents of the surveys for their time and their inputs.

Lastly, a big hug to all the Trees...You make our cities liveable!

EXECUTIVE SUMMARY

Cities are in an urgent need to adapt to the impacts of climate change, particularly, high temperatures and heat stress. Urban Forests are the most effective means of climate adaptation. However, the multiple benefits of urban trees are highly undervalued in the urban contexts. This project focuses on positioning urban trees as effective agents in improving the overall liveability of cities. The premise of the project lies in the fuzzy front end of the innovation process where the i-Tree technology is being redeveloped for its effective adoption in Netherlands. The goal of the project is to synchronize the technical potential of i-Tree as a tool and communicate the benefits of trees to multiple stakeholders in the process.

The methodology involves conducting extensive literature review in the field of urban forestry and public participation in urban forestry practices. The literature review helps in highlighting some of the key problems causing the lack of public participation. The preliminary research is followed by a questionnaire for citizens. This survey is conducted to understand their perceptions about urban trees and their management. Multiple interviews are conducted with experts and citizens to dive deeper into the systemic challenges associated with urban forestry. The interviews are followed by two case studies that examine the relationship of citizens with urban trees. After these steps, the problem is reframed to three main areas: the top down approach in urban forestry practices, the gap of knowledge between stakeholders and the

focus on planting trees instead of their maintenance. The overall design direction aims to address these problems through a series of interventions across the system of urban forestry. The concept introduces a public awareness campaign to bridge the knowledge gap between citizens and other stakeholders. The campaign is proposed to stretch over a duration of 10-11 months with several touchpoints along the way for citizens to get enthusiastic about the idea of maintaining and taking care of urban trees. The touchpoints aim to target events like Dutch Design week, Boomfeestdag (Tree Festival) and Springsnow festival. To make the awareness program desirable and interesting. A podcast series and a guide is developed called "How to befriend a Tree?". A concept for the i-Tree Eco tool is proposed which communicates tree benefits in a way that is comprehensible by all the citizens. All the touch points lead the audience of the campaign to the digital platform of i-Tree Netherlands which helps people become caretakers of trees easily.

The research looks at public participation through the perspective of city authorities and other public and private actors. It is recommended to look into the citizen-led initiatives of urban forestry and forms of collaborative governance. Future research can shift from a user-centred perspective to a more-than human perspective forging new relationships of humans with the urban forests consciously considering our impact on urban trees.

CONTENTS

1. Introduction	
1.1 i-Tree 2.0 NL Project Context	2
1.2 Project Scope	3
1.3 Project Approach	6
2. Research Part A: Literature Review	
2.1 Urban Forestry	10
2.1.1 What are Urban Forests and Urban Forestry?	10
2.1.2 Challenges faced by Urban Forests	11
2.1.3 Importance of Urban Forests	12
2.1.4 Measuring Urban Forest benefits using i-Tree tools	13
2.2 Role of Stakeholders	14
2.3 Public Participation in Urban Forestry	16
2.3.1 Best Practices of Public Participation around the world	16
2.3.2 Importance of Public Participation	18
2.3.3 How are citizens currently placed in city's operations?	20
2.4 Understanding the needs of citizens	22
<i>Key Insights</i>	24
3. Research Part B: Interviews, Survey, Case Studies	
3.1 Survey for citizens	28
3.2 Expert Interviews	30
3.3 Case Study - Tiny House Tussentij	32
3.4 Case Study - IVN Nature Education	36
<i>Key Insights</i>	38
4. Problem re-framing	
4.1 Knowledge gap between the stakeholders	42
4.2 Strong participation and Sense of Stewardship	44
4.3 Problems to be addressed	46
4.4 Design Direction	47
5. Design Strategy and Concepts	
5.1 Institutional Frameworks	50
5.2 Public Awareness Campaign	56
5.3 "How to befriend a Tree?"	62
5.3.1 Guide	62
5.3.2 Audio Podcast Series	63
5.4 i-Tree Netherlands: Platform and Tool	66
5.4.1 i-Tree Platform for all citizens	66
5.4.2 i-Tree Eco tool	68
5.5 Gamification: Motivation and Engagement	72
5.6 User Journey and different touch points across the campaign	74
6. Evaluation and Discussion	78
7. Recommendations and Conclusion	84
<i>References</i>	86
<i>Appendix</i>	88

CHAPTER 1: **INTRODUCTION**

1.1 i-Tree 2.0 NL Project Context

1.2 Project Scope

1.3 Project Approach

1.4 Thesis Structure

1. INTRODUCTION

1.1 i-Tree 2.0 NL Project Context

In the face of increasing weather extremes, Dutch Cities must adapt to deal with the impacts of climate change especially higher temperatures. Changes are needed in the urban environments not just in the physical realm but also transitions in policy and governance and the resilience of urban communities. Green spaces, particularly urban forests are one of the most effective means of climate adaptation. Trees can help in reducing the impacts of prolonged periods of heat stress and problems caused by Urban Heat Island phenomenon. **The ubiquity of trees in cities positions them as 'essential workers' for resilience-building in urban communities.** Beyond the cooling benefits, the urban forest offers added benefits to urban water management, air quality, biodiversity, health & wellbeing, and overall urban liveability. Urban Forest can be understood as the entire mosaic of trees in urban public open spaces (van der Velde, R., 2021). Planning urban landscapes with trees can increase the property value and attract tourism and business (UNFAO, 2016). i-Tree is a peer-reviewed software suite from the USDA Forest Service that provides urban forestry analysis and benefits assessment. It has been released as international public domain software. It is currently being developed to effectively measure and monitor the contribution of urban trees to mitigate climate change risks. Developing accurate and climate zone-specific datasets within the i-Tree model tool will equip planners, designers, and greenspace professionals to realise urban forests more effectively for climate adaptation (van der Velde, R., 2021).

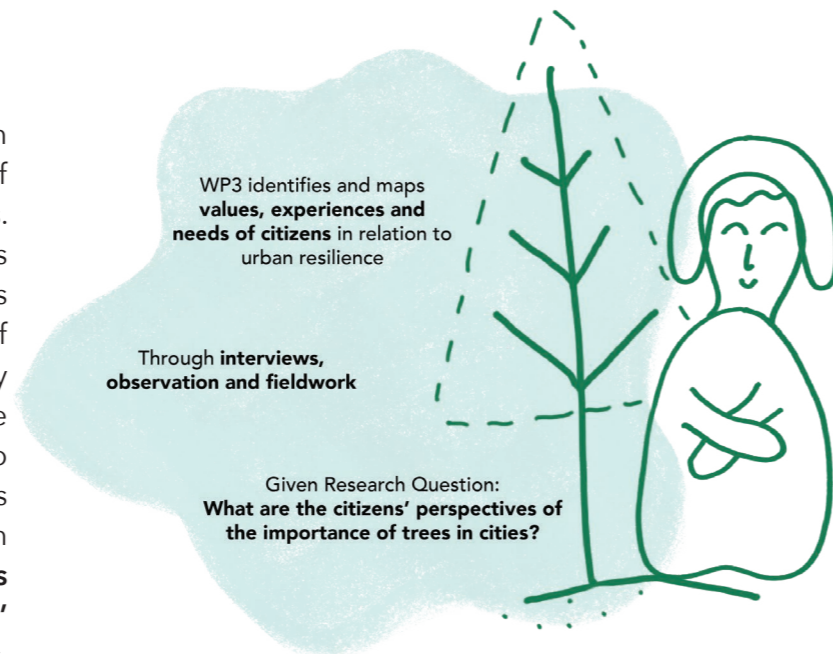


Figure 1: Overview of the given problem area and suggested methods

In this case, it is important to understand the potential of i-Tree technology and develop applications that create value for stakeholders by solving problems caused by climate change. The focus of this project lies in the first stage of Work Package 3 of the entire research work plan. The adoption and success of i-tree cannot be assumed on the performance benefits of trees alone. To avoid the obsolescence of i-Tree that could be caused by a 'technology push', there is a need to employ co-design techniques to map the needs and interests of citizens. **In WP3 the focus lies in incorporating broad stakeholder participation at various stages of design and implementation of i-Tree tool.** This includes making sure that citizens are actively involved as a valued party in the process and result of the project. **Active participation of stakeholders would begin with understanding the values, experiences and needs of citizens and municipalities in relation to urban climate resilience.** The involvement of designers is to ensure that all stakeholders are part of the setting in an inclusive and constructive manner (van der Velde, R., 2021).

1.2 Project Scope

Planning and acting on issues of people's living environments (like urban forestry) have shifted from abstract public interest to active public engagement. Including citizens in the planning of urban greening is based on the importance of exchange of knowledge and transparent communication between the stakeholders (Konijnendijk van den Bosch, C. et al., 2005). But there is a tendency to involve citizens in a passive way with no plans of long-term engagement to the development of solutions. There is a need of shift in the mindsets of local authorities from just planting trees to investing in the future of livable cities. Local people are a mine of knowledge and experience which can lead them to generate possible creative ideas if given a chance. Involving people would not only encourage them to take care of their green surroundings but also re-engage them with their surroundings and each other (Konijnendijk van den Bosch et al., 2005). Another reason to involve public is to increase the awareness and appreciation of the benefits of urban forests. Helping the people develop a connection with trees is also the first step towards improved environmental education of youth.

When involved in the planning and decision-making of public space development, citizens value the following:

(i) They typically expect to influence decisions and have an impact; (ii) Residents might feel that the most important stage to involve them is at the point at which planning goals are set, in particular, at the local level; (iii) Once involved, people want to have a view on what happens with their input and how decisions are taken.

If this is not followed up, it can lead to disillusionment and anger other (Konijnendijk van den Bosch et al., 2005).

In practice, however, people's involvement is often limited to the implementation stages of plans and projects. It is common to find city authorities keen to put people's participation on their agendas, while only using them as data gatherers and providers of ideas for solutions, without giving them any feedback about what happens with their input. It is common to find people engaged in voluntary work and in raising money for a project, but having little or no say in the way a project is chosen, what the priorities are and how subsequent action may be taken (Konijnendijk van den Bosch, C. et al., 2005).

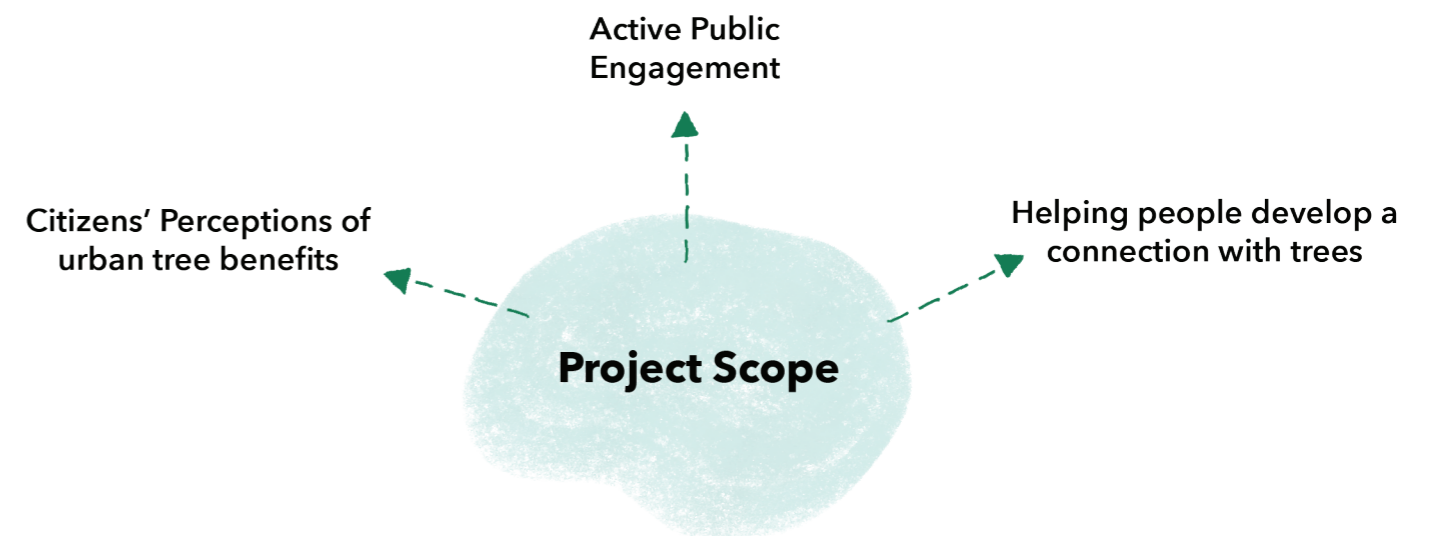


Figure 2: Overview of the Project Scope

1.2.1 Opportunities

The participation of citizens in urban forestry is driven by the common-sense realisation that the urban trees and greenspaces can only be planned and managed successfully with the direct involvement of its ultimate end-user – the urban dweller. (Konijnendijk van den Bosch et al., 2005)

With time, professionals and experts have recognised the need of active public participation in the decision-making about urban forests . **A prime opportunity lies in experts regarding the public as equal and capable stakeholders who possess creativity and enthusiasm about urban forests.**

“City authorities and experts have the opportunity to repackage themselves, not as technical experts of climate resilience in cities seeking public endorsement for completed plans, but as facilitators intent on assisting communities to translate their needs and preferences regarding the urban forest into action on the ground.”

(Konijnendijk van den Bosch et al., 2005).



RESEARCH QUESTION

How can the implementation of i-tree tool help in bridging the knowledge gap and removing friction between the Dutch city authorities and the urban communities by combining the two mindsets (top-down and bottom-up)?

1.2.2 Problem Definition

The problem that is aimed to solve with the design solution of this project is the **tension between the vertical (top-down approach of city authorities) and horizontal (led by citizens) mindsets while developing strategies to create resilient cities.** The challenge is to combine these two approaches, represent the values and interests of urban communities and communicate them to the multiple stakeholders involved in the development of i-Tree tool.

1.2.3 Sub-research questions

- How can citizens be involved in the front end of the design of cities as the ‘experts of their experiences’?
- What are the implications of i-tree tool on the perceptions of Dutch citizens and decisions of city authorities?
- How can i-tree support and strengthen the strategies of urban greening in Dutch cities?

1.2.4 Objectives

- Developing a framework of the network of stakeholders, their interactions with each other and the position of i-tree in strengthening these connections to actively engage citizens in urban forestry:
 1. To effectively communicate the benefits of urban trees and urban forestry initiatives to citizens.
 2. To ensure that citizens are involved with the project at a personal level to create a sense of belonging within their surroundings.
- To map the values, experiences, needs and perspectives of citizens for the development of a climate resilience strategy.
- To make the benefits of urban trees relatable, tangible, and specific for the multiple stakeholders especially citizens.

1.2.3 Project Approach (Methodology)

The left side represents gathering data and analyzing it. The data is gathered through questionnaires filled by citizens, interviews with experts from municipalities, consultancies, NGO and citizens. The right-hand side represents ideation and conceptualization. What connects them is called 'bridging'. The right-hand side is the inspiration-driven approach led by a designer.

It draws primarily from the future and can be based on anticipatory thinking. This is where Speculative design is used to imagine possible futures in the organisation of urban forestry practices in cities. **The gap between research and design is the result of the differences between the roles and responsibilities of stakeholders, ownership over parts of process, areas of expertise or their values.** This research focuses on how i-Tree can be modeled and

applied to bridge the knowledge gap between the municipalities and citizens. When talking about the future experience, the real experts are the people that the designer is attempting to serve through the design process (in this case, citizens). **This shift in mindset helps invite the future 'users' of urban forests into the front end of design process and design solutions with them not just for them.**

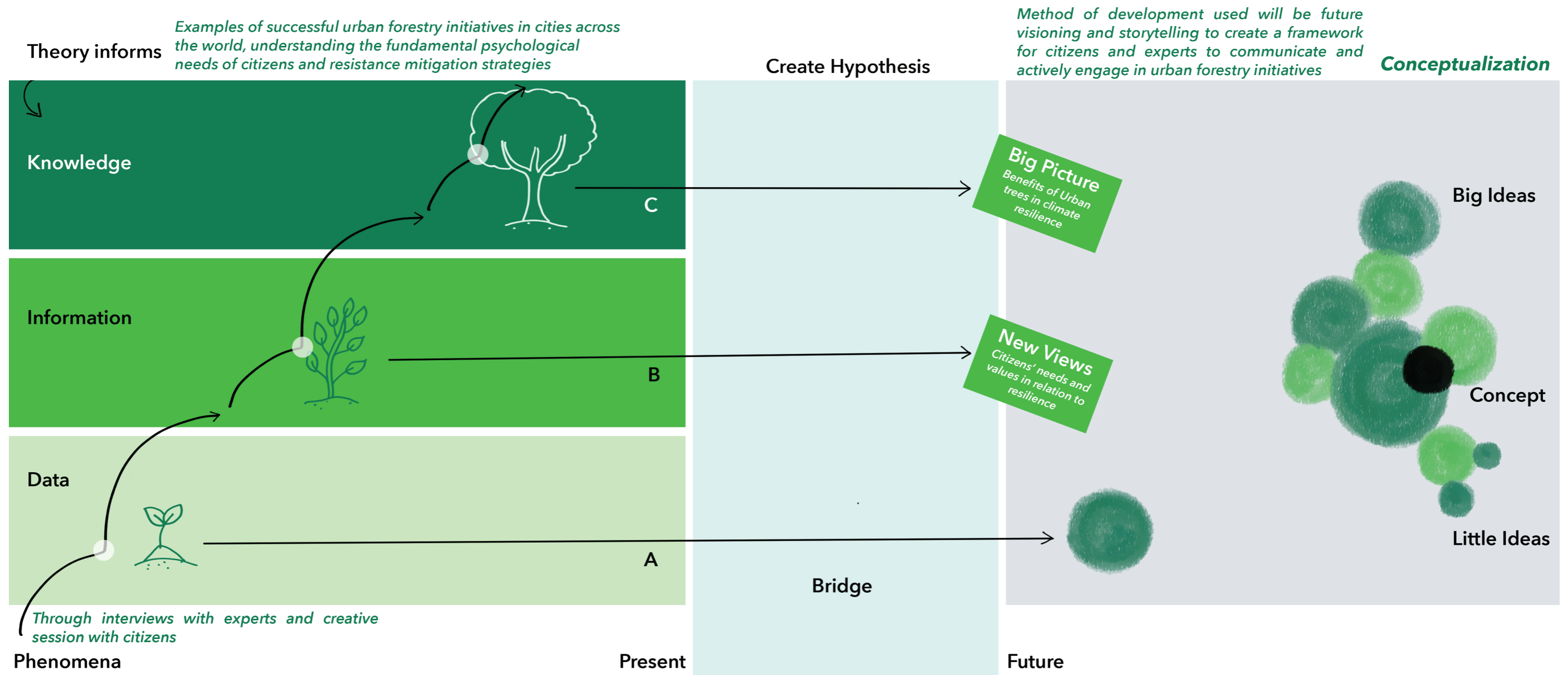


Figure 3: Overview of the project methodology and approach
Source: Sanders L., & Stappers P.J. (2012) Convivial Toolbox

CHAPTER 2:

RESEARCH (Part A: Literature Review)

2.1 Urban Forestry

- 2.1.1 What are Urban Forests and Urban Forestry?
- 2.1.2 Challenges faced by Urban Forests
- 2.1.3 Importance of Urban Forests
- 2.1.4 Measuring Urban Forest benefits using i-Tree tools

2.2 Role of Stakeholders

2.3 Public Participation in Urban Forestry

- 2.3.1 Best Practices of Public Participation around the world
- 2.3.2 Importance of Public Participation
- 2.3.3 How are citizens currently placed in city's operations?

2.4 Understanding the needs of citizens

2. PART A: LITERATURE REVIEW

2.1 Urban Forestry

2.1.1 What are Urban Forests and Urban Forestry?

The term urban forest refers to all trees and shrubs in a densely populated, urban area. An urban forest can include trees in private properties (like yards), on streetways, parks, green spaces and in watersheds (Safford, H. et al., 2013). In many regions, urban forests are the most extensive, functional, and visible form of green infrastructure in cities. The definition of Urban Forestry as given by British National Urban Forestry Unit (NUFU 1999) describes it as a 'planned approach to planting and management of trees and woods in towns. **However, Urban Forestry is not just the management of different elements of urban green structures but can also be seen as a more integrative approach involving multiple stakeholders and partnerships. It is a strategic approach that requires development of long-term policies in order to provide multiple benefits to urban societies** (Konijnendijk van den Bosch et al., 2005). Figure 4 shows urban forestry's multifunctional emphasis that incorporates socio-cultural, ecological and economic aspects.

It demonstrates the different actors involved in urban forestry programs. The participatory and partnership character of urban forestry is highlighted through the mention of different public and private actors. Urban forestry actors within the public sector include politicians, government officials or municipality employees, and local public workers. Private actors include consultancies, the business sector (real estate companies), user or interest groups, as well as citizens in general (Konijnendijk van den Bosch et al., 2005).

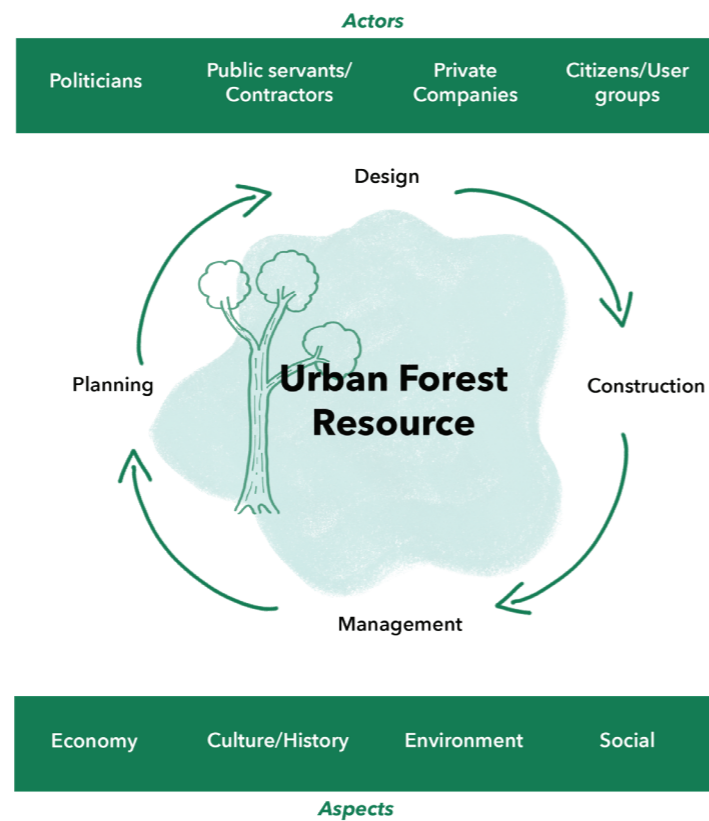


Figure 4: The Urban Forestry Model representing actors and activities related to Urban Forestry
Source: Adapted by Randrup (2005)

Other important actors that can be seen in the front lines of organizing urban forestry initiatives are non-profit or non-governmental organizations that facilitate the interests of various groups including municipalities and groups of citizens. Although they are not represented in this Urban Forestry model, their role in the planning and executing of various urban forest projects cannot be ignored. The importance of NGOs and NPOs in the development of urban forests are discussed further in the next section.

2.1.2 Challenges faced by Urban Forests

The urban forests in Dutch cities have been facing challenging conditions for tree growth (Cities4Forests, 2019). Some challenges like urbanization, deforestation and climate change effects are why municipalities are struggling to manage their urban green spaces. (Galle, N., 2020). Maintaining tree-based resources is critical. However, there seems to be insufficient resources for proper care in cities in the face of competing infrastructural and spatial demands, like housing shortage. Another challenge being faced by the urban forests is the exposure to high temperatures, pollutants, and problematic growing conditions (van der Velde, R., & Dijkstra, L., 2019). Emerging challenges related to densification of urban forests, climate change mitigation, urban biodiversity, health & wellbeing and energy transition are also expected to have a significant impact on the urban forest in the Netherlands in the future (van der Velde, R., & Dijkstra, L., 2019). In some cases, there is a communication gap between stakeholders which can lead to unclarity regarding the maintenance responsibility of urban trees. **Continuous maintenance is needed by the trees so that they can survive in the hot temperatures of the city. Without proper care and maintenance, urban trees are at a risk of living fast and dying young which can cause wastage of money and resources** (Galle, N., 2020). Detailed tree metrics and tree inventory of a city are required to understand the benefits provided by individual trees and their planting sites. This knowledge is needed for the long-term monitoring of urban trees for effective urban green space decisions. (Galle, N., 2020).

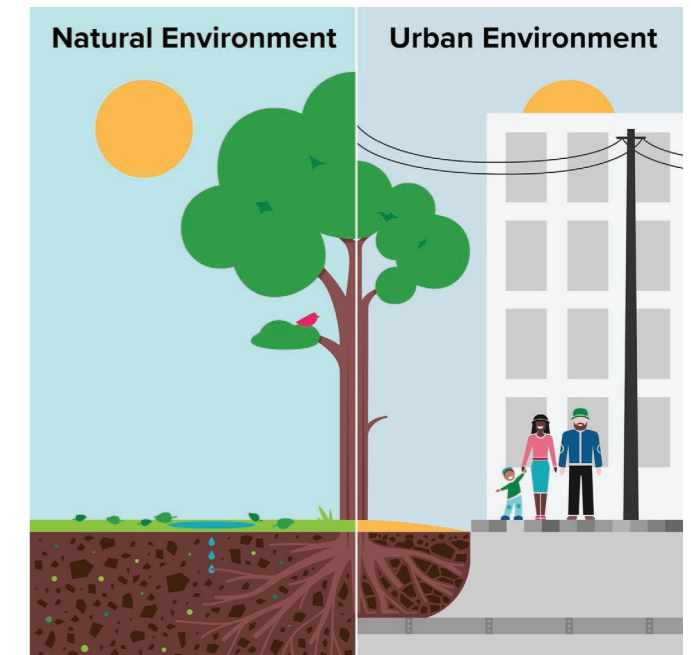


Figure 5 Challenges faced by urban trees
Source: City4Forests

Therefore, it is crucial that the knowledge of urban forests be elaborated to deal with their development in a proactive way and the full potential of urban green spaces can be realised (van der Velde, R., & Dijkstra, L., 2019). Urban trees are often viewed as a financial burden or risk. Residents living around trees might complain about the size of trees and the nuisance caused by them. The reasons behind this could be the incomplete understanding of benefits provided by urban trees. **The multiple benefits of urban trees can be undervalued by the public and by the decision-makers.** (Cities4Forests, 2019).

2.1.3 Importance of Urban Forests

As part of a city's infrastructure, urban trees provide multiple environmental, ecological, socio-cultural and economic benefits. They remove pollutants from the air acting as effective air filters and store carbon that is crucial in reducing the impacts of climate change. Other climatic and physical benefits of urban trees include flood prevention, erosion control, wind control and sound control (Konijnendijk van den Bosch et al., 2005). Strategic placement of trees in urban environments can help cool the air by up to 8 degrees Celsius, reducing the need for air conditioning by 30 per cent (UNFAO, 2019). The cooling capacities and thermal benefits of urban forests are key benefits in the face of increasing temperatures in cities.

Social benefits of trees include the increase in recreation opportunities, improvement in people's physical environments and the cultural importance of green spaces. Trees can have important educational value in bringing people, especially children and youth, closer to their natural surroundings. Staying in close contact with trees can help children learn more about nature than in an otherwise artificial environment (Konijnendijk van den Bosch et al., 2005). At a local level, trees can enhance economic development, promote tourism, and improve property values (Konijnendijk van den Bosch et al., 2005).

Some benefits of tiny forests that are not more than the size of a basketball court can make a huge difference by providing shade, attracting plants, animals and insects, and even storing some amount of carbon. The Muziekplein forest is one of seven such ultra-small forests in the Dutch city of Utrecht (Hewitt, E., 2021).

Jeroen Schenkels, a senior advisor for the city of Utrecht on green planning, said that tiny forests potentially are nature-based solutions that can help reducing the effects of heat waves in the city and improve water retention. However, other than that one of the biggest values of urban trees is social. "One of the most important things is that you give people the opportunity to be involved in nature in the neighbourhood"

- Hewitt, E., (2021).



Figure 6: Benefits of Urban Forestry
Source: City4Forests

Climate action plans of cities often incorporate urban forestry as a means to mitigate climate change in their adaptation strategies, recognising the benefits of healthy trees to strengthen a community's ability to withstand climate-related threats. **Active urban forest management strengthens community resilience to climate change impacts and other potential disasters.** Adaptation Strategies like these have the potential to create more livable places to live, work and play (Safford, H. et al., 2013).

2.1.4 Measuring Urban tree benefits

i-Tree is peer-reviewed software suite developed by the USDA Forest Service that provides urban and rural forestry analysis and benefits assessment tools. It was initially released in August 2006 and since then various communities, non-profit organisations, consultancies, volunteers, and students have used i-Tree tools to report data on individual trees, neighbourhood and even entire states (source website). The i-tree tools quantify the environmental benefits of trees in relation to heat cycles in order to strengthen forest management efforts. To fully understand the thermal benefits of a tree, the metrics provided by i-Tree tools apply to different tree species and to the overall performance over the tree's life (van der Velde, R., 2021). The flagship tools for i-Tree include: i-Tree MyTree, i-TreeLandscape, i-TreeDesign, i-Tree Canopy, i-Tree Eco and i-Tree Hydro. The i-tree 2.0 NL project aims to develop accurate tree metrics for optimal cooling performance of various tree species in Dutch cities to help reduce the heat stress experienced by the urban environments.

However, to achieve the desired results of urban cooling, Dutch cities cannot solely rely on data provided these tools. **The i-Tree application must also be usable and integrated with the functioning of various stakeholders involved in the urban greening efforts.** Effective adoption of the tool and its synchronous application is one of the key objectives of Work Package 3.

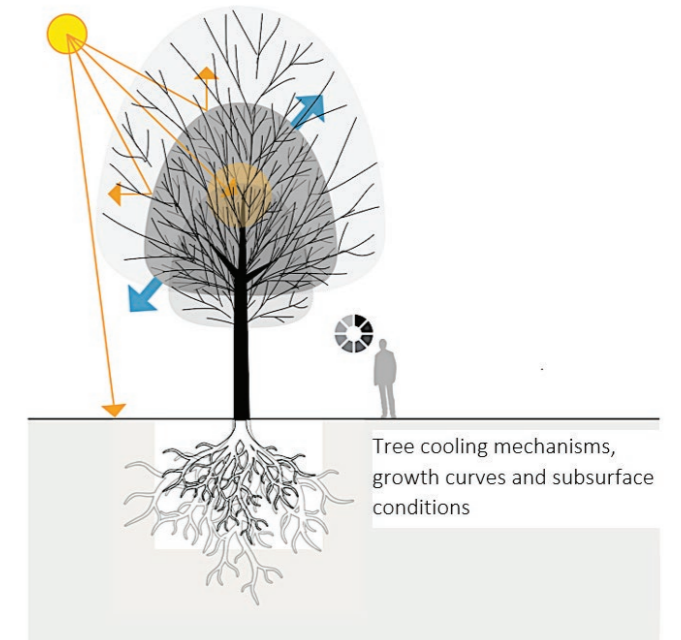


Figure 7: Cooling mechanisms of trees
Source: van der Velde, R. (2021)

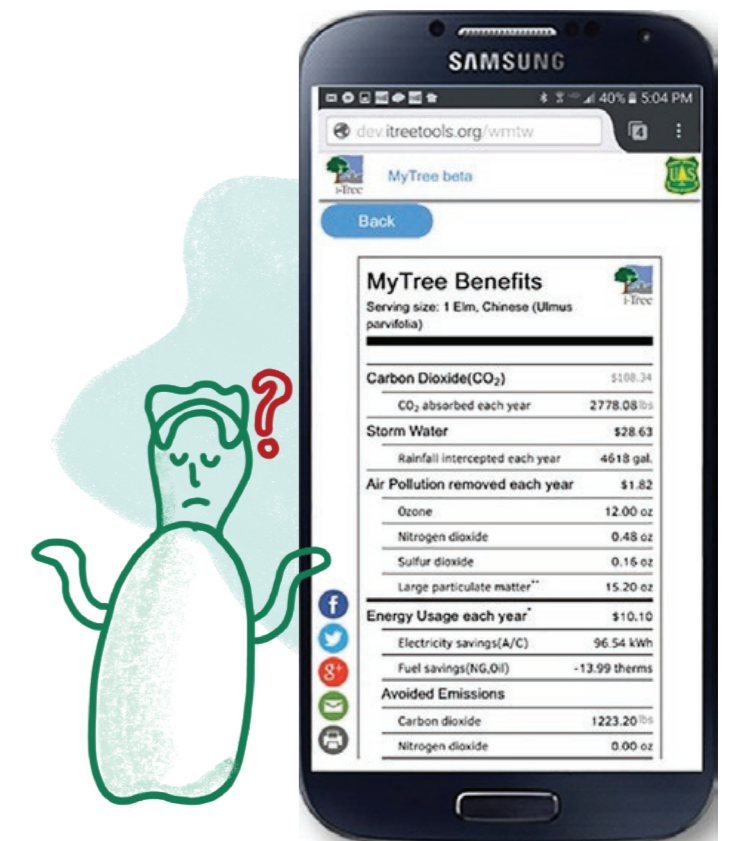


Figure 8: My Tree beta
Source: itreetools.org

2.2 Role of Stakeholders

When it comes to planting and maintaining urban forests, collaboration and partnerships amongst stakeholders are as important as the physical fabric of the cities. The social and organisational processes involved in WP3 of the i-Tree project extend beyond the traditional key players. This phase (WP3) seeks to identify and map values, experiences, and needs of citizens in relation to urban trees with other project partners (van der Velde, R. (2021). **The aim is to bring citizens and organisations together around a shared vision of resilient cities and affirm their long-term commitment towards the joint action of green cities.**

In the wide framework of an urban context, it is necessary to have a clear distinction between stakeholders and partners in the urban forestry projects. Within this framework stakeholders are those groups of individuals and organisations who have an interest in urban trees and forests either as potential contributors or because they might be affected in some way by its management. This could include citizens and non-profit organisations. On the other hand, partners could be agencies or individuals who are directly involved in the management process (Konijnendijk van den Bosch et al., 2005); in this case, municipalities, consultancies, and tree officers.

The municipalities' role is to establish the right policy context at local level, city level or national level. In most urban forestry projects, municipalities also provide with financial resources. They can be involved in acting of planting more trees and coming up with urban re-development projects.

Consultancies and firms provide human, technical and intellectual resources (Konijnendijk van den Bosch et al., 2005) by offering their expertise in the field of urban forestry, architecture, landscape design, co-designing methods and others. Some of these services include involving citizens in projects for their validation. Their role highly depends on who their clients are and what are their expectations. For example, in case of a project funded by municipality to create a public park, the consultancy's role will depend on what the municipality's intentions are about public participation, role of trees and other planning related objectives.

An overview of the roles of different stakeholders in urban forestry practices is shown in Figure 9. The role of citizens as an important stakeholder in urban forestry projects is explored in the next section.

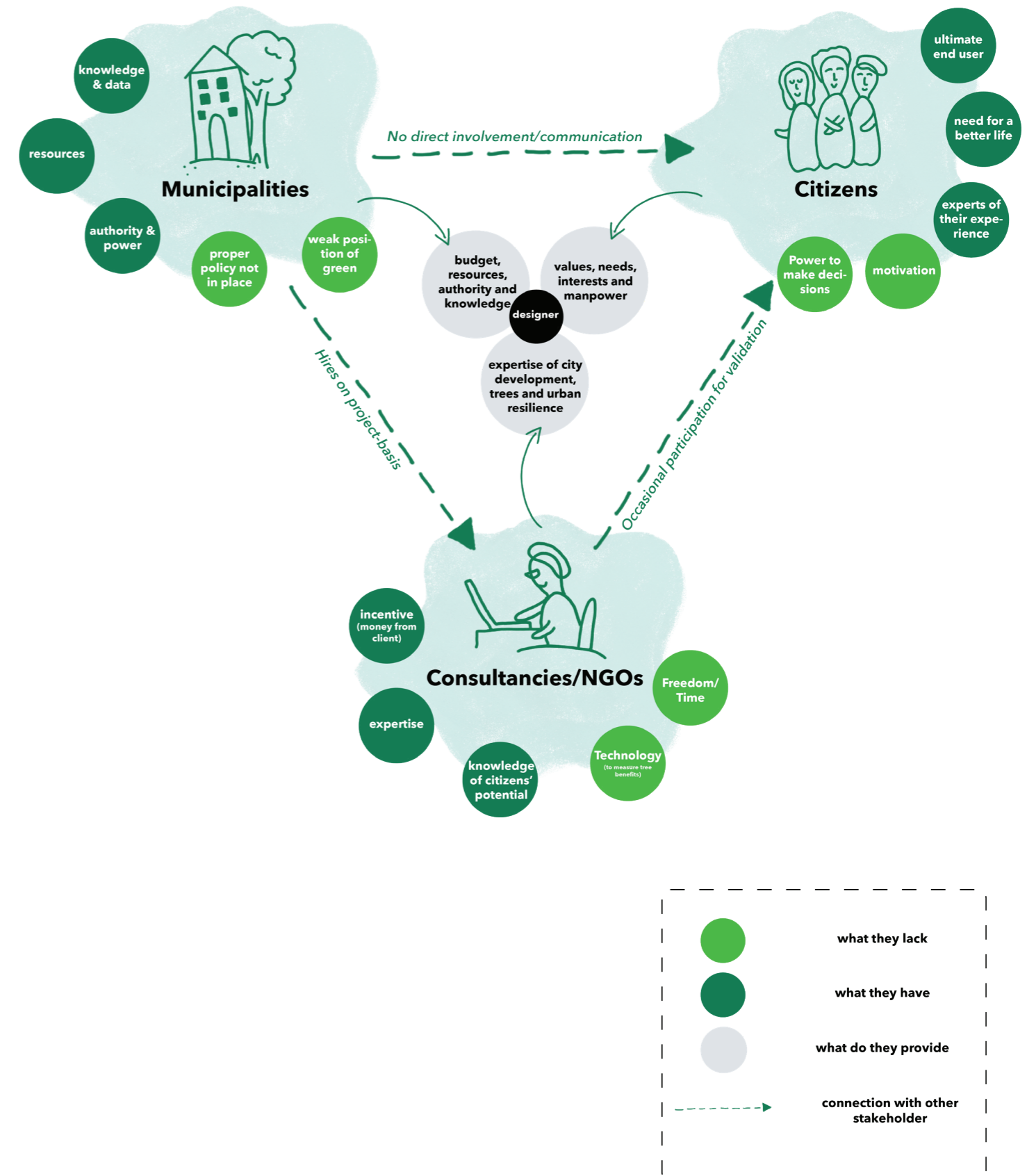


Figure 9 Map of Stakeholders and their interactions with each other in relation to urban trees

2.3 Public Participation

2.3.1 Best Practices of Public Participation around the world

The risks posed by excessive urban heating and climate change have put large cities under threat. However, cities also provide numerous opportunities for urban development, education, and lifestyle changes.

As mentioned in previous sections, trees can prove to be powerful tools for tackling urban challenges while improving the well-being of citizens. Some inspiring examples of urban resilience and the importance of public participation in urban forestry initiatives are briefly explained in this section. (Food and Agriculture Organization, 2018)

Vitoria-Gasteiz, Spain

The peri-urban land in Vitoria-Gasteiz was perceived by the people to be “nobody’s land” which led to its abandonment. To address this issue, the city authorities initiated a reforestation plan to imbibe a sense of ownership amongst citizens. The citizens, local businesses and educational institutes came together to plant thousands of trees to create a green belt. The project provided a great opportunity for people from different backgrounds to come together and be a part of city level initiative. The city authorities believed that participation was essential to increase the care for natural environment (Food and Agriculture Organization, 2018).



Phoenix, Arizona

Rapid Urbanization since 1950’s has contributed to the growth of urban heat and reduction of urban trees and greenspaces. To reduce the effects of urban heat, city management is working with non-profit organizations, businesses, and local communities to bring back shady trees and urban greenspaces. The city has an online community tree map called ‘MyTreeKeeper’ wherein citizens can look up the benefits of over 93,000 trees around the city. Initiatives like ‘Love your Block’ and ‘Resilient PHX’ have been developed for the local communities and volunteers to support small scale efforts (Food and Agriculture Organization, 2018).

Halifax, Canada

The city of Halifax in Nova Scotia faced a series of disasters including a beetle infestation, storms and hurricanes that destroyed several urban trees. There was a need for a forestry initiative to restore the loss of trees. Citizens were actively involved in the planning of this initiative by conducting multiple educational events. Towards the implementation of the plan multiple workshops were conducted for the people to gather input from communities. Around 500 citizens participated in an online survey to set the public priorities of the plan (Food and Agriculture Organization, 2018).



Karura Forest, Nairobi

A forest in Kenya which was once crime-ridden and unsafe has been transformed into a commercial forest full of opportunities by and for the local communities. Public Participation in Karura forest has proved important in solving environmental problems. A partnership between the Community Forest Association and the locals has benefitted the citizens by providing employment opportunities through an increase in tree planting (Food and Agriculture Organization, 2018).

Beijing, China

The capital city of China was at a risk of becoming a concrete jungle without the presence of any urban forests. “Forest City Program” initiative was launched in 2004 with an objective of improving the living conditions in cities by planting more trees. The afforestation initiative involved social workers in the plantation activities. It was noted that public satisfaction with this initiative that was aimed to be 72.3% was in fact 94%.

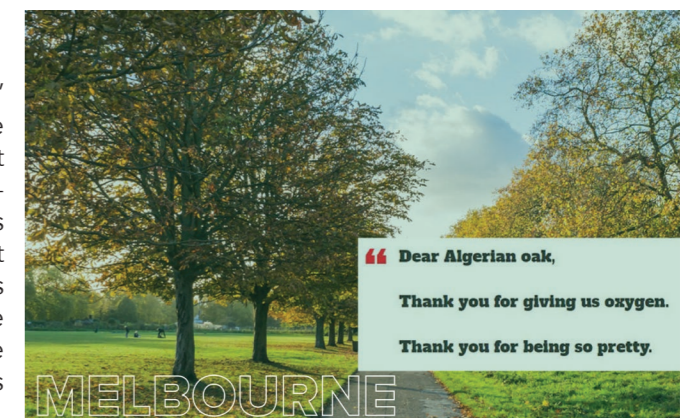


City of Ljubljana, Slovenia

Most of this city’s forest is privately owned so it is important to educate people about the benefits of the trees and involve people in forest-related activities. The forest provides a very interesting outdoor environment for forest education. Several seminars and initiatives are organized to raise the awareness of the benefits of trees. Involving citizens through education ensures the maintenance and improvement of the city’s forest (Food and Agriculture Organization, 2018).

Melbourne, Australia

The Australian city of Melbourne started “Email a Tree” campaign to improve the connection of citizens with the trees. The city didn’t just want to inform the public about their plans but involve them actively in the decision-making process as well. Collaboration with public was important to identify local solutions specific to different streets and localities. Innovative and interactive techniques were employed to enhance public engagement like value mapping and photo sorting. The process was time-intensive and costly, but it yielded positive results for the city’s improvement (Food and Agriculture Organization, 2018).



2.3.2 Importance of Public Participation

In the recent past, cities have experienced a shift in the planning of urban forestry projects from serving the public to actively engaging them throughout the process. Great emphasis has been put on the exchange of knowledge and development of ideas along with all relevant stakeholders including citizens and community groups (Van Herzele, A. et al., 2005).

Urban citizens possess huge potential in delivering creative ideas and a wealth of skill and manpower to the planning and maintenance of urban trees. The idea of public involvement of is crucial to the long-term success and overall quality of urban trees and to maximize their benefits for the local community. Some of the major objectives of involving citizens in urban forestry practices are mentioned below:



Enhancing the Quality of Decision-Making

Plans created by decision-makers can benefit immensely by using local knowledge. People are the experts of their own environment where they live, work and play. Moreover, it is important for communities to be heard in the initial stages of planning when their opinions can be considered and implemented. **Building consensus in the decision-making stages can enhance the quality of the decision and help stakeholders share the same vision for their locality.**



Encouraging a Sense of Ownership

Transformative outcomes can be achieved if **citizens start feeling that the trees surrounding them are 'theirs'**. If people feel that they 'own' a couple of trees outside their house because of their own input and efforts towards them, it will become a part of their routine to take care of those trees. Involving people in planning and decision making is also a way for them to invest more time in taking care of the trees. This way people can be actively engaged with their own surroundings and participate in local initiatives for urban greenery.



Raising awareness of Urban Forestry Related Issues

Involving more and more citizens in urban forestry initiatives can be extremely effective in increasing awareness about trees and their benefits. If public is actively involved in the planning and maintenance of the trees in cities, they would appreciate trees' values and develop a mutual understanding about urban greenery with other stakeholders involved. **Connecting people with trees can prove to be a vital first step towards educating people about other environmental challenges like climate change.**

“No longer is the resilient city the result of a centralized strategy designed by public authorities; rather, it is the consequence of interactions between city-dwellers who now have the ability to self-organize.

The city-as-platform helps residents to get in touch with each other and helps to accustom people to risk and resilience.”

(Martin-Moreau, M., & Ménascé, D., 2018).



Figure 10: Groene van Prinstererlaan
Source: Harthoorn, J. (2018, May 25). Brabants Dagblad.

Example of weak participation in Waalwijk, Netherlands:

An example of a disorganized citizen participation took place in Waalwijk, Netherlands where residents of Groene van Prinstererlaan complained about the nuisance caused by eight lime trees on the street outside their homes. The redevelopment plans of the Grotestraat-oost project were made together with the residents unlike the usual resident involvement at the end of the project. However, participation in the planning and decision-making stage did not guarantee the success of the redevelopment project. In attempt of getting the trees removed, several residents spoke to the city council explaining the inconvenience they had been facing due to the large trees. The municipality agreed to remove the trees but did not take any action towards it. In the municipality's opinion the big trees provide more value to the neighborhood than they cause nuisance. Experts suggested that there is a lack of big, old trees in Waalwijk in comparison to Tilburg and Heusden,

which is why it is necessary that citizens recognize their importance. On the other hand, residents explained that they support the urban trees as long as they do not cause major inconvenience to them. This example indicates the gap in knowledge between the municipalities and local communities. The lack of communication widens the knowledge gap even more which was also the reason for conflict in Waalwijk. There needs and concerns about the trees were not addressed in a proper manner. Another reason was the ad hoc manner of participation where the residents were involved in the beginning of the project but not followed up with in the later stages which led to dissatisfaction, lack of trust and anger amongst the residents. However, the citizens were not convinced with this argument and demanded that the lime trees be replaced with another tree species. The citizens also criticized the decision-making process of the city officials and the lack of transparency in their operations. Harthoorn, J. (2018)

2.3.3 How are citizens currently placed in city's operations?

Public involvement is extensively promoted in connection with planning and management of urban trees and forests. However, participation is often incorporated in an ad hoc manner without clarifying the role and contribution of citizens. Mostly, citizens are engaged in voluntary work associated with urban trees with little to no say in the decision making (Van Herzele, A. et al., 2005). **Public participation is taken for granted and seen as a separate action of getting validation or approval from citizens.** Citizens often feel that they are consulted after all the major decisions have already been taken by the authorities or 'experts'. In the management and maintenance of urban trees, the potential of citizens is highly untapped and rarely recognised (Molin, J. et al., 2016).

Once citizens are involved, it is important for them to know how their inputs are being implemented. Not following up with citizens or not giving them feedback can lead to disillusionment and detachment with the greenspaces. In some cases, it can lead to dissatisfaction or anger. In practice, municipalities put citizen participation in their plans but only use them as data providers for the validation of plans. **They are sometimes used to provide ideas and opinions about the plans but without any proper feedback about what happens with that input.** (Van Herzele, A. et al., 2005).

“If you have to walk to your car every other day with a bucket to scrape the mess off it, the fun is quickly gone”, indicated a woman.”

- A Resident of Groene van Prinstererstraat

Majority of the local communities and social groups are not strong enough to initiate participation or get involved in the planning stages of a project. They need support of agencies and proper guidelines in place for effective involvement. Therefore, city authorities need to bridge this knowledge gap by understanding the needs and interests of citizens in relation urban trees. This is discussed further in the next section.

2.3.4 Understanding the needs of citizens

This section discusses the need of citizens to be actively involved with the planning and decision making about the trees in their surroundings. As mentioned in the earlier sections city authorities need support from the citizens to implement changes in their environment as they (citizens) are the ultimate users of the city's green infrastructure. In this section, we try to understand what motivates active involvement from the citizens' perspective and how this motivation can be sustained for a long-term engagement of citizens with urban trees.

Maslow's Hierarchy of Needs explains that the behavior of citizens is motivated, not just with external conditions (like active participation) but also their personal needs. An elaborate representation of Maslow's Hierarchy of Needs is shown in figure 11.



Figure 11: Pyramid representation of Maslow's Hierarchy of Needs
Source: Desmet & Fokkinga 2020

A study done to understand the implications of Maslow's Hierarchy of Needs in design practice and gain a deeper insight into the fundamental psychological needs of people was analyzed at this point. Desmet P. and Fokkinga S., 2020 introduce a typology of Thirteen Fundamental Needs for Human-centered Design that focuses on user experience and well-being. To create and sustain positive experiences of citizens with urban forests it is vital that the proposed design solution fulfils their psychological needs through active involvement and long-term engagement.

The typology can be used to understand and study the needs of citizens (or even other stakeholders) in the context of urban forestry and urban trees. It can also be used to understand the needs of citizens who are engaged in these initiatives as compared to those who are not. The fundamental needs provide a framework which includes all urban citizens and their context-specific needs in relation involvement with urban trees. An overview of the Thirteen Fundamental Needs is shown in figure 12.



Figure 12: Overview of Thirteen Fundamental Needs
Source: Desmet & Fokkinga 2020

As seen in the best practices of public participation in urban forestry across different countries (Food and Agriculture Organization, 2018), citizens are enthusiastic to participate if they feel like they can have a real impact. It is common for citizens to feel very insecure about the actual impact of their efforts on the plan (Konijnendijk van den Bosch et al., 2005).

“Seeing that your actions or ideas have an impact on the world and contribute to something, rather than seeing that you have no influence and do not contribute to anything.”

- Desmet & Fokkinga 2020

In the coming sections, the need for citizens to have an impact in their surroundings with the actions they take is explored.

CHAPTER 2:

RESEARCH (Part A: Literature Review)

KEY INSIGHTS

- Urban Forestry is more than just the management of different elements of urban green structures.
- Urban Forestry can be seen as an integrative and strategic approach involving multiple stakeholders and partnerships: Urban forestry actors in public sector, private actors, interest groups and citizens.
- Continuous maintenance is needed by urban trees so that they can survive in the hot temperatures of cities. Without proper care and maintenance, urban trees are at a risk of living fast and dying young.
- The multiple benefits of urban trees can be undervalued by both citizens and also by the decision-makers. Urban trees might be viewed as a financial burden or risk by public actors.
- The i-Tree technology must be integrated with the functioning of various stakeholders involved in the urban greening efforts.
- Urban citizens possess huge potential in delivering creative ideas and a wealth of skill and manpower to the planning and maintenance of urban trees.
- Objectives of involving citizens in urban forestry:
 - (i) Enhancing the Quality of Decision-Making
 - (ii) Encouraging a Sense of Ownership
 - (iii) Raising awareness of Urban Forestry
- Citizens often feel that they are consulted after all the major decisions have already been taken by the authorities or 'experts'.
- The typology of universal psychological needs can be used to understand and study the needs of citizens in the context of urban forestry. The coming chapters focus on one of the fundamental needs of: **Impact**

CHAPTER 3: **RESEARCH (Part B: Field Study)**

3.1 Survey for Citizens

3.2 Interviews with Experts

3.3 Case Studies

3.3.1 Tiny House Tussentij, Dordrecht

3.3.2 Tiny Forest, Delft - IVN Nature Education

3. PART B: FIELD STUDY

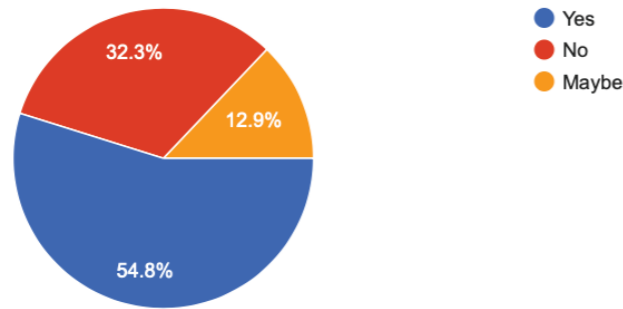
3.1 Survey for Citizens

As part of the preliminary research a survey was conducted to firstly, understand the perceptions of citizens (mostly living in Netherlands) about the greenspaces around them like community gardens, parks, street trees and tiny forests. Secondly, a goal of the survey was to understand citizens' preferences about the greenspaces in their surroundings and how would they improve the quality of these places if given a chance. Lastly, the survey asked about citizens.

knowledge of who is responsible for the maintenance of urban trees. The results of the survey are shown below. As shown in the survey results, most of the respondents live within a kilometer away from the closest greenspace from their home and still feel that it is not enough and there is a need for more green spaces/trees in their neighborhood. However, 61.3% of the respondents have never participated in any maintenance activity of trees/greenspaces around them.

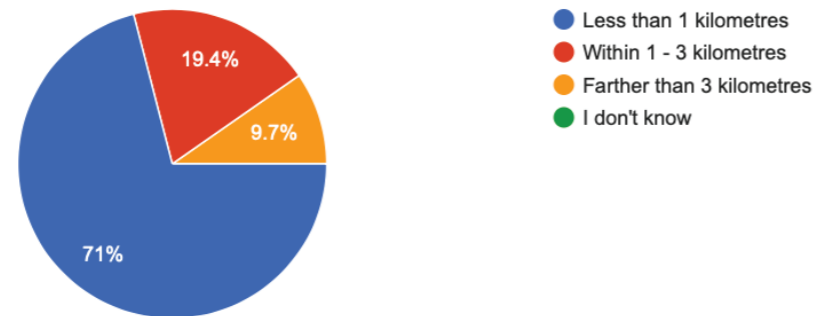
Do you feel the need for more green spaces/trees in your surroundings?

31 responses



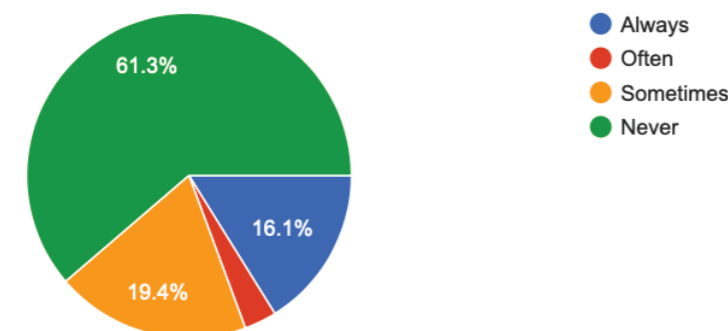
How far do you live from the closest green space or urban forest?

31 responses



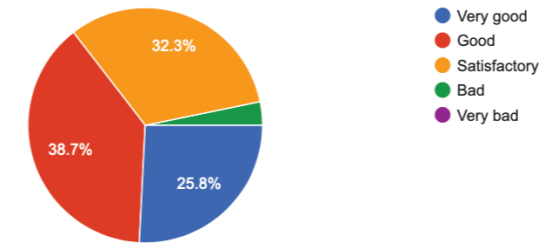
How often do you take part in protecting/maintaining the trees in your surroundings?

31 responses



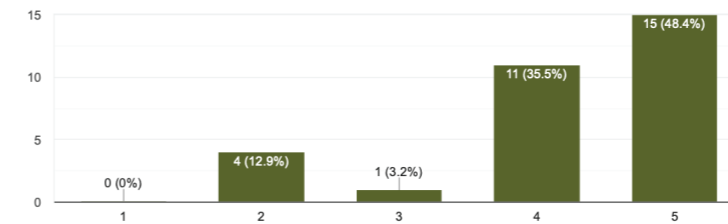
What is your assessment of the quality of green spaces and trees around you?

31 responses



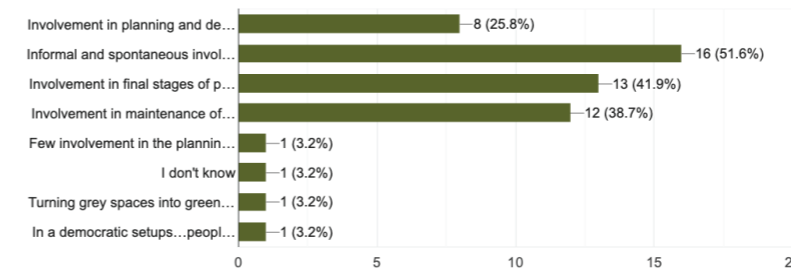
On a scale of 1 to 5, how important do you think is the participation of citizens in the planning of greening Dutch cities?

31 responses



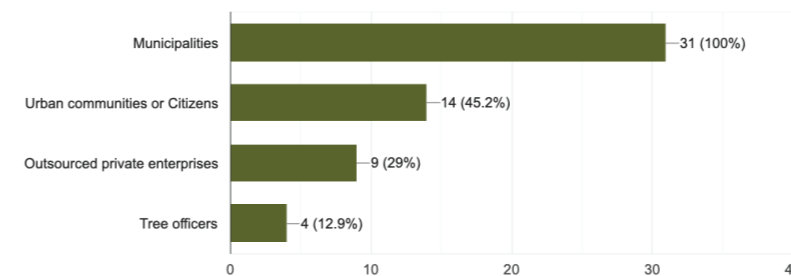
What do you think is the current involvement of citizens in the cities' initiatives towards urban greening?

31 responses



Who do you think is responsible for the maintenance and management of urban trees and green spaces?

31 responses



Mixed responses were noted when asked about the quality of these greenspaces. Some respondents felt that the quality was satisfactory while some felt that it was good and even very good. Interesting responses were noted when asked about how they would improve the greenspaces around them. Some of the responses to that question are highlighted below. The objective for this question was to understand the needs and preferences of citizens in relation their surroundings. The question was framed in this manner to encourage open answers about anything in greenspaces the respondents would like to change and not about a specific aspect. The diversity of answers ranged from vertical forests and increase in biodiversity to interactive and incentive-based spaces.

It was noted that 87.1% of the respondents were aware about the cooling performances of trees and other ecosystem services (ES) like air pollution control and water retention. 48.4% of respondents chose 5 on the scale when asked about the importance of involvement of citizens in the maintenance and planning of urban greening initiatives. Most respondents felt that their current involvement was informal and spontaneous. Lastly, all the respondents believe that it is the municipalities who are responsible for the maintenance and management of urban trees with 45.2% also chose urban communities for this responsibility.

3.2 Interview with Experts

As part of the preliminary research, interviews were conducted with experts from consultancies, a manager and a community leader to understand their experiences with public participation in urban forestry. The first two interviews give insights from a consultancy's perspective.

Robert Kruijt

*Landscape Architect, Wonderwoods
Arcadis*

- Client for Wonderwoods is a private real estate company and the design vision is provided by the municipality of Utrecht.
- The municipality conveyed the citizens' needs and interests to the designers at Arcadis.
- Arcadis conducted public presentations for people living around Wonderwoods to provide them with updates about the project.



Lior Steinberg

*Urban Planner & Co-founder
Humankind City*

- There are two kinds of citizens: Active citizens who are already part of greening initiatives. They are easiest to reach out to. Inactive citizens (most population) who are not interested in being part of city initiatives.
- The main challenge is to attract more and more people to participate.
- People like to discuss 'values' and 'meanings' but not technicalities of the issue.
- There is a complicated mindset when it comes to 'sharing'. "Who owns what?" "Who has what role?"
- Gap of knowledge is a big challenge
- Top-down is the fastest approach to get things done but for long-term acceptance and satisfaction bottom-up is a more effective approach.
- In most cases, after a project is done with a municipality they don't have a long-term engagement with the citizens. This leads to lack of trust from the citizens' side.



The questions asked were about their roles and responsibilities towards public participation, interaction with municipalities and their approach towards participation.

The third interview was conducted with a Project Manager from an NGO to understand the working of their organisation, their goals, and their interaction with municipalities during their process.

Rick van Cleef

*Project Manager, Tiny Forest Project
IVN Nature Education*

- Importance of one key experience in nature in your youth has the potential to plant a seed in your heart for a lifetime
- Participation of public is important because when you take care of a tree/garden your heart opens up to the nature.
- Challenge - Cities can't handle being the only ones responsible in maintenance of urban trees, they need support from more people
- Municipalities might not engage with the Tiny Forest after the project is done. Groups of 'interested' people are mostly responsible in maintaining the plantations.
- Most of the time it is the same group of people who are always interested in greening initiatives
- Giving training to people who are not interested and retaining their engagement is a challenge
- It is difficult to get youth interested in greening initiatives because the organisation is still traditional in its ways and its image.



Ruud Guldmond

*Resident, Tiny House, Tussentij
i-Tree Climate Arboretum, Dordrecht*

- Tiny House Residents live in the area rent-free and in return, give something back to the community.
- All the residents take care of the trees. They take turns to water the trees every week. It's called "Tree Turn".
- It takes a lot of time and efforts to take care of the trees.
- Residents have felt pity for the trees because they are in boxes.
- Incentive - At first it was just having a good view of trees but now they feel responsible for them.
- "Those trees cannot live without our caring"
- "Through this project I look at other trees differently".



3.3 Case Studies

3.3.1 Tiny Houses, Tussentij, Dordrecht



Figure 12: Residents of Tiny House showing the Climate Arboretum

Project Background

A TU Delft project team from the Faculty of Architecture, led by dr. J.R.T. (René) Van der Velde, is conducting research on the cooling performance of trees and urban microclimate regulation. For this study, urban trees have been planted in different arrangements to develop insights into the performance of different tree configurations in various urban situations. The climate arboretum in Tussentij, Dordrecht has 75 tree species planted in mobile containers in the configuration shown in figure 15. The Urban Climate Arboretum in Dordrecht is part of a development location, which is currently inhabited by a few tiny houses. **The inhabitants of these tiny houses are a vital part of the arboretum: they take care of the trees while the research team conducts the measurements.** The trees are planted in containers and can easily be moved together with the tiny houses once the development of the location starts.

Tussentij is a temporary location for the trees. Another location in Dordrecht was originally intended to be the climate arboretum for these 75 trees. However, due to some problems with the residents at the planned location which arose due to knowledge gap and misunderstanding in relation with welcoming greening the location was changed to Tussentij.



Figure 13: Details on individual trees



Figure 14: Glimpse of the Tiny House, Tussentij

About the residents

Tussentij provides space for three Tiny Houses out of which residents of one house Ruud Guldmond and Hester Annema have been living there since the beginning of the climate arboretum project. Both are actively participating in the maintenance and care of trees along with the other residents. Others are relatively newer residents but have already taken up their responsibility of watering the trees regularly. An interview was conducted with Ruud Guldmond to understand the practicalities of the project and how they got involved with the research. The interview gave a deeper insight into the context and was used as a basis to create an interactive group interview session with all the residents at the location in Tussentij.

Objective of the session

Since the residents are the primary caretakers of all the 75 trees, they seem to have developed a personal relationship with them. As mentioned by Ruud in the interview, the trees are like their children who need constant care and attention. **Despite the time and efforts needed in the maintenance process, the residents have been persistent in watering and pruning the trees.** Most of the residents have had almost no prior experience with urban trees except Hester who is a Landscape Architect and holds interest and expertise in this area. She has led the project from its beginning and is responsible for encouraging other residents to do the same. The objective of the session conducted was to understand the relationship of residents with the trees and how it has evolved over the length of the project.



Figure 15: Drone shot of the Climate Arboretum trees in Tussentij

Session Description

The session was conducted on-site amidst the climate arboretum trees in Tussentij. Four residents participated in the session including Ruud and Hester. It began with a tour of the area where Ruud talked about his experience with the trees and the development of the project over the last 2 years. He described how the watering mechanism evolved and became easier with a bag system that allows the water to reach the roots more efficiently without any spillage. Ruud was accompanied by another resident, Hannel who had moved in recently and had already developed a close relationship with the trees.

The session was mostly informal where the residents described their overall experience of living in Tiny Houses surrounded with trees. **They mentioned having weekly turns to water the trees which they refer to as "Tree turn"**. Since there were multiple interviewees, the interview process was modified into a more interactive session to encourage insightful responses from everyone. Each question was written on a separate sheet of paper and the participants were given sticky notes to write their answers. After each question, the participants were asked to elaborate on their answers which encouraged interesting discussions amongst them.



Figure 17: Residents filling up their responses outside the Tiny Houses

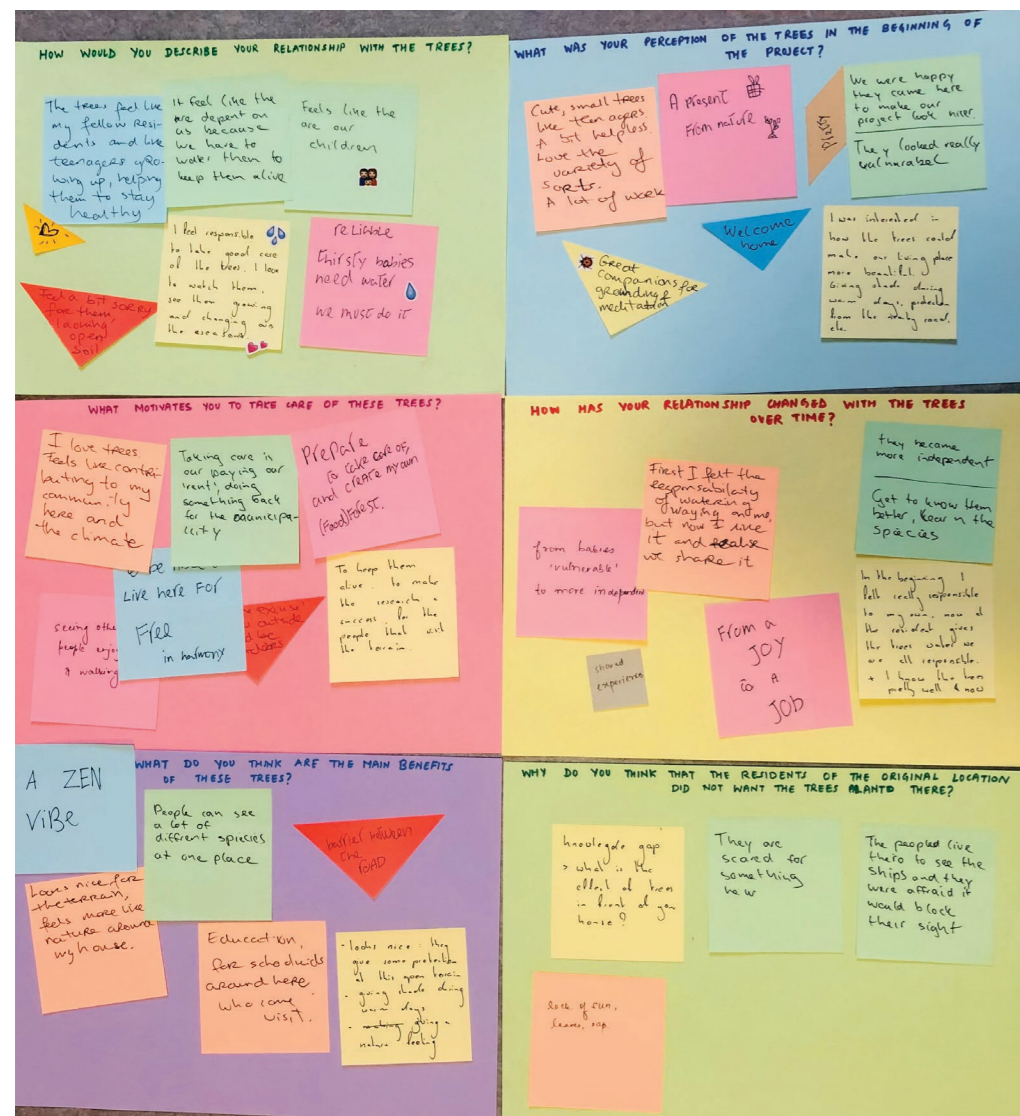
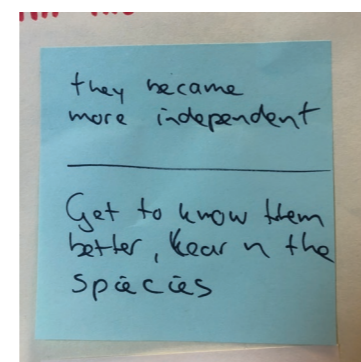
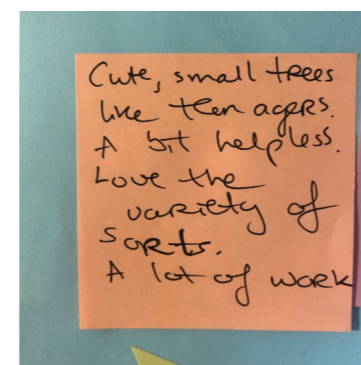
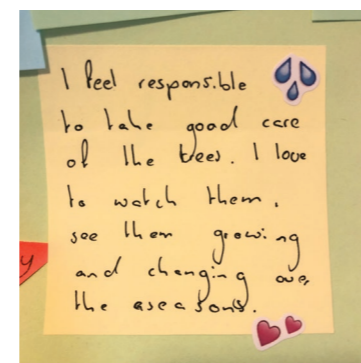


Figure 16: Images of the responses of residents of Tiny House after the group interview session



Questions asked in the session:

- How would you describe your relationship with the trees?
- What motivates you to take care of the trees?
- What was your perception of the trees in the beginning of the project?
- How has your relationship with the trees changed over time?
- What do you think are the main benefits of these trees?
- Why do you think the residents of the original location did not want the trees planted there?

Summary of responses from the session:



Trees are like our children. They are dependent on us and need help to stay healthy



Taking care of the trees is a learning experience and also a way to contribute to the community



From a responsibility to a shared experience of taking care of the trees. Knowledge gain about maintenance



They not only provide aesthetic benefits but also educational and security benefits

3.3.1 Tiny Forest, Delft, IVN Nature Education



Figure 18: Details of the Tiny Forest of Schoemaker Eiland



Figure 19: Project Manager explaining the instructions for maintaining and cleaning Tiny forests



Figure 20: A volunteer at IVN cleaning up the dried leaves in Tiny Forest

Background

IVN is an organization for Nature Education and Sustainability that operates in Netherlands. IVN's mission is to bring nature closer to people, so that they can embrace their natural surroundings again and take better care of it. Their activities are divided into four major themes, 'Nature Health', 'Child and Nature', 'Nature in the neighborhood' and 'Nature and recreation'.

The Tiny Forest initiative was started by IVN in 2015 to help local communities and school children to create accessible little pockets of forests in highly urbanized areas of Dutch cities. One of the main objectives of Tiny Forest initiative is to engage children and youth in every step of the process where they can learn how to maintain it and follow nature lessons in the outdoor classroom. The Tiny Forest in Schoenmakersplantage, Delft was developed in 2018. The amount of carbon it sequestered in 2020 was close to 108.1 kgCO₂/year. (Effects of Tiny Forest, ivn.nl)

A one-day program was conducted at Schoenmakersplantage, Delft to provide basic training and education to a few volunteers about the benefits and maintenance of Tiny Forests. An introductory presentation was conducted which was followed by an afternoon of working in the Tiny Forests. The volunteers were involved in helping in the cleaning of tiny forest by pulling out weeds and pruning the trees.



Figure 21: Volunteers cleaning up the entrance to the Tiny Forest

Objective of Participating:

An interview was conducted with the Project Manager of Tiny Forest, South Holland, Rick van Cleef before the day of training. The insights gained from the interview were combined with the experience of being a participant for the training day which were based on observations and conversations with other volunteers. Since most of the volunteers were attending IVN's event for the first time, their experiences and motivations in relation to urban trees were valuable.

Key insights from the session:



Importance of one key experience with trees in your youth that plants a seed of care for a lifetime



Maintenance of trees needs manpower for which municipalities need people's support



The incentive of meeting new people and working towards a shared goal can actively engage youth



Difficult to get youth interested because the organisation is still traditional in its ways and its image.

CHAPTER 3:

RESEARCH (Part B: Field Study)

KEY INSIGHTS

- The survey results showed that most respondents felt that their current involvement was informal and spontaneous. The respondents believed that it was the municipalities' responsibility to maintain and manage the urban forests.
- 61.3% of the respondents have never participated in any maintenance activity of trees/greenspaces around them.
- Interviews with experts from private sectors showed that public participation is disorganised in most cases. This is due to multiple reasons. The most important being: Lack of interest among citizens to actively participate
- Lack of interest is because of two main reasons: the gap of knowledge between stakeholders and the complicated mindset when it comes to 'sharing'. "Who owns what?" "Who has what role?"
- The municipality often fails to engage the citizens for a longer term after the project is completed. Lack of engagement can lead to distrust amongst citizens.
- Interview with NGO revealed that it is difficult to get youth interested in greening initiatives because of the traditional way of participation.
- Cities can't handle being the only ones responsible in maintenance of urban trees, they need support from urban citizens.
- Citizens need to feel responsible for the trees first before they can actively engage in their care and maintenance.
- The incentive of meeting new people and working towards a shared goal can actively engage youth. Citizens value the community feeling while participating in social or environmental related initiatives.

CHAPTER 4: **PROBLEM REFRAMING**

4.1 Knowledge gap between stakeholders

4.2 Strong participation and Sense of Stewardship

4.3 Problems to be addressed

4.4 Design Direction

4. PROBLEM REFRAMING

4.1 Knowledge gap between stakeholders

Municipalities, consultants, and environmental policy makers face a dilemma: the scientific knowledge about urban tree benefits is a necessity but not sufficient in the urban context where different stakeholders are involved. When taking decisions about people's environment it is crucial to consider the citizens' values and preferences. However, perceptions of citizens can be based on personal biases, anecdotal evidence, and assumptions about the impacts of urban trees (Okrent, 1998; Renn, 2006). From the interviews with consultants and a project manager, it was found out that municipalities are increasingly using public participation processes to enhance communication through methods like public presentations and testing plans and concepts with the citizens. The aim of the public participation is to communicate knowledge about decisions and hear public opinions before final decisions are made.

However, as in the case of the climate arboretum, Dordrecht, there is a possibility of citizens disagreeing with the final decisions made by authorities because the plans don't meet with their expectations and preferences of urban trees. Apart from the conflicting interests of stakeholders, communication between them is also highly dependent on the internal and external context. **The internal context is the experiences, knowledge, and attitudes of stakeholders. The external context is the setting up of the participatory processes in a specific situation.** For successful public participation and citizens' engagement with urban forests there is a need of a mutual understanding, and development of long-term relationships among stakeholders. This can be achieved by a two-way communication of listening and speaking by all the stakeholders, especially municipalities and citizens.

Glicken (2000) makes a general division of three types of knowledge in participatory processes (Figure 22): cognitive, experiential, and value-based knowledge. Cognitive knowledge is based on the technical expertise of individuals. This type of information is presented by scientists and other experts and involves factual arguments about issues like heat stress caused by global warming, climate change and the most effective methodologies for assessing the damage caused. According to Innes (1999) cognitive knowledge often constitutes only a small part of the information that experts use to their arguments about the problem in hand and decide what strategies might work. The second type of knowledge is experiential. It is based on personal experiences developed by individuals. In the area of urban forestry, this knowledge is usually conveyed by residents or users. The third type of knowledge called value-based knowledge. It based on social interests, perceptions of social value and the 'goodness' of actions.

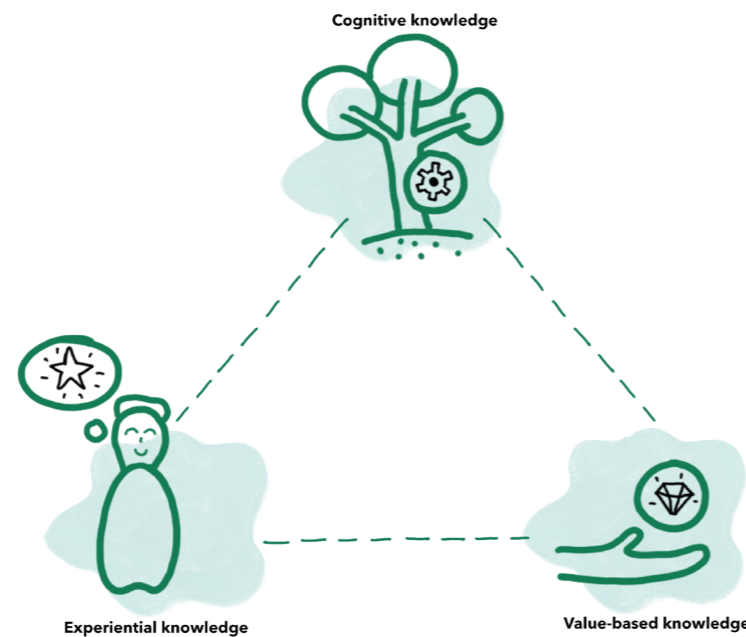


Figure 22: Overview of Three types of knowledge in participatory processes

In the project scenario, **information provided by i-Tree tool is the cognitive knowledge used by municipalities and consultants** who need the scientific information in the planning of projects. **The citizens living in urban areas provide the experiential knowledge** related to urban trees and their perceptions and experiences with urban forestry. **The value based knowledge is the moral aspect of being a part of urban greening initiatives** and helping the community in the planning and maintaining of urban trees. The inclusion of experiential and value-based knowledge in participatory processes raises the importance of stakeholder identification and participation (Glicken J., 2000).

The case mentioned in section 2.3.3 from Waalwijk, Netherlands focuses on the negative impacts of trees on residents of Groen van Prinstererlaan. The residents stressed on the need to control and regulate the trees or remove them completely since the trees were creating problems because of their big size. The municipalities failed to see the negative impacts of the lime trees as they were focused on the ecosystem benefits the trees provided. The second case of climate arboretum in Dordrecht focuses on the negative impacts of the 75 trees that were supposed to be planted for research purposes. However, an ecosystem benefit of trees that is providing shade was seen as a negative effect by the residents since it would block the sunlight coming to their homes (as told by residents of Tiny House Tussentij). Based on interview with the residents of Tiny House, Tussentij they were initially excited about the idea of 75 trees being planted in their premises for their appearance and aesthetic benefits.

From the interviews and case studies, it was noted that ecosystem services like air pollution control, climate change mitigation, carbon sequestration and cooling performance of trees are not benefits mentioned by residents. But the ES Benefits lie at the core of decision makers.

The challenge is to represent ES benefits to all the stakeholders explicitly with emphasis on its social and health impacts.

Summing up the problem of knowledge gap between stakeholders:

- Conflicting interests of different stakeholders are an outcome of knowledge gap between them.
- Communication between stakeholders is dependent on internal and external context: internal context being the experiences and values of stakeholders and external being the set up of participatory processes.
- There are three types of knowledge in participatory practices: cognitive, experiential and value based.
- The inclusion of experiential and value-based knowledge in participatory processes raises the importance of stakeholder identification and participation (Glicken J., 2000).
- The citizens living in urban areas provide the experiential knowledge related to urban trees and their perceptions and experiences with urban forestry.
- The challenge is to represent ES benefits to all the stakeholders explicitly with emphasis on its social and health impacts.

4.2 Strong Participation and Sense of Stewardship

As described in previous sections, a common argument for participation of citizens within the planning and implementation of urban forestry projects is that participation improves the ability to deliver effective and agreeable outcomes. A study done by Handberg, Ø. (2018) compares weak participation, medium participation and strong participation based on the degree of involvement of stakeholders and the time of their involvement in the process. **Weak participation is about consultation**, where decision makers (municipalities or consultancies) are informed by the stakeholders (citizens) of their opinions. **Medium level participation is consent** where the decision makers seek validation or approval about the plans and the stakeholders may have a choice to veto the decisions. Lastly, **strong participation is where citizens take the lead and make actual choices with some constraints**.

“People are more likely to support and implement decisions they have participated in making”

- Schultz et al. (2011, p. 662)

Until now, it is established that active participation of stakeholders improves the quality of decision-making and the overall success of the outcome. Handberg, Ø. (2018) summarizes key mechanisms through which participation may improve the outcome, in this case, the quality of urban trees. These mechanisms are knowledge, empowerment, transparency, and sense of ownership. The argument of better knowledge improving the relationship between stakeholders was discussed in the previous section (section 4.1). This section describes how strong participation can establish a sense of ownership amongst citizens about for urban trees and specifically, trees in their surroundings. According to the endowment effect (Kahneman et al., 1991), **“we tend to value an object more when we possess it”**. To improve the quality of decisions about urban trees, there is a need to induce a sense of ownership amongst citizens. This sense of ownership can be achieved by an increased degree of involvement of citizens in the planning and overall care of trees.

As it was mentioned in the interview with one of the consultants, it was mentioned that there is a complicated mindset that stakeholders have about “sharing”. Citizens are not entirely aware of who “owns” or “controls” the urban trees in public areas. However, the importance of a sense of ownership amongst citizens can prove helpful in the overall success of urban forestry initiatives and the quality of urban trees. Feelings of ownership have strong behavioral effects (Pierce, JL. Et al., 2003). Psychological ownership is a state in which individuals feel as though the target of ownership or a piece of that target is “theirs” (Pierce, JL. Et al., 2003). Based on the research by Pierce, JL. Et al. (2003) there are three key experiences through which psychological stewardship arises. These experiences are, controlling the ownership of target (object), coming to know the target intimately, and investing the self in the target. **In case of urban trees, where their maintenance and care are a crucial aspect of a long-term relationship, “stewardship” of trees fits the context more accurately than “ownership” of trees.**

Controlling the stewardship of trees - The objects over which individuals can exercise control are more likely perceived to be theirs (Pierce, JL. Et al., 2003). Control also includes regular and easy access to the object. **Accessibility to a tree and the assurance that a tree is “theirs” can enhance the feeling of stewardship amongst citizens.**

Coming to know the trees intimately - Citizens can feel attached and psychologically tied to trees if they are actively engaging in getting to know the trees better (Pierce, JL. Et al., 2003). **The more information possessed about trees, the more intimate and stronger is the connection between the individual and trees(s).** An increase in the familiarity and knowledge about trees leads to more attachment (Pierce, JL. Et al., 2003).

Investing self into trees - Investing time, efforts and energy into the care and maintenance of trees can increase the sense of stewardship in citizens. An example of this is the Tiny Forest initiative described in section 3.3.1. where maintenance is used as the first step for new participants to become familiar with trees. The feeling of responsibility towards trees, either perceived or real leads to feeling of stewardship (Pierce, JL. Et al., 2003).

Tuiny Forest example

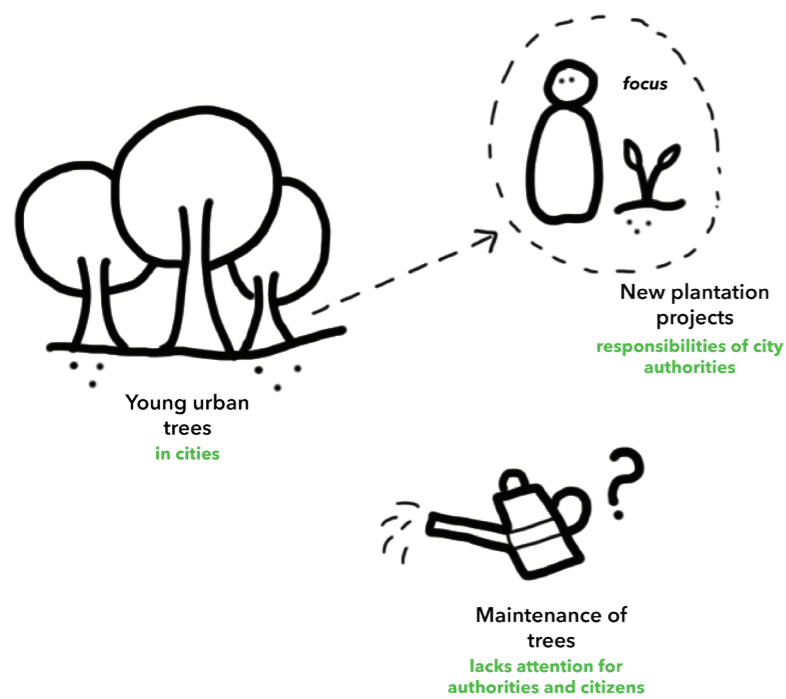
A Tuiny forest is a ready-made package to plant your own forest in your garden. It is a product IVN Nature Education which comes with five native tree, five shrubs, seeds and soil. The project manager from IVN described the kit as a huge success as around 1000 Tuiny Forests got sold out within weeks of its launch and have been in high demand ever since. The idea of having your “own” tiny forest in your garden was appealing to a lot of individuals. The kit comes with a step-by-step manual with plantation instruction and tips for maintaining adding to the convenience and accessibility of the product.

Source: <https://www.ivn.nl/tinyforest/tiny-forest-worldwide>



Figure 23: Overview of three key experiences through which psychological stewardship arises

4.3 Problems to be addressed



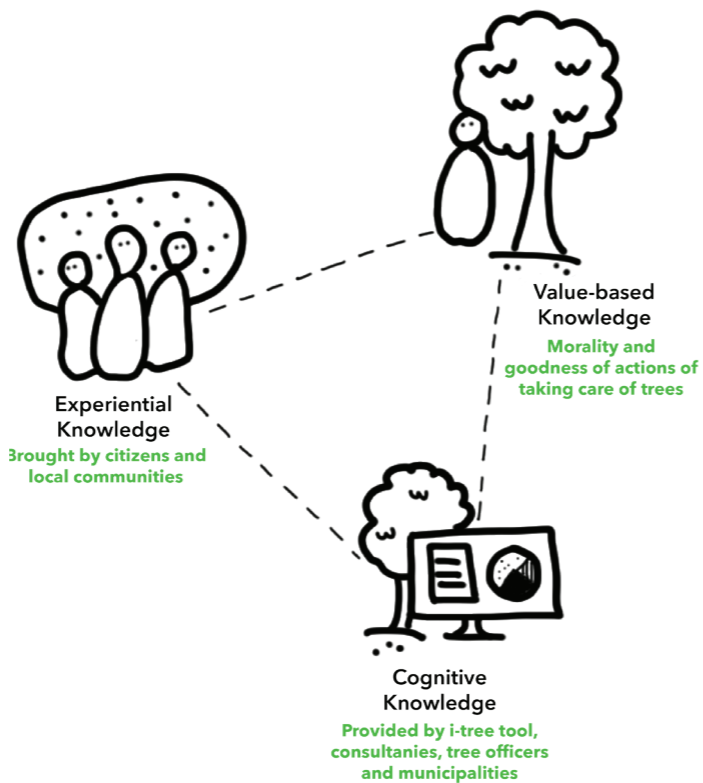
Focus on planting and not maintenance

Municipalities need to understand the success metrics of trees should not just be defined in number of plantation projects but also the care and maintenance of young trees that need more attention. The need for manpower and support should be communicated clearly by municipalities to encourage active participation in maintenance activities.



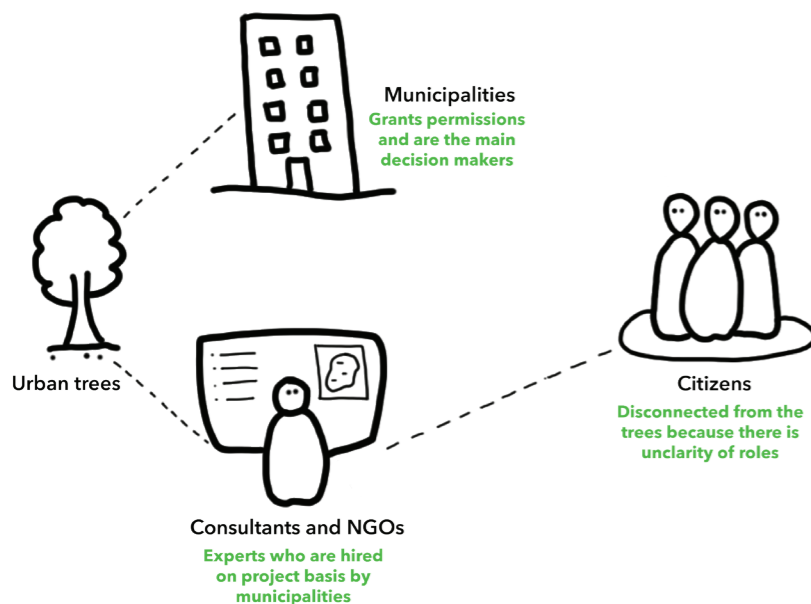
Knowledge gap

Currently, there is a lack in the synergy of the three types of knowledge brought to the table by different stakeholders. For long-term success of urban trees, the knowledge gap between stakeholders need to be bridged.



Top-down approach

The current process of decision making and the top-down approach in the governance of urban trees need to be transformed. There needs to be a shift in the relationship of stakeholders and their roles in urban greening to accommodate the opinions and preferences of local communities.

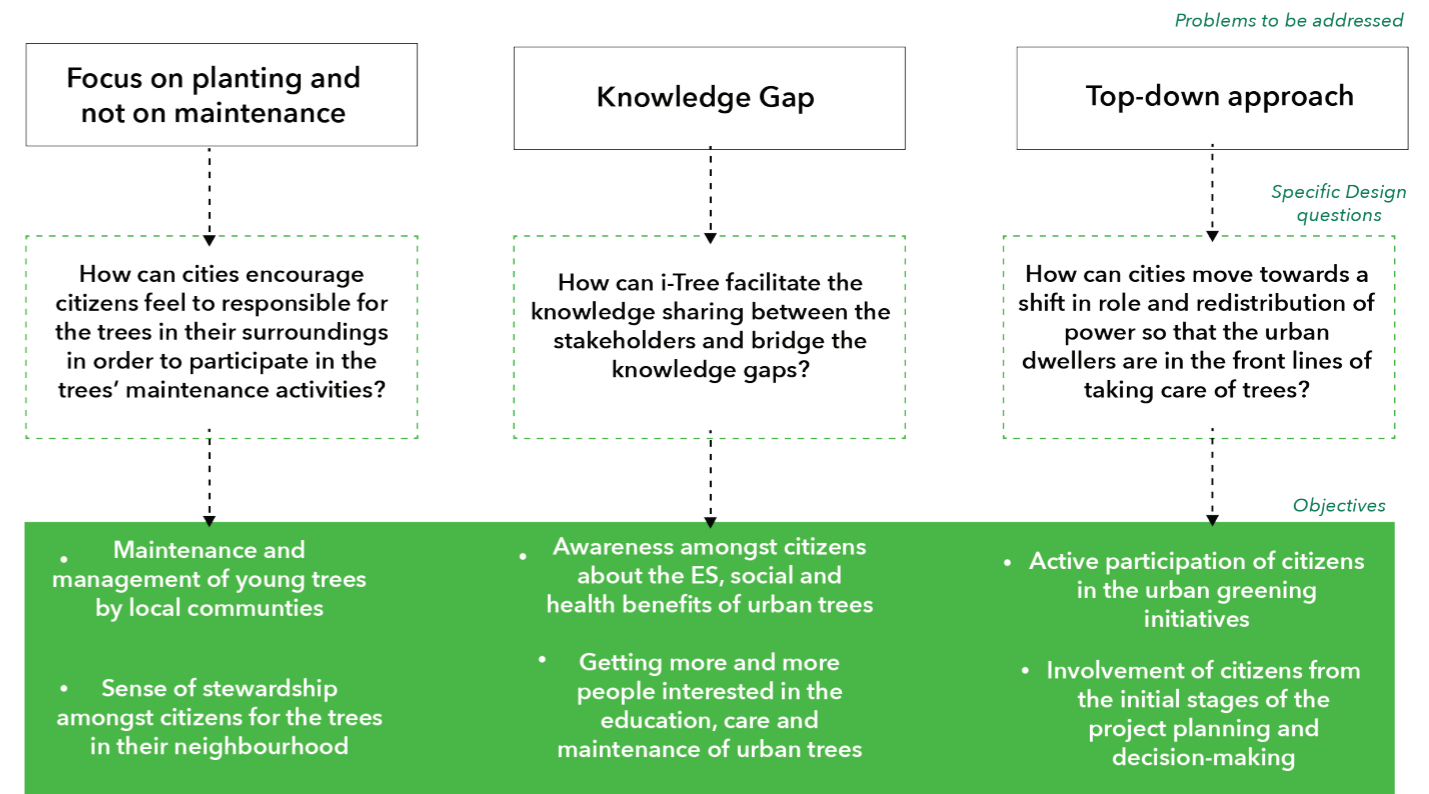


4.4 Design Direction

Chapter 4 dives into the specific problems that need to be addressed within the project context. These problems emerge in the literature in Chapter 2 in a broad sense. Some of them are noted in the context of Dutch cities and organisations in Chapter 3 through interviewees and case studies. Section 4.3 sums up the specific problems that need to be addressed within the scope of the project. The figure below shows the problems on top that are: Knowledge gap between stakeholders, focus of cities on increasing planting of trees and the top-down approach employed in cities for urban forestry initiatives and projects. The problems are followed by the specific design questions which need to be answered for each problem to achieve the objectives mentioned at the bottom.

Overall Design Direction

To design a sequence of institutional models where i-tree technology can be placed as leverage points across the system to improve the participation of citizens in urban forestry activities. To develop i-tree technology as a product service system which facilitates active engagement and knowledge sharing amongst stakeholders.



CHAPTER 5: **DESIGN STRATEGY AND CONCEPTS**

5.1 Institutional Frameworks

5.2 Design Strategy and Concepts

5.2 Public Awareness Campaign

5.3 i-Tree Tool Concept

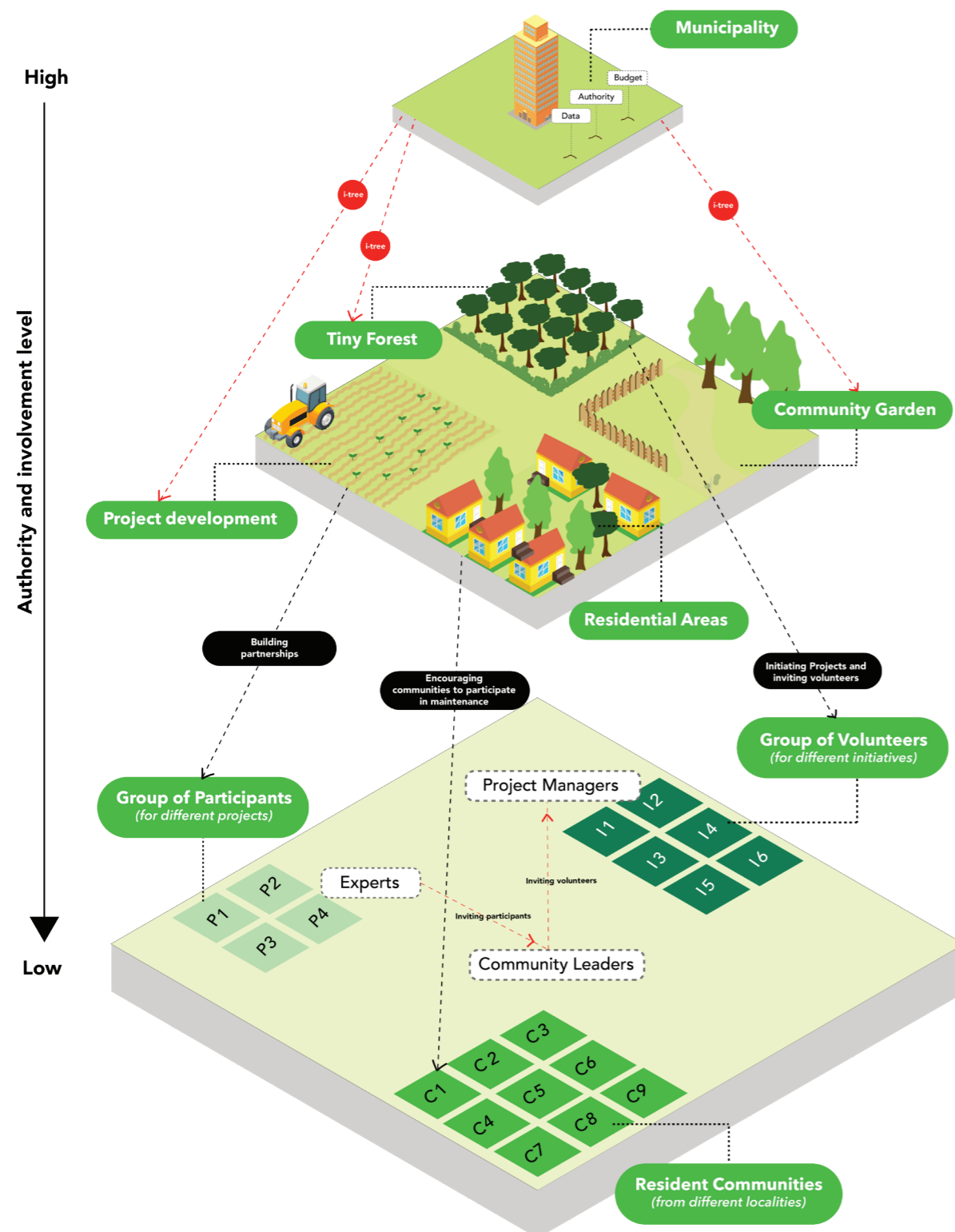
5.4 Guide for the uninitiated citizens - "How to befriend a Tree?"

5.5 Gamification: Motivation and Engagement

5. DESIGN STRATEGY AND CONCEPTS

5.1 Institutional Frameworks

Current situation of urban forestry participation and i-tree usage in the near future



About the framework

Figure 24 shows the current institutional infrastructure where different stakeholders are placed on different levels based on the decision-making power they have in cities' urban forestry projects. The main stakeholders in this framework include: Municipalities (first plane), NGOs, Consultancies and Real estate companies (second plane) and lastly the urban citizens (third plane).

First Plane

At the top plane is a city's municipality which possesses the most power in decision making, provision of budget, knowledge and partnering with other organisations. As mentioned in section 2.2, the role of municipalities in the current system is to take action of planting more trees and coming up with urban re-development projects. A municipality is also responsible for developing and communicating the vision for urban trees in city's development projects.

Second Plane

For the first purpose of planting more trees towards a specific objective, municipalities may reach out to NGOs for their expertise and large network of volunteers in the field of urban forestry. The municipality allocates budget and shares their vision for the project with the NGOs. They may also be responsible for providing a location for the project. As seen in IVN Nature Education's case, municipalities provide budget and permissions to plant Tiny forests in primary school premises. For achieving the goal of new urban (re)development projects, municipalities hire consultancy firms with expertise in landscape architecture, urban planning and urban forestry. The vision shared by municipalities could include the involvement of public in validation of ideas or plans. This depends on the goals of a municipality about the project. The second plane shows the urban development projects that are carried out in cities like tiny forests, community gardens, residential projects and commercial projects.

Third Plane

The third plane shows the stakeholders of urban forestry who have relatively less say in the decision making of planning projects. These stakeholders include, NGOs, consultancies, volunteers, and urban communities. The "experts" from consultancies may or may not involve citizens as participants in their process. In one of the interviews (section 3.2), it was mentioned that even if there is involvement during the development of space, a long-term engagement of citizens with the urban trees and municipalities is unlikely in most cases.

Public Participation in Urban Forestry

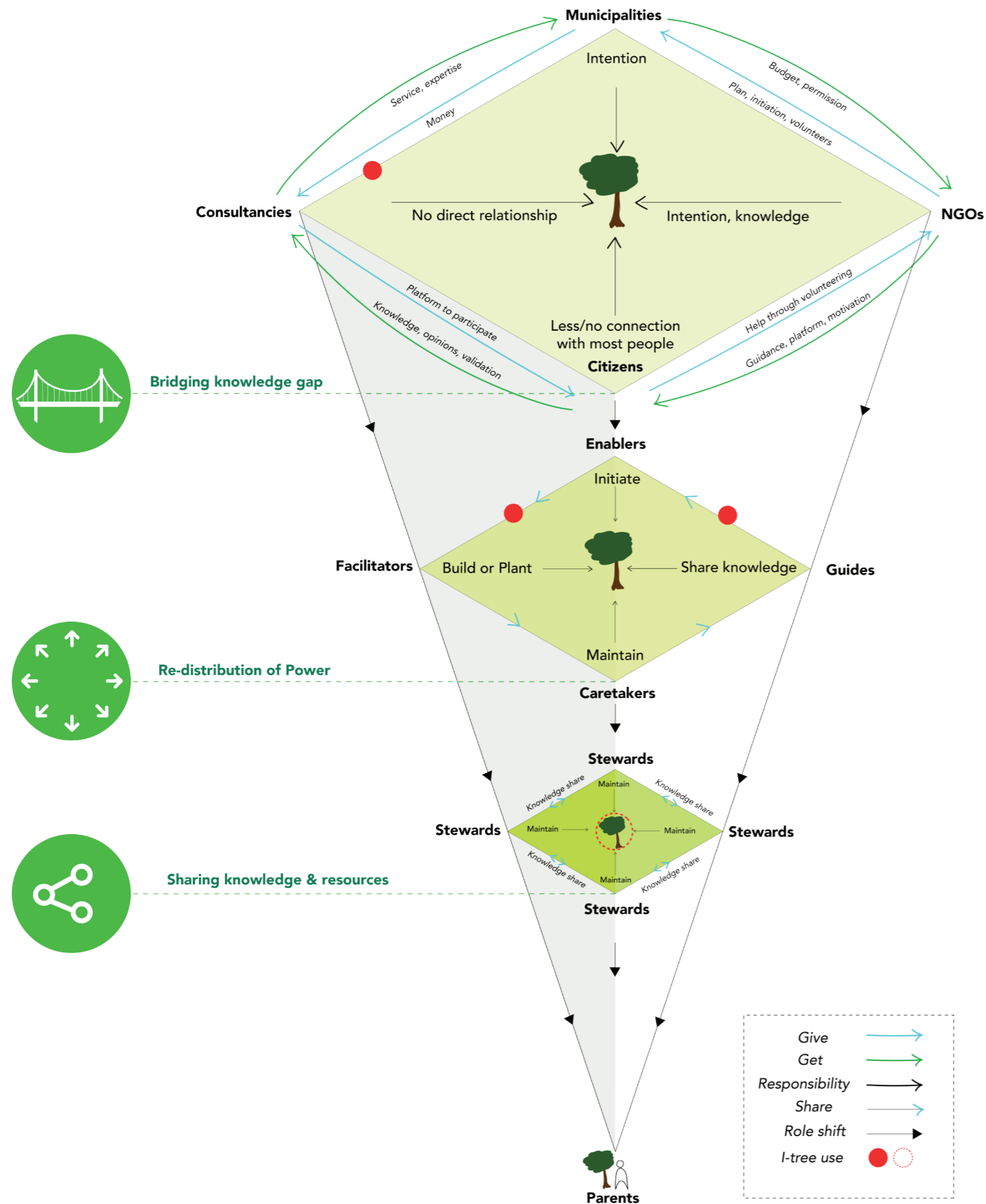
The connections from second plane to third plane show how citizens can be involved in urban forestry projects in the current situation. This is by encouraging them to volunteer in greening initiatives or maintenance drives done by NGOs and by giving them opportunities to participate in the planning of public spaces. However, these are efforts put in one way by organisations to citizens. To bridge the gap of knowledge between stakeholders, it is crucial that the communication and efforts are two way as mentioned in section 4.1.

Role of i-Tree

The red bubbles show the areas of placement for i-Tree tool in the current situation of urban forestry. The tool is currently built for expert use only so its placement is between the first and second plane of the framework. The cognitive knowledge gained from i-tree tool can be used for urban (re)development projects where the users of the tools are experts from consultancies and municipalities. The knowledge can also be used by NGOs to communicate the benefits of trees and attract more volunteers for their initiatives.

Next section focuses on how the institutional framework can be transformed to address the problems faced by stakeholders, as mentioned in section 4.4.

Relationship, Responsibility & Role Shift in the Urban Communities in relation to urban forestry



About the framework

Figure 25 shows the shifts in roles, responsibilities, and relationships amongst the stakeholders in order to address the problems at hand in relation to urban forestry practices in Dutch cities. The plane on top is the current system of urban forestry practices showing the relationship between stakeholders, their role in the system and their connection with urban trees. The planes are set on a timeline with the top being the present, second plane being 3-5 years ahead in the future and third being 5-8 years ahead in the future.

First Plane

On the first plane, the stakeholders are far away from each other depicting the knowledge gap between them. The arrows between stakeholders show what each of them provide and receive in their relationship with the other. In the center, there is a depiction of urban trees and the stakeholders' connection with them. **Currently, there is no direct relationship or responsibility of citizens towards the urban trees.** The volunteers or citizens interested in taking care of trees do so through NGOs and their initiatives. According to one of the interviewees from the NGO, the volunteers are usually the same people who participate in their activities frequently. One of the biggest challenges faced by NGOs is to attract more citizens who may not be presently interested in initiatives for various reasons.

Second Plane

The second plane is a result of shift in roles, responsibilities, and relationships amongst stakeholders. This shift is possible by bridging the current gap in knowledge of each of the stakeholders. Bridging of the knowledge gap leads to a change in roles of municipalities to enablers because of their power and resources. The consultancies become facilitators instead of being the only experts. They facilitate the active participation of citizens in urban forestry practices through their knowledge. **The citizens' role changes to caretakers of urban trees who maintain and manage the urban forests for a long-term even after the participation in the planning process.**

The NGOs with their network of volunteers and expertise in urban forestry practices become guides who (i) use their knowledge for the improvement of these interventions and (ii) to invite more citizens for participation in the initiatives.

Third Plane

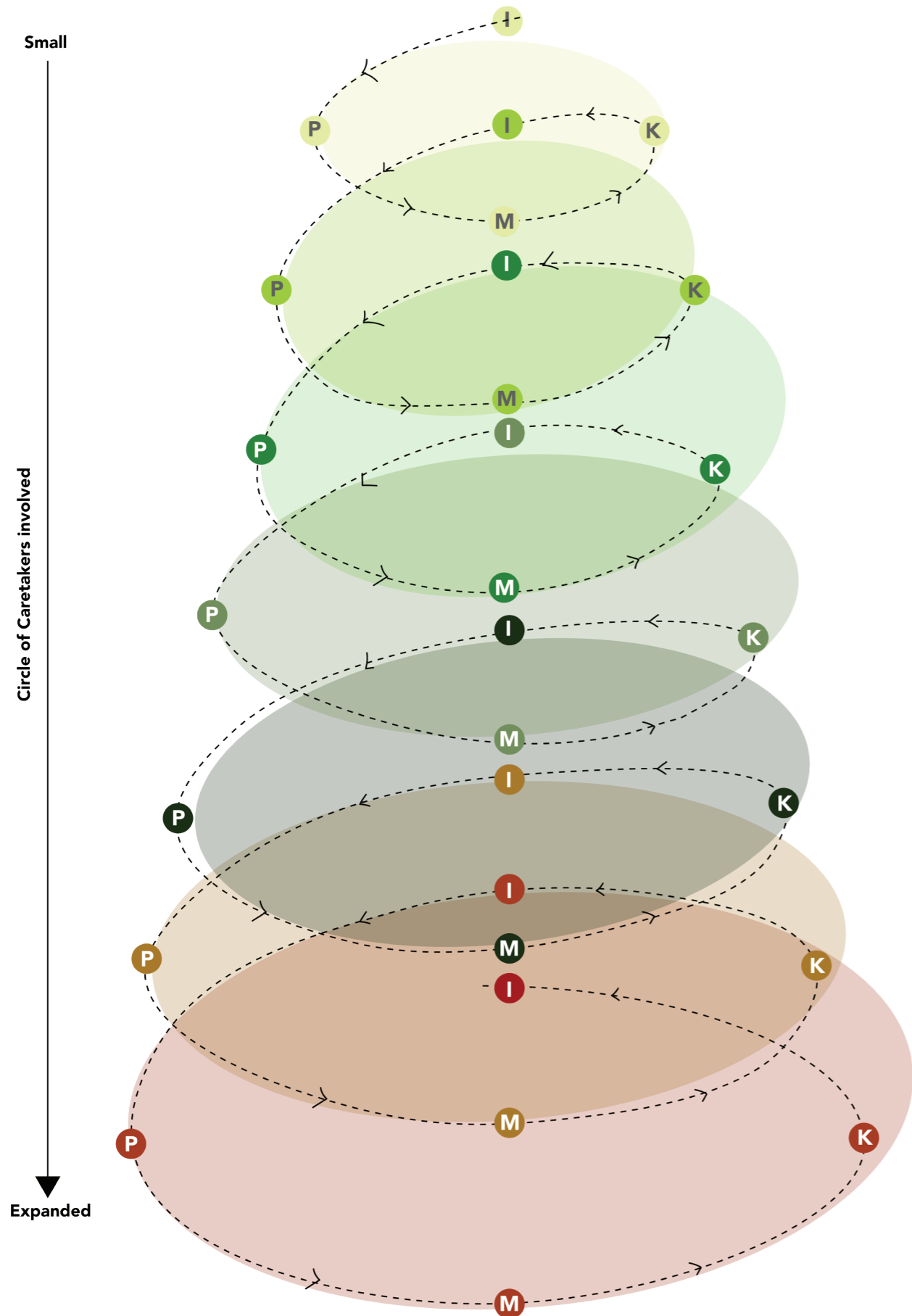
The third plane is where all the stakeholders' role shifts to becoming stewards of the urban forests and trees. This will be achieved through a distribution of power among stakeholders. **In this plane the focus shifts to maintenance of the urban greenery by everyone without any authoritative agency.** The local communities share their knowledge about urban trees with each other without any difference in roles and responsibilities. The continuous sharing of knowledge and resource and a development of the sense of stewardship towards trees eventually leads to citizens acting as the "parents" of trees. This is an abstract argument ahead in the future based on the feelings expressed by residents of Tiny Houses in Tussentij (section 3.3). The more time and efforts invested by the residents in the 75 trees of climate arboretum, the deeper they care about the health of trees. They believe the trees to be like their children, which leads to stronger bond between people and trees.

Role of i-Tree

The red bubbles depict the placement of i-tree technology and the shift in its role over time. In the first plane, the technology is placed towards the experts (consultancies) as is its current use. In the second plane, i-Tree becomes a product-service system that facilitates knowledge sharing amongst stakeholders and facilitates active participation. **In the third plane, i-Tree becomes of central importance as it acts as a platform to guide all the activities related to urban forestry in a city.**

Next section focuses on how the shift in responsibilities can help in bringing in more and more citizens to be a part of urban forestry initiatives, thus making this a community-wide practice.

Knowledge gained leads to knowledge sharing



54 Figure 26: Institutional Framework 3: A representation of how knowledge gained can lead to knowledge sharing

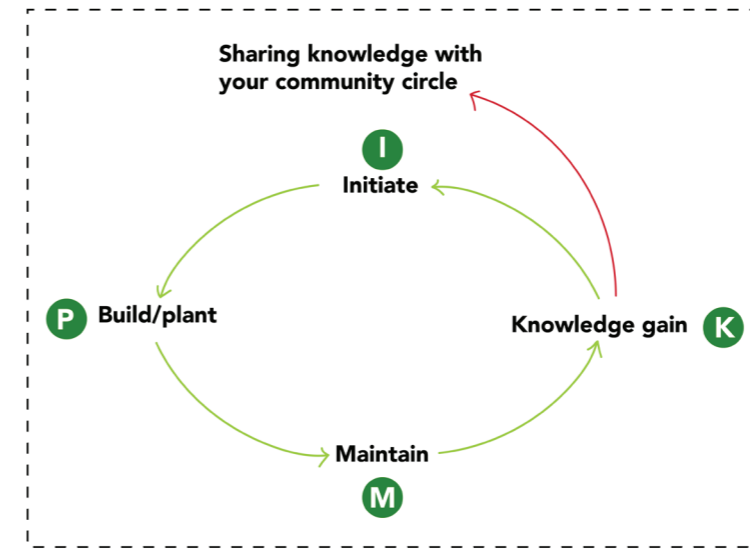


Figure 27: A representation of each process cycle of knowledge sharing leading to knowledge gained

Figure 26 shows how the number of caretakers involved as active participants in the care and maintenance of urban trees increase overtime. The circle becomes bigger by the sharing of knowledge of urban trees and their benefits.

The plans are first initiated by enablers with the help of other stakeholders. The facilitators take a lead in the development of the project. This step is also done with active participation from caretakers and enablers. The caretakers are responsible for the maintenance and management of urban trees. Active participation helps them gain better understanding of the benefits of different trees in their neighborhood that they are taking care of. These experiences are communicated by the caretakers to other stakeholders and more citizens who might not be interested in these activities initially.

Citizens who are new participants in the maintenance projects will gain experiences and share their knowledge with more citizens. This is how knowledge gained can be helpful in knowledge sharing with even more citizens contributing to an increase the number of caretakers for trees.

5.2 Public Awareness Campaign

Introduction

The i-Tree consortium has multiple stakeholders who possess different levels of knowledge and expertise about urban forestry. The focus of the research lies in citizen involvement and their contribution to the development of the greenspaces in cities. However, not all citizens are aware and informed about the vulnerability of urban trees and the measures they can take to proactively help. The first steps towards making citizens feel responsible for the care and maintenance of urban trees is bridging the knowledge gap between different stakeholders. Public awareness is important to increase the enthusiasm and support amongst citizens for the trees in their neighbourhood. An awareness campaign would stimulate self-mobilisation and action for the amelioration of urban trees in cities. The campaign is used as the first step towards informing the community about the situation of urban forests in Dutch cities.

Objective

The aim of the campaign is to highlight the lack of maintenance of trees in such a way that the information provided can solicit action to make changes. This includes achieving long lasting behavioural changes amongst citizens with regard to participating in urban forestry practices. The awareness campaign will ensure that all relevant stakeholders understand the benefits of urban trees and the urgent need for the trees' conservation.

Stakeholder Participation

Urban Forestry practices requires the conjoint efforts of these stakeholders who could be individuals, businesses, industries, governments, and other actors. The main stakeholders involved in the public awareness campaign are: **Municipalities, i-Tree Research team, NGOs and Consultancies.** The effectiveness of an awareness campaigns depends on the credibility, expertise and reach of the stakeholders involved.

Government authorities like Municipalities have the resources to develop the campaign strategy along with the expertise provided by the research team of i-Tree and consultancies. The credibility to the cause is highly increased by environmental NGOs who have large volunteer networks and existing initiatives for urban trees. NGOs know the target audience better and the best way to communicate with them.

Target Audience

Since the cause of the campaign concerns the health and maintenance of urban trees, the public awareness campaign aims to reach as many urban citizens in Dutch cities as possible. The target audience would include:

- The **network of existing volunteers** of the NGOs,
- All the **urban citizens who are not interested** in urban greening initiatives yet
- Citizens who are interested in taking care of trees **but do not know where/how to start**
- Citizens **who are not aware of the benefits** provided by urban trees
- **Primary school children** who have Tiny Forest programs in their school

Communication Channels

The communication strategy is tailored to the different types of target audience based on their demographics and level of knowledge about urban trees for maximum engagement with the campaign. Three different types of media are identified to communicate the message in the most effective way. The choice of media is influenced by the stakeholders of the campaign and their network. Each medium has multiple communication channels. These are:

- **Outdoor Advertising** - Posters, Street billboards and Digital billboards in cities
- **Social Media** - Instagram, Facebook and Website of NGOs, municipalities and i-Tree Netherlands.
- **Direct Media** - Events like Dutch Design week (Consultancy), Boomfeestdag (NGO), Springsnow Festival (NGO)



Problem Statement

The campaign aims to raise awareness and educate the citizens about the situation of urban trees in Netherlands. The care and maintenance of urban trees, as most citizens believe, falls under the responsibility of municipalities. However, cities need help and co-operation of the citizens to ameliorate the condition of young trees so that they can grow and provide maximum environmental, social and health benefits to the future cities. The problem is highlighted with shadows of dying trees falling on walls, which represents the built environment of cities.



Messaging

The idea of the campaign is based on the comparison between some characteristics and traits of Dutch individuals with the current situation of urban trees. The characteristics like the average height of Dutch men, happiness and well being index of Dutch children and the culture of riding bikes is specific to the people of Netherlands.

The first part of the message aims to elicit the sense of relatedness to the posters. Once that is established, the attention is directed towards the health of urban trees. The urban trees need the same level of care and maintenance as some of the highlighted aspects in the posters.



Call to Action

The principle aim of the campaign is awareness about the maintenance and care of urban trees. This is followed by educating people how to maintain some common trees. However, awareness generated through posters can have a significant social impact only if it is followed by a call to action.

The series of posters encourage people to scan the QR code in the corner which redirects them to the further steps of the campaign. Each poster poses a question to the audience asking them if they would like an urban tree to be as happy and healthy as a Dutch citizen. The comparison is provocative and its objective to be make people think about the trees with more empathy.





Timeline of the Campaign

Figure 28 shows the timeline of the Public Awareness Campaign, objectives of each touchpoint, organisation responsible for the touchpoint and how it contributes to the overall vision for future cities.

Category: Social Impact; Behavioural change

Duration: 10-12 months

Stakeholders leading the event:

Municipalities	
NGOs	
i-Tree Team	
Consultancies	



Public Awareness Campaign

Spreading awareness about the need for citizens to take care of the urban trees – via social media posts, billboards, i-Tree website and events.



How to befriend a tree?

- Primary schools with Tiny Forests will be provided with handbooks of the guide with activities.
- The campaign redirects audience to the podcast series



Daycare for Trees

The Tiny Forests will be called Daycare for young trees where people can learn about urban tree care and maintenance and volunteer their time



Springsnow Festival

The podcast nudges audience to visit the festival (an attraction during Spring in Amsterdam). The festival is used as a leverage point to raise awareness about i-tree



Dutch Design Week

The consultancies (part of i-tree consortium) participate in the Dutch Design Week to present the work that i-Tree is doing through an installation



Boomfeestdag 'Tree Holiday'

People from all ages can participate in the plantation and maintenance of trees

February - April

March

March

21st April - 21st May

22nd - 30th October

16th November

- The public awareness campaign is the first touch point for citizens to understand the need for their participation in maintaining urban trees.
- The campaign is a combined effort of municipalities and the i-Tree research team.
- To tap into a larger network of citizens, communication channels of all the stakeholders will be utilised during different stages of the campaign.

- "How to befriend a tree?" aims to encourage people to get to know the trees, their benefits and their need for proper maintenance at a young age.
- It is divided into 2 parts: A guide for Primary school children with simple and interactive activities and a podcast series which is based on the experiences of trees in Dutch cities.
- It is an informal and unique approach of educating citizens about urban trees.

- Urban Tiny Forests have multiple environmental benefits. Netherlands has hundreds of Tiny Forests, some of which are need better care and maintenance.
- Daycare for trees is an initiative to invite people to volunteer in learning about trees and how to take care of them.
- It is a crucial step in the campaign that calls for impactful action by citizens for urban trees.

- Amsterdam is home to 75,000 Elm trees that shed trees in spring. Eau d'Amsterdam organises the Springsnow festival every year to celebrate the beautiful phenomenon of Elm trees.
- Amsterdam being the Elm capital of Europe is a touchpoint to raise awareness about urban trees in Netherlands.
- The month long festival can use direct media as a leverage point to bring the visitors's attention to the cause.

- The consultancies and Architecture firms who are partners in the i-Tree consortium can use their network and expertise to present the campaign in the Dutch Design Week.
- The visitors of DDW, having more knowledge about urban trees can directly contribute to the late stages of the campaign.
- The awareness at this stage would focus more on active participation of citizens in turban forestry via the i-Tree platform

- Boomfeestdag or National Tree Festival is celebrated in Netherlands every year since 1980. The aim of the festival is tree plantation by children.
- i-Tree proposes to shift the focus from tree plantation to tree maintenance where not just children but everyone interested can participate in learning about the care and maintenance of urban trees.
- The Tree Festival marks the end of the i-Tree campaign in November.

Figure 28: Timeline of the Campaign and overview of the touchpoints

5.3 How to befriend a Tree?

5.3.1 Guide

The guide “How to befriend a tree?” is a journey of individuals from being uninterested in urban trees to eventually becoming their care-takers. The guide’s strategy is based on the three key experiences of an individual to achieve a sense of stewardship towards urban trees. These key experiences are: Coming to take the control of trees, getting to know the trees and investing time and efforts into the trees’ growth (fig. 23).

The primary target audience for the guide is children in schools with Tiny Forests in their premises. NGOs like IVN are engaging with children actively through their numerous initiatives of Tiny Forests across Netherlands. Primary school children, as a part of their curriculum participate in the planting of Tiny Forests with the help of their teacher and volunteers from IVN. They also have the potential to establish a long-term engagement with the Tiny Forests and use that knowledge of trees to improve the quality of urban trees in the future.

Through a series of activities in the guide, primary school children can start a journey of a long term-engagement with trees. Certain activities in the guide are designed for children to do it with their parents/guardians. These activities are activation points for uninitiated adults to get introduced to the maintenance of urban trees.



Figure 29: Guide– How to befriend a Tree?

Uninitiated individuals are those who have no special knowledge or experience about urban trees. They do not hold any specific interests or motivations towards the green in their surroundings. These individuals constitute the largest part of the local communities, as told by one of the interviewees in section 3.2. However, it is crucial that the uninitiated individuals participate actively in the maintenance of trees and eventually be a part of the planning and decision-making process of the urban forests too. **Some of the activities have a QR code that direct readers to the i-Tree platform** where they can see the experiences shared by other parents and citizens, in general, in Tiny Forests.

5.3.2 Audio Podcast Series

The posters and a particular activity from the Guide directs audience to the audio podcast series called “How to befriend a Tree?”

The podcast is the one of the first steps for citizens to get to know the trees. Before people are educated about how to take care of trees, it is important that they are interested in urban trees first. To generate that interest, the podcast tells stories of individual trees of different species in an informal storytelling manner. The stories are narrated by the individual trees themselves to create a sense of empathy through their personification. The most common species in Netherlands are chosen to narrate their experiences. These are, English oak, Red oak, European beech, White birch, Maple etc. **The aim of the podcast is for citizens to get to know trees more intimately and become familiar with a tree’s journey. This is the first step for citizens to develop a stronger connection with trees in their surroundings and be encouraged to take part in its maintenance.**

Each episode focuses on one particular tree in Netherlands. **The tree outlines its experience of living in an urban setting and the challenges that come with it.** The challenges highlighted by each tree are narrated in simple terms, making it easy to understand for all listeners. For example, Evi – The Elm Tree talks about the Elm tree disease and the lack of space in cities for her to grow and flourish. Although the listener might not start taking care of a tree immediately after listening to the podcast, they would remember that there is a need for their contribution to the cities.

The goal of the podcast is to paint a picture in the listener’s mind about the life of that tree. It helps the listener in changing their perspective of what it seems like an ordinary tree that is unnoticeable in a neighbourhood.

The podcasts are concluded with the tree requesting listeners to participate in taking care of urban trees.

Scan the QR code to listen to first episode of “How to befriend a Tree? – Evi, The Elm tree”



Figure 30: Podcast landing page mockup



Being a Steward

Find a tree in your neighbourhood or any other place you visit often. This tree stays with you throughout the book's activities. Name your Tree!

Name: _____

Species of your tree is _____

Spend an afternoon with your tree

Think about all the time you spend with your tree. What are your thoughts? Write them down in the space on the left.

Describe your mood when you are with your tree.

To see other people's stories of afternoons with their trees scan the QR code

Learn how to take care of your tree

"How to befriend a tree?" is a podcast series by the trees themselves where they tell us about their lives and how we can take care of them! Scan the QR Code to listen to the podcast now

Note down the steps to take care of your tree!

Your journey to befriend a tree looks like this

Investing your time into the tree

Getting to know the tree

Being a Steward

Hi, I am here and I am here to befriend a tree!

When these books and sheets have been used for the full 12 weeks, you have been successful in the process of becoming a tree steward. You will have a tree that you have looked after and cared for. You will have a tree that you have made your friend.

Week 1

Look closely at your tree and draw the following tree parts with details

fruits

Week 2

Look closely at your tree and draw the following tree parts with details

leaves

flowers

bark

branches

Getting to know the Tree

Know your tree species

white birch

english oak

European beech

Scan the QR code to find out more about the different species of trees and how to care for them.

Investing time in your tree

Just like your other friends, trees can have personalities too. Write down what your tree is like.

5.4 i-Tree Netherlands — Platform and Tool

5.4.1 Platform for all citizens

Introduction

i-Tree Netherlands is an online platform for all the stakeholders of urban forestry practices in Dutch cities. The website is the landing page for the audience of the public awareness campaign. Along with being an awareness generating platform, i-Tree Netherlands is also the first touch point for enablers and facilitators to start a new project. It comprises of the i-Tree tools used for measuring the tree metrics and tree benefits during a development project. The information generated by i-Tree tools in this process is open-source and visible to all the stakeholders including citizens.

This ensures transparency amongst all the partners and citizens alike. One of the problems being solved with transparency is the knowledge gap between the so called 'experts' and citizens. The platform ensures a smooth transition of citizens from being unaware and disinterested in urban trees to being their care-takers. Everyone can contribute to the urban trees in different ways. Each way has different stages and steps of contribution depending on the knowledge level of users. The platform is used to communicate these steps clearly.

Objectives



The ultimate objective is citizen participation in the decision making of future cities with regard to urban forestry



Bridging the knowledge gap by communicating the benefits of urban trees in a way that all citizens can understand



Transparency in the system to reduce the perception of government authorities on trees and encouraging citizens to participate



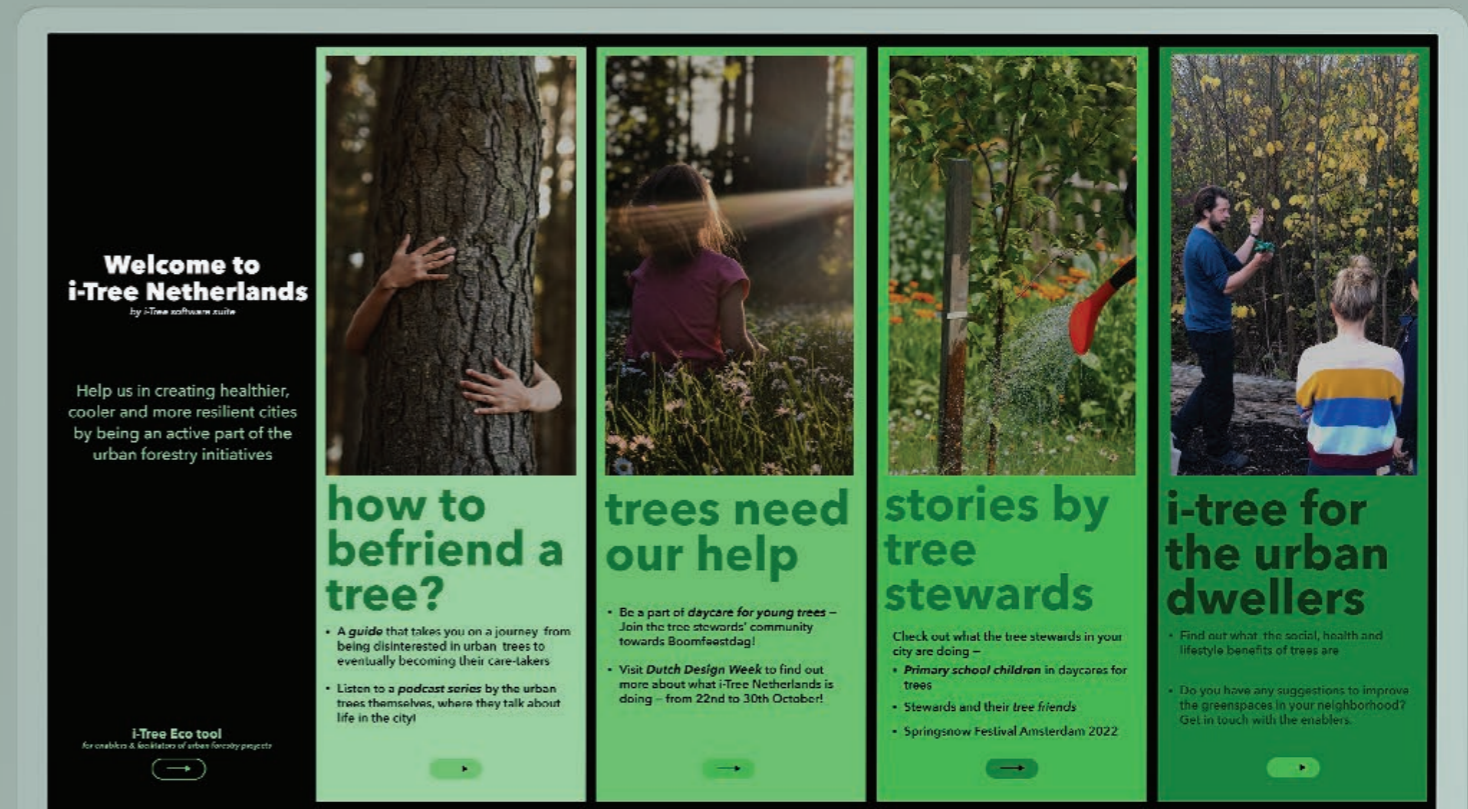
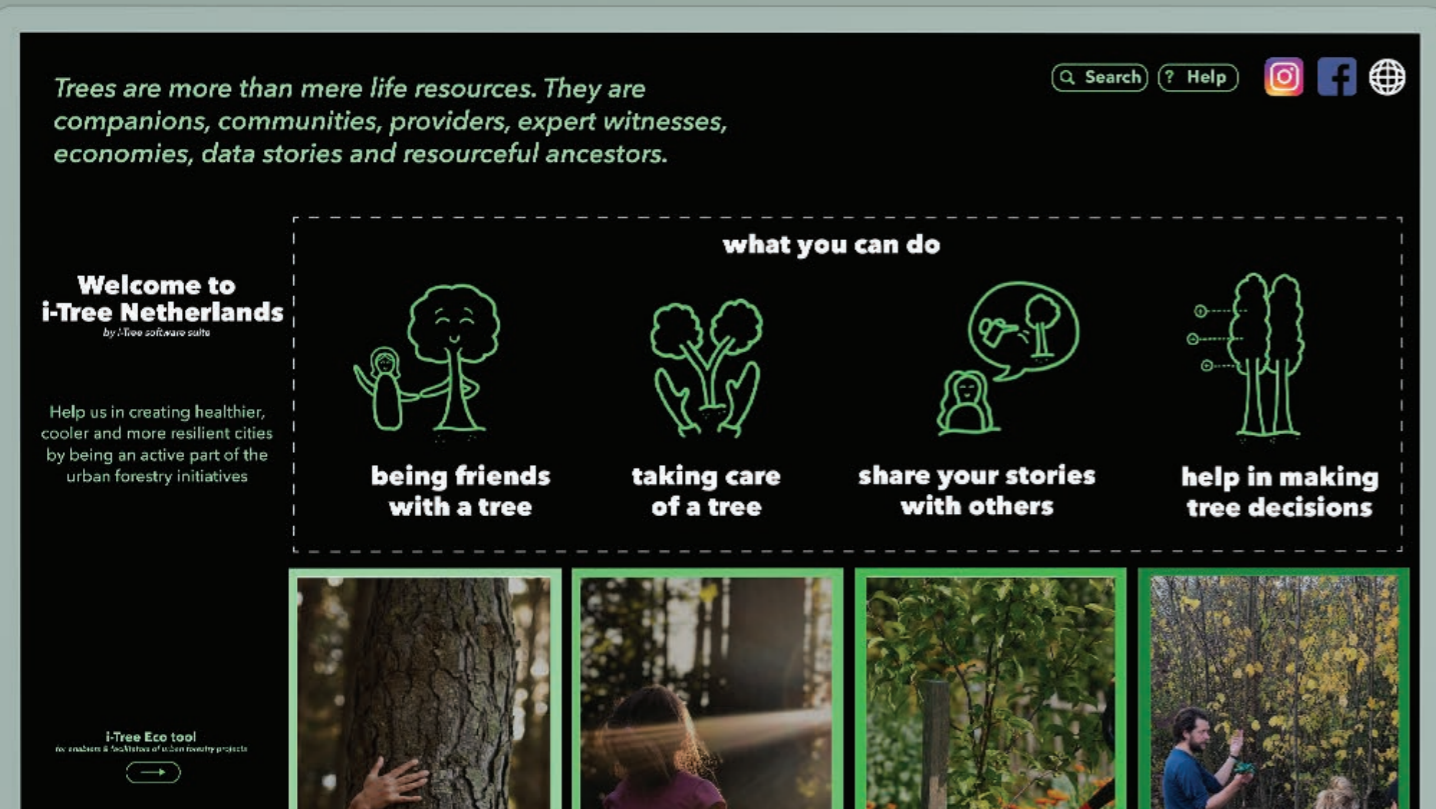
Educating people on the current situation of urban trees and giving them clear actions to move forward in their contribution



Citizens can see the impact that they have created in the urban forestry of cities with their help



Building a community of care-takers where everyone can share their experiences of contributing and participating



5.4.2 i-Tree Eco tool

i-Tree Eco (version 6) is a flexible software application designed to use data collected in the field from single trees, complete inventories, or randomly located plots throughout a study area along with local hourly air pollution and meteorological data to quantify forest structure, environmental effects, and value to communities (i-Tree Tools , 2021). Currently, i-Tree Eco describes environmental benefits of trees that consist of cooling air temperature, reducing water runoff, air pollution removal, carbon sequestration and improving the city's biodiversity. Other than the environmental benefits, i-Tree Eco provides Forecasting modeling options like tree planting inputs and extreme event impacts. It also provides management information like cost benefit analysis which are crucial in determining a project plan.

The current target users of i-Tree Eco include government agencies, consultants, nonprofits, universities, researchers, volunteers, educators, and advocates (i-Tree Tools , 2021). To encourage citizen participation in the urban forestry practices, it is important that more and more people are aware of the tree benefits. Awareness and better knowledge of urban tree benefits can help in the increment and enhancement of public participation.

However, presenting these benefits in a technical terminology could be a possible barrier in positioning the need for green in development projects. Tree metrics presented without the social, health and aesthetic benefits are rejectable by stakeholders like municipalities and project developers. The tool is developed for 'expert' users who possess a certain level of knowledge about the performance metrics of trees.

The challenge is to redesign the i-Tree Eco tool in a way so that it can communicate all the benefits of trees (ecosystem, social, health, monetary) effectively to all the stakeholders involved.

Other than the ecosystem benefits, trees also provide social, health and aesthetic benefits. The ecosystem services of trees can be translated into monetary values to make them more insightful. **To be able to make a difference in an area it is important to emphasize those benefits of trees which are relatable and relevant for a wider group of people.** This includes local communities, NGOs as well as consultancies and municipalities. The i-tree tool concept simplifies the process of working by dividing it into phases (fig. below). These are some basic steps that could be applied to most urban (re)development projects.

The last phase in the planning process is where reports of the project can be seen. The reports are divided into two categories: one for facilitators and enablers and the other one for caretakers (as proposed in section 5.1). Both show different set of reports highlighting relevant benefits for the target user. For example, the report for caretakers focuses on the cost benefits, maintenance required for different species, social benefits, health benefits of trees, cooling and air pollution control.





Process in steps

PHASE 1 Planning for your Project

PHASE 2 Setting up your Project

PHASE 3 Collecting your field data

PHASE 4 Working with i-Tree eco

PHASE 5 Viewing your reports



Data fields

Land use

Ground cover

DBH Classes

Maintenance

Custom fields

Reports

for facilitators and enablers

for caretakers

Choose the boundary of your area

City

Neighbourhood

Park

Others

Choose the type of inventory

Complete inventory

Plot-based inventory

For caretakers

Summary

Composition & Structure

Individual level results

Pest Analysis

Caretakers Report

For facilitators

Summary

Composition & Structure

Individual level results

Pest Analysis

Facilitator's Report

Choose the boundary of your area

City

Neighbourhood

Park

Others

Choose the type of inventory

Complete inventory

Plot-based inventory

Specifying the data collected

Data fields

Define plots

Project Strata

Inventory

5.5 Gamification: Motivation and Engagement

Introduction

The design strategy and concepts presented in the previous chapters have the common objective of ultimately allowing all the citizens and other stakeholders to use i-Tree technology as the central guiding tool towards greener cities with healthy urban trees.

The starting point of the innovation process of the project was to **balance technology-focused thinking and user-focused thinking**. Throughout the project, insights were provided related to citizens' needs, expectations and perceptions with regard to urban trees. However, the i-Tree platform is the principal product which needs to be accepted by citizens in the longer term. Therefore, it was crucial to strengthen the benefits of i-Tree platform and tool for all urban citizens.

The public awareness campaign, guide, podcast and ultimately the i-Tree technology have the potential to create value for citizens on different levels. **It can enhance people's knowledge about urban trees, their skills of taking care of trees, deliver peace of mind and create social value by giving them a chance to contribute a healthier environment.**

Gamification

Gamification applies "game mechanics" to non-game contexts, in this case, public participation in urban forestry. The i-Tree platform will introduce a community tree map where citizens will be able to see all the urban trees in their city including the ones that they take care of. **Citizens can check the health of their tree with simple indicators like emoticons.** Having a map of the city helps citizens in understanding their contribution to the urban development. It provides a broad perspective to every individual care-taker of the impact they have on the environment with a simple act of taking care of a tree.

"While it is people's intrinsic motivators that initially attract them to the product, extrinsic motivators keep drawing them back. Gamification principles can help the design offer extrinsic motivation."

- Nas, D. (2021). *Design Things that Make Sense*

Intrinsic motivators

The intrinsic motivators that draw people to the touchpoints of the campaign are:

- (i) the **sense of relatedness** to the message of the posters, i.e., focus on certain characteristics that Dutch people are proud of. The audience of the awareness campaign can instantly develop a personal connection with the cause highlighted in the poster. This is because characteristics like height, taking care of their bikes and having the highest happiness index are what Dutch citizens feel proud of.
- (ii) **being stimulated** by reasons like the attractiveness of the poster or feeling sorry for the dying trees.

Extrinsic motivators

Based on the book "Design things that make sense" by Deborah Nas (Nas, D., 2021), there are eight basic gamification elements that can serve as building blocks in the design of the community tree map. These elements drive the extrinsic motivation of users. **Simple gamification elements like points, badges and roles of a user can enhance motivation and engagement with i-Tree platform.**

The gamification of the community tree map in the i-Tree platform is done to fulfill a universal psychological need of: **Impact**.

Seeing that the actions of citizens towards taking care of trees have a real impact on the urban environment can drive them to contribute even more. It makes the citizens feel like they can influence change and build towards something significant in their cities. **Each element in the community tree map aims to present the impact to the caretakers.**

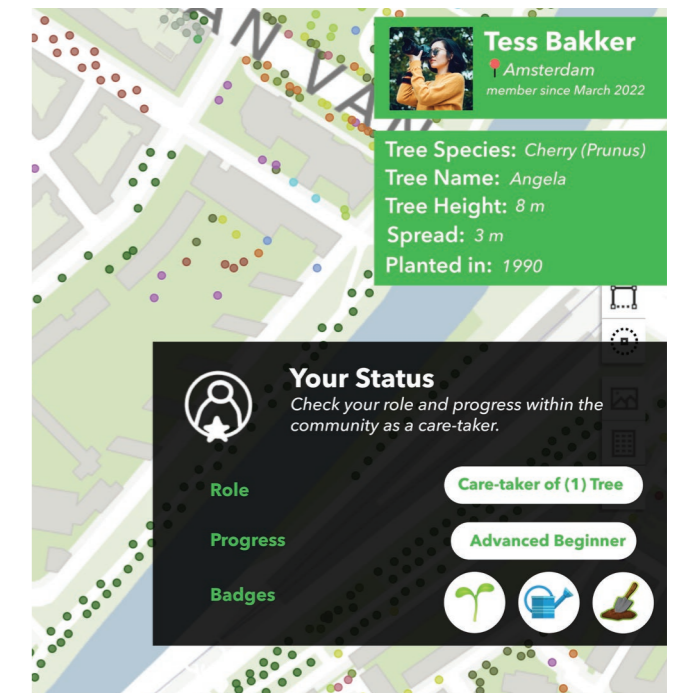
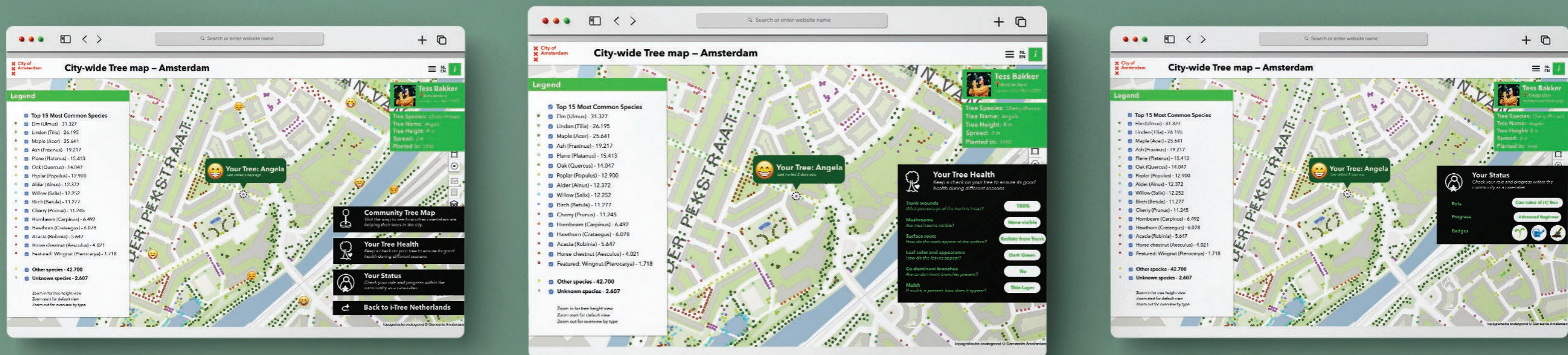
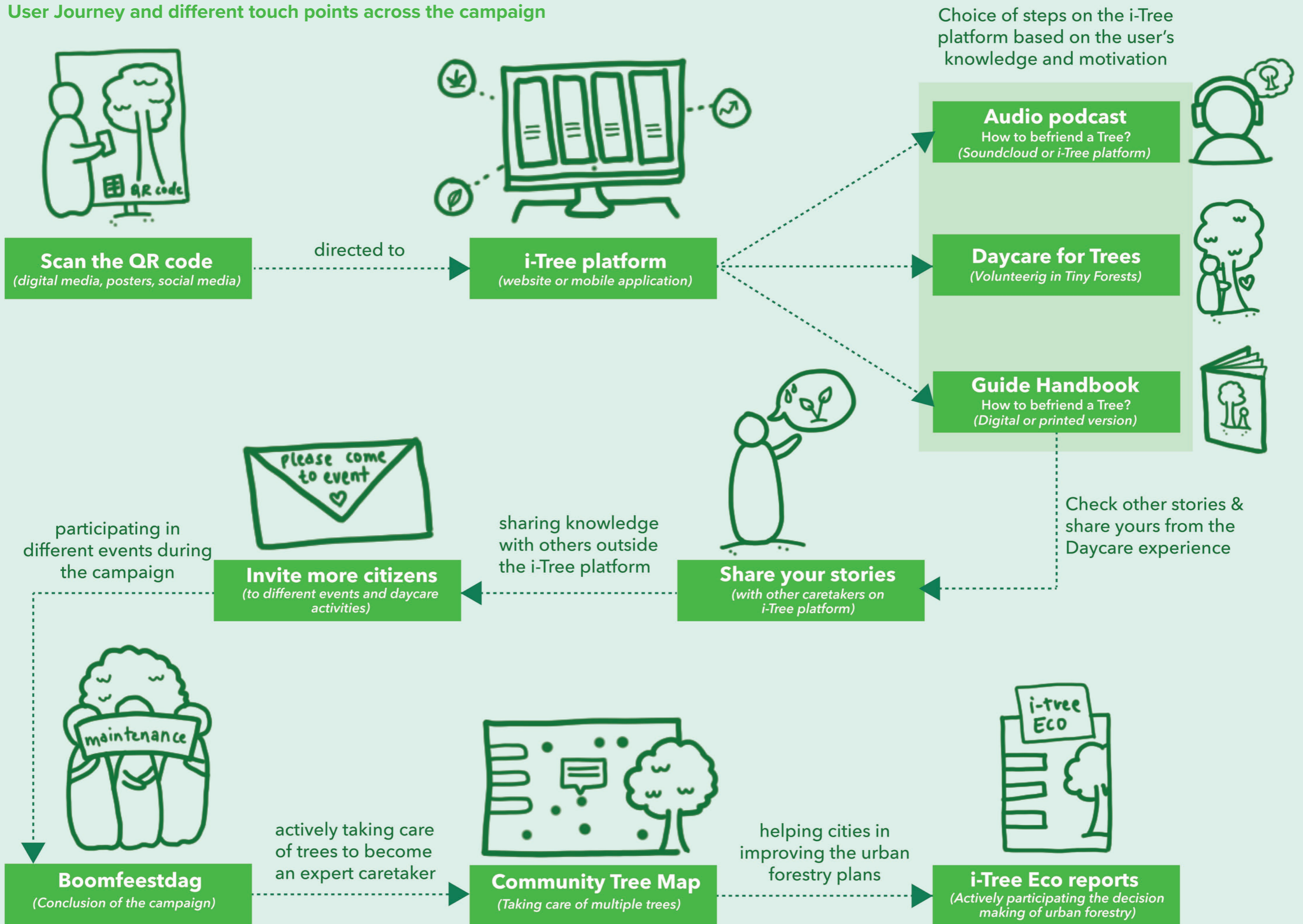


Figure 33: Gamification elements used in the i-Tree Community Tree Map: Role, Progress and Badges



5.6 User Journey and different touch points across the campaign



CHAPTER 6: **EVALUATION AND DISCUSSION**

6.1 Evaluation of Prototypes

The survey results (section 3.1) point out that the citizens are not entirely aware of their role in urban forestry practices. 100% of the responders believed that the municipalities are solely responsible to take care of urban trees and expect no help from citizens whatsoever.

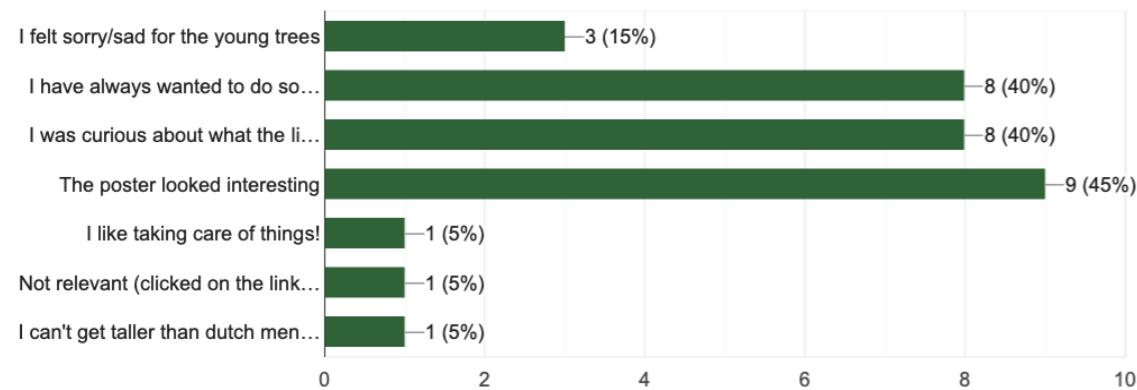
To change this perception of citizens, it is important to let them know that their contribution is necessary in the maintenance of urban trees. The aim of the public awareness campaign was to increase the visibility of the cause: "Young trees need citizens' help for their care and maintenance."

To evaluate the effectiveness of the public awareness campaign in stimulating citizens to become caretakers of trees, a survey was conducted. **The aim of the survey was to evaluate the prototypes that are the first touch points for citizens to get connected to i-Tree.** The first touch points included evaluating impact of the posters, audio podcast and the guide. The posters were put up in semi-public spaces like building entrances, parking and laundry rooms. The 'call to action' for these posters was to scan the QR code which led to the evaluation form online.

The form had three sections for three different prototypes: posters, podcast, and guide. **Each section had questions asking people for their first reactions, motivations and intentions to participate further.** In total, 20 responses were recorded from anonymous individuals. The images below summarise the responses received through the survey. There were open ended questions asking people for their first impressions of prototypes (appendix). The results from the survey were used as validation for prototypes and some improvements have been discussed in the next section.

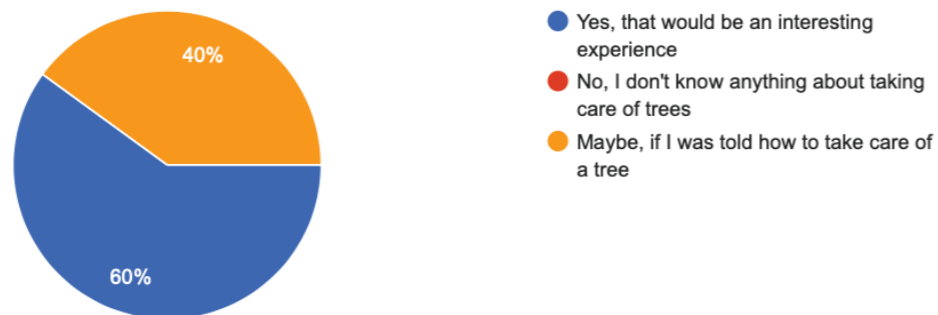
What prompted you to scan the QR code in the poster?

20 responses



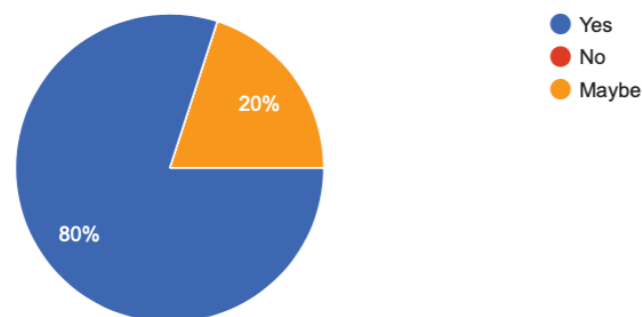
Would you like to take care of a tree?

20 responses



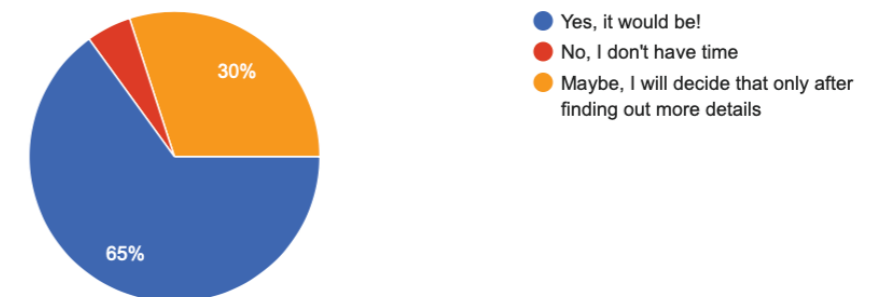
Would you befriend a tree if you knew their story?

20 responses



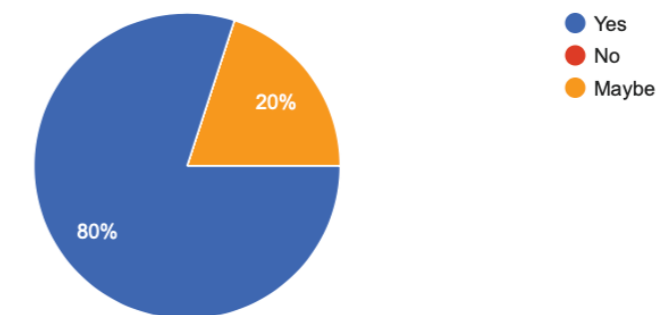
Would the podcast be helpful in encouraging you to volunteer your time for taking care of a tree?

20 responses



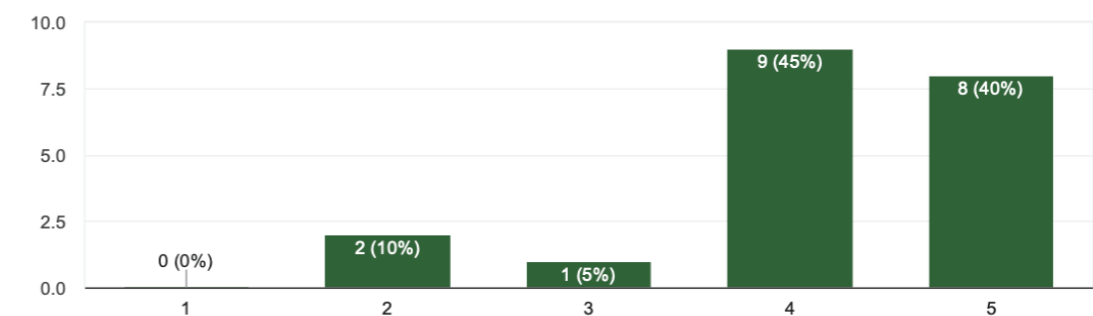
Would you like to use the guide to get started with taking care of a tree?

20 responses



One a scale of 1-5, how much do you think is the guide helpful in teaching people how to befriend a tree and take care of it?

20 responses



6.2 Discussion

The proposed strategy and concepts suggest an immediate entry point of citizens in the urban forestry practices of cities. Looking at the big picture, the long-term objective of the i-Tree project is to strengthen the role of urban trees in cooling Dutch cities amidst risks of climate change. The focus of this project lies in making citizens aware of the urgency to fight climate change.

“Fighting climate change” might seem expendable and vague to most citizens— one of the biggest reasons for people to take tree benefits for granted. **The ultimate objective of the design strategy is to make tree benefits perceivable and position urban trees as crucial entities of cities.** For this purpose, the posters, guide and audio podcast series aim to build a personal connection between citizens and trees.

Speculative Design is used to understand and address the complexity of the current organisation of urban forestry practices in cities. The institutional frameworks proposed in section 5.1 demonstrate answers to the question of “How can the role i-Tree technology evolve overtime to solve the wicked problems present in the current urban forestry practices?” **The frameworks push the existing boundaries of governance in cities and imagine a closer relationship of citizens and urban trees.**

However, to make the vision more plausible, roadmaps can be designed with clearly defined milestones for each stakeholder involved in the urban forestry practices. These roadmaps can visualise the evolution of the trees and their role in making cities cooler through accomplishable actions.



Figure 35: The Chipko Movement, India, 1987

As pointed out during the evaluation of the public awareness campaign, **citizens might be hesitant to invest their time in taking care of trees if there is no immediate incentive to do so.** The gamification aspect of the i-Tree platform addresses the problem by providing extrinsic motivators to users for long-term engagement. However, these motivators are not explicit in the beginning of the user journey. Poster as an entry point to becoming a caretaker stimulate people’s intrinsic motivators like feeling bad for the trees or sense of relatedness. The intrinsic motivators prove effective only when citizens arrive at the i-Tree platform by scanning the QR codes on the posters. Even so, **there is a need to explore the provision of incentives right at the beginning of a user’s journey.** This can be achieved when the poster design can successfully communicate “what do citizens get in return for helping trees?” in the first glance.

As proposed in this project, “How to befriend a Tree?” Guide is a handbook (printed and digital) that aims to help citizens in building a personal relationship with a tree. On the other hand, the community tree map uses gamification elements to increase motivation and engagement with the caretakers. Both the concepts take place at different stages of the user journey and have different objectives. Certain ways can be explored to combine both prototypes into a ‘shared experience’ that helps users transition from being uninitiated in the field of urban forestry to being active caretakers of trees. **A possible use of augmented realities to blend the physical and digital experience of care-giving and maintenance can be explored with this concept.**

CHAPTER 7: RECOMMENDATIONS AND CONCLUSION

7. RECOMMENDATIONS AND CONCLUSIONS

7.1 Recommendations for further research

The development of i-tree technology as a tool and as a platform for sharing knowledge and communication within stakeholders has been discussed in the previous chapters. For the use of i-tree tools in Netherlands, further research can still be conducted.

i-Tree as an independent agency

The i-Tree technology has potential to improve the position of urban trees in cities' project (re)development plans.

However, for the communication of these benefits to municipalities and authorities, it is recommended to consider an independent agency of i-Tree experts. The experts could include tree officers and environmental scientists. **This advisory agency can function parallel to the project developers so that they can strengthen and approve the plans with their deep knowledge about different tree species and their benefits.** Another role of the agency could be strengthening i-Tree science and undertaking new research for the dutch climate. The specific roles, responsibilities and relationships of this agency can be further explored for implementation in practice.

Participatory form of governance

This study investigates the top-down approaches present in the current system of urban forestry practices and the implementation of i-Tree technology for different stakeholders in that system. **For further research, the focus can be shifted to a participatory form of governance where the citizens, NGOs and entrepreneurs manage urban forests at different levels without direct involvement of city authorities.** Citizen-led initiatives in the field of urban forestry can be explored where target users of the i-Tree tool are not experts but citizens themselves.

The tool will facilitate the planting and maintenance activities of urban trees for all the urban dwellers. The strategy development and redesigning of the tool could be the outcomes of such a research.

More-than Human Design Perspective

This study focuses on the improvement and encouragement of active citizen participation in the (re)development of their own urban surroundings. However, the participatory approaches explored in this study and the participatory approaches already being applied in cities remain largely human-centered.

Design visions for governance of urban forestry can be explored for further research. This would imply a shift in mindset from anthropocentric perspective to a more-than-human perspective. This means that the implementation of i-Tree technology cannot solely depend on the needs of citizens. There is an urgent need for cities to not just hear the human voices but also the non-humans ones (Clarke et al., 2019). **Future research can dive into further analysis of decentralising human agency in urban contexts and design a participatory approach with non-human entities like urban trees in mind.**

7.2 Conclusion

The digital platform for i-Tree Netherlands serves as a product-service system with multiple channels, tools and sub-platforms to solve the problems related to public participation in urban forestry practices. One of the main problems highlighted during research is the lack of interest amongst citizens when it comes to participating in urban forestry initiatives. The lack of interest is a result of several underlying problems like: the knowledge gap between stakeholders, top-down approach in the system and the focus on planting more trees instead of maintaining the young trees. The proposed concept of an awareness campaign has potential to prove effective in drawing citizens' attention to the urgent needs of urban tree care and maintenance. Other touch points like podcast series and the guide to "How to befriend a Tree?" were evaluated to check their effectiveness and the interest they generated amongst audience.

The i-Tree platform is capable of facilitating communication amongst the stakeholders and ensure transparency in the decision-making process of planning development projects. An important part of the platform is the i-Tree Eco tool which was redesigned to facilitate the transparent and informative decision making.

The approach of speculative design has been used in the project to map out the complexities in the system of urban forestry. A shift has been reimagined in the roles of different stakeholders, their responsibilities and their relationship with each other and the environment. i-Tree has the potential to drive the planning of urban greening in a way that involves active participation of government actors, private actors and all the citizens.

I hope that, in its small way, this project kick-starts a holistic future of liveable cities with urban trees as the most essential citizens.

REFERENCES

Clarke R, Heitlinger S, Light A, Forlano L, Foth M, DiSalvo C (2019) More-than-human participation: design for sustainable smart city futures. *ACM interact* 26(3):60-63 (1) (PDF) Encountering ethics through design: a workshop with nonhuman participants. Available from: https://www.researchgate.net/publication/346517665_Encountering_ethics_through_design_a_workshop_with_nonhuman_participants [accessed Dec 16 2021].

de Koning, J., Puerari, E., Mulder, I., & Loorbach, D. (2019). Landscape of participatory city makers: A distinct understanding through different lenses. *Formakademisk*, 12(2), 1-15. [3]. <https://doi.org/10.7577/formakademisk.2706>

Desmet, P., & Fokkinga, S. (2020). Beyond Maslow's Pyramid: Introducing a Typology of Thirteen Fundamental Needs for Human-Centered Design. *Multimodal Technologies and Interaction*, 4(3), 38. MDPI AG. Retrieved from <http://dx.doi.org/10.3390/mti4030038>

Food and Agriculture Organization. (2018). *Forests and Sustainable Cities: Inspiring stories from around the world* (Vol. 69, Issue 250).

Galle, N. (2020). Five key challenges urban foresters face. <https://www.nadinagalle.com/blog/five-key-challenges-urban-foresters-face>

Galle, N. (2020). Why municipalities struggle to keep their urban forests alive. <https://www.nadinagalle.com/blog/why-municipalities-struggle-to-keep-their-urban-forests-alive>

Glicken, J. (2000) Getting stakeholder participation 'right': a discussion of participatory processes and possible pitfalls *Environmental Science and Policy*, pp. 305-310

Handberg, Ø. (2018). No sense of ownership in weak participation: A forest conservation experiment in Tanzania. *Environment and Development Economics*, 23(4), 434-451. doi:10.1017/S1355770X18000190

Harthoorn, J. (2018, May 25). Residents hope against nuisance lime trees Brabants Dagblad.

Hewitt, E. (2021). Why 'tiny forests' are popping up in big cities. *National Geographic*. <https://www.nationalgeographic.com/environment/article/why-tiny-forests-are-popping-up-in-big-cities>

Innes, J. (1999). Information in communicative planning. *Approaching the Millennium: American Planning Association National Planning Conference*, Chicago, IL.

i-Tree Tools (2021, December 7). *i-Tree Eco* <https://www.itreetools.org/tools/i-tree-eco>

IVN Natuureducatie. (2021). Tiny Forest Jongerenteam. <https://www.ivn.nl/provincies/zuid-holland/tiny-forest-jongerenteam>

Jim, C. Y., & Chen, W. Y. (2006). Perception and attitude of residents toward urban green spaces in Guangzhou (China). *Environ Manage*, 38(3), 338-349. DOI:10.1007/s00267-005-0166-6

Kahneman, D., Knetsch, J. L., Thaler, R. H., 1991. Anomalies: The Endowment Effect, Loss Aversion, and Status Quo Bias. *Journal of Economic Perspectives* 5 (1), 193-206.

Konijnendijk van den Bosch, Cecil & Nilsson, Kjell & Randrup, Thomas & Schipperijn, Jasper. (2005). *Urban Forests and Trees: a reference book*. 10.1007/3-540-27684-X.

Mahmoudi Farahani, Leila & Maller, Cecily. (2018). Perceptions and Preferences of Urban Greenspaces: A Literature Review and Framework for Policy and Practice. *Landscape Online*. 61. 1-22. 10.3097/LO.201861.

Martin-Moreau, M., & Ménascé, D. (2018). Urban resilience: introducing this issue and summarizing the discussions. *Field Actions Science Reports*. The journal of field actions, 6-11.

Molin, Julie & Fors, Hanna & Faehnle, Maija. (2016). Citizen participation for better urban green spaces. 10.13140/RG.2.1.4027.8646.

Nas, D. (2021). *Design Things that Make Sense*. BIS Publishers

Okrent D. (1998) Risk perception and risk management: on knowledge, resource allocation and equity *Reliability Engineering and System safety*, pp. 17-25

Pierce JL, Kostova T, Dirks KT. The State of Psychological Ownership: Integrating and Extending a Century of Research. *Review of General Psychology*. 2003;7(1):84-107. doi:10.1037/1089-2680.7.1.84

Rafiee, A., Dias, E., & Koomen, E. (2013). Between green and grey: Towards a new green volume indicator for cities. *Proceedings of CUPUM 2013: 13th International Conference on Computers in Urban Planning and Urban Management - Planning Support Systems for Sustainable Urban Development*, 1, 1-18.

Remme, R., Nijs, T. d., & Paulin, M. (2018). *Natural Capital Model - Technical documentation of the quantification, mapping and monetary valuation of urban ecosystem services*. RIVM Report 2017-0040, 76. www.rivm.nl/en

Renn, O. (2006) *Participatory Processes for designing environmental policies* *Land Use Policy*, pp. 34-43

Safford, H.; Larry, E.; McPherson, E.G.; Nowak, D.J.; Westphal, L.M. (August 2013). *Urban Forests and Climate Change*. U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. www.fs.usda.gov/ccrc/topics/urban-forests

Sanders L., & Stappers P.J. (2012) *Convivial Toolbox: Generative Research for the Front End of Design*. BIS Publishers

UNFAO. (2016). *Building greener cities: nine benefits of urban trees*. Food and Agriculture Organisation of the United Nations. <https://www.fao.org/zhc/detail-events/en/c/454543/>

UNFAO. (2019). *How Trees Are Revolutionizing Cities Around the World*. Food and Agriculture Organization, United Nations. <https://www.connect4climate.org/article/how-trees-are-revolutionizing-cities-around-world>

van der Velde, R. (2021). *i-Tree 2.0-NL: Next-generation metrics and methodologies for urban forestry and climate resilience in Dutch cities*. https://www.urbanforestry.nl/wp-content/uploads/2021/06/i-Tree-2.0-NL_project-plan_june-2021.pdf

van der Velde, R., & Dijkstra, L. (2019). *Urban forestry programme outline*. Delft University of Technology. http://pure.tudelft.nl/ws/portalfiles/portal/71757304/programme_outline_PURE.pdf

Van Herzele A., Collins K (2005) *Interactive greenspace: people participating with professionals in parks and woodlands. A manual for public participation in urban parks and woodlands*. Ministerie van de Vlaamse Gemeenschap, Afdeling Bos en Groen, Belgium. Available from <http://www.bosengroen.be>

What are the effects of a Tiny Forest®? (n.d.). Retrieved February 07, 2022, from <https://www.ivn.nl/tinyforest/tiny-forest-world-wide/effects-tiny-forest>

DESIGN
FOR OUR
future



IDE Master Graduation

Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT

Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

STUDENT DATA & MASTER PROGRAMME

Save this form according the format "IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy". Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1!

family name <u>Ramchandani</u>	Your master programme (only select the options that apply to you):
initials <u>D</u> given name <u>Deeksha</u>	IDE master(s): <input type="radio"/> IPD <input type="radio"/> DII <input checked="" type="radio"/> SPD
student number <u>5194032</u>	2 nd non-IDE master: _____
street & no. <u>E</u>	individual programme: _____ (give date of approval)
zipcode & city <u>Z</u>	honours programme: <input type="radio"/> Honours Programme Master
country <u>I</u>	specialisation / annotation: <input type="radio"/> Medisign
phone _____	<input type="radio"/> Tech. in Sustainable Design
email _____	<input type="radio"/> Entrepreneurship

SUPERVISORY TEAM **

Fill in the required data for the supervisory team members. Please check the instructions on the right!

** chair <u>Prof. dr. Rebecca Price</u>	dept. / section: <u>DOS</u>
** mentor <u>Prof. dr. Jeroen van Erp</u>	dept. / section: <u>HCD</u>
2 nd mentor <u>Prof. J.R.T. van der Velde</u>	
organisation: <u>Faculty of Architecture, TU Delft</u>	
city: _____ country: _____	

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v.

Second mentor only applies in case the assignment is hosted by an external organisation.

Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

comments (optional)

Procedural Checks - IDE Master Graduation

APPROVAL PROJECT BRIEF

To be filled in by the chair of the supervisory team.

chair Prof. dr. Rebecca Price date _____ signature _____

CHECK STUDY PROGRESS

To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair. The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: _____ EC	<input checked="" type="radio"/> YES all 1 st year master courses passed
Of which, taking the conditional requirements into account, can be part of the exam programme _____ EC	<input type="radio"/> NO missing 1 st year master courses are:
List of electives obtained before the third semester without approval of the BoE	

name _____ date _____ signature _____

FORMAL APPROVAL GRADUATION PROJECT

To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **. Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?	Content: <input type="radio"/> APPROVED <input type="radio"/> NOT APPROVED
Is the level of the project challenging enough for a MSc IDE graduating student?	Procedure: <input type="radio"/> APPROVED <input type="radio"/> NOT APPROVED
Is the project expected to be doable within 100 working days/20 weeks?	
Does the composition of the supervisory team comply with the regulations and fit the assignment?	

_____ comments

name _____ date _____ signature _____

Using i-Tree tool to support greening of Dutch cities for urban resilience project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 30 - 08 - 2021 21 - 01 - 2022 end date

INTRODUCTION **

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

In the face of increasing weather extremes, Dutch Cities must adapt to deal with the impacts of climate change especially higher temperatures. Changes are needed in the physical realm, transitions need be made in policy and governance, and the resilience of urban communities to these conditions needs to be improved. Green space, and the urban forest in particular, is one of the most effective means of climate adaptation through the ability of trees to ameliorate extremes in urban thermal cycles. The ubiquity of trees and green space in cities also positions them as effective agents for building climate resilience in urban communities.

The key partner for this phase (Phase A) will be city administrations partnering in the project. Municipalities will provide a connection to citizens who can participate in Phase A.

Stakeholders' Values:

People typically expect to influence decisions and change. Residents might feel that the most important stage to involve them is at the point at which planning goals are set, in particular, at the local level. Once involved, people want to have a view on what happens with their input and how decisions are taken. If this is not followed up, it can lead to disillusionment and anger.

Current placement of citizens in the city operations:

In most cases, people's involvement is often limited to the implementation stages of plans and projects. In practice, however, it is common to find local agencies keen to put people's participation on their agendas, while actually only using them as data gatherers and providers of ideas for solutions, without giving them any feedback about what actually happens with their input. Based on literature, it was common to find people engaged in voluntary work and in raising money for a project, but having little or no say in the way a project is chosen, what the priorities are and how subsequent action may be taken.

Research gap/limitations:

This tension between vertical and horizontal mindsets lies at the heart of the construction of resilient cities. Neither seem sufficient when taken in isolation: self-organization risks being sub-optimal, and top-down profoundly undermines citizen appropriation. Deciding how best to combine these two approaches is the biggest single challenge currently facing public and private actors. Use of pre-packaged approaches might have little or no relevance to the situation in hand, and might effectively eliminate the vast range of relevant knowledge and information which can be gathered by simply observing the social dynamics of city administration and citizens driving the evolution of a local process.

Opportunities:

Public participation is driven by the common-sense realization that the urban forest can only be planned and managed effectively with the direct involvement of its eventual end-user – the urban dweller. Professionals should recognize this, and should regard the public as equal and capable partners with a wealth of creativity and enthusiasm to bring to the process. Professionals have the opportunity to repackage themselves, not as technical experts of climate resilience in cities seeking public endorsement for completed plans, but as facilitators intent on assisting communities to translate their needs and preferences regarding the urban forest into action on the ground.

space available for images / figures on next page

introduction (continued): space for images

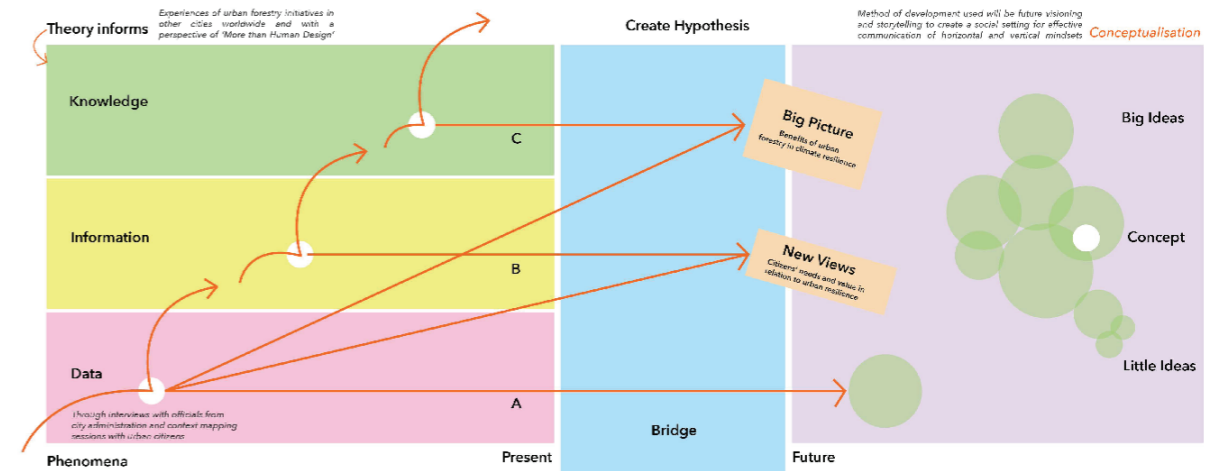


image / figure 1: Bridging from research to design to shift understanding from present to possible future scenarios



image / figure 2: All stakeholders in the Work Package 3 of the overall project, with focus on municipalities & citizens

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

Problem Definition:

The problem I aim to solve with my design solution is the tension between the vertical (top down approach of city authorities) and horizontal (led by citizens) mindsets while developing strategies to create resilient cities. The challenge is to combine these two approaches, represent the values and interests of urban communities and communicate them to the multiple stakeholders involved in the development of i-tree tool.

Objectives:

1. Developing and organizing participatory workshops:
 - To effectively communicate the benefits of urban trees and urban forestry initiatives.
 - To ensure that citizens are involved with the project at a personal to create a sense of belonging within their surroundings.
2. To map the values, experiences, needs and perspectives of citizens for the development of a climate resilience strategy.
3. To make climate change relatable, tangible, and specific for the multiple stakeholders especially citizens.

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

To solve the tension between the vertical and horizontal mindsets, I plan to design a product-service system which provides support to the multiple stakeholders in different phases of i-tree strategy development. Along with a system, I will design a strategic road-map with the role of citizens in the i-tree tool's contribution towards resilient Dutch cities.

Context mapping:

Aim of this (key) method is to help us understand the everyday experiences of citizens related to urban forestry and climate resilience. To create a holistic vision combining different perspectives, views, disciplines, and ideas, this method will work best in a multi-stakeholder project such as this. Deliverable of this step will be an info-graphics with data gathered and its analysis which will guide the ideation phase.

Future Visioning:

The aim of this method will be to express a desired future of a resilient city that serves as a strategic reference point. This will be done by imagining and creating various user scenarios of desired user experiences of citizens. The result will be a strategic road-map that will contribute to inspiring multiple stakeholders and capture the unmet needs of the citizens.

Storytelling and Role Playing:

This step will determine the interactions of the solution with its intended users. The possible end deliverable would be an interaction walk-through of a social setting or a platform for communication which will be captured by photography or a video.

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 30 - 8 - 2021 end date 21 - 1 - 2022

	Fulltime during 4th semester																				
Calender Week	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	1	2	3
Project Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		18	19	20
Kickoff meeting																					
Planning and setup of context mapping sessions																					
Context mapping sessions and analysis																					
Mid-term meeting																					
Ideating and developing design solution																					
User testing and report writing																					
Greenlight meeting																					
Refining and review																					
Graduation																					

The initial weeks will be spent getting in touch with the city administrations and recruiting the participants for context mapping. This will be followed by the development of a context mapping session and creating sensitizing toolkits for the participants. Week 5-7 will be utilized for conducting pilot sessions, context mapping sessions and analyzing the data gathered in the process. The mid-term takes place in Week 8 for which one of the key deliverables would be to create an infographic poster along with a presentation.

In the weeks following the mid-term meeting, the focus will be on bridging the research insights to a design solution using the methodology mentioned in the above section. The concept iteration, development and user testing will be done in weeks 10-12. The design solution which will possibly be a platform/social setting for communication will be presented to the committee in week 16 (green light meeting). The green light meeting will take place before the Christmas break.

Week 17,18,19 will be spent on refining the concept, creating the final presentation and working on the feedback from green light meeting. The graduation ceremony will be held in the third week of January (Week 20).

MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, Stick to no more than five ambitions.

1. Using analytical and critical thinking -
 - Assessing the strengths and weaknesses of conducting context mapping sessions with a broad target group
 - Articulating my thinking to multiple stakeholders in the project
 - Breaking down and making sense of complex processes into smaller steps
2. Research
 - Developing in depth knowledge of participatory processes and generative tools by conducting context mapping sessions.
 - Learning about making a plan and creating timelines in a multi-stakeholder project
 - Attention to detail - capability to identify important aspects that need to be within the framework and scope of the project
3. Applying and building on the knowledge from two electives - Creative Facilitation and Deep Dive (More than Human Design).
 - Using the learning, techniques and tools of creative facilitation for participatory processes and effectively communicating the results to multiple stakeholders.
 - Using the perspective of More than Human Design to experiment with the ways to access and include the knowledge and behavior of non-human entities (trees) in design work.

FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

Interview Questions Robert Kruijt, Landscape Architect Wonderwoods, Arcadis

Mapping and representation of citizens' values:

- As a landscape architect for a residential project in the middle of the city, did you inquire the needs of Utrecht citizens at any given point in the design process? (Here, the citizens being, people who live around Jaarbeursplein or potential residents?)
- Did you have any direct meetings with the city authorities? If yes, was there a mention of involving the citizens to understand the context and their perceptions about urban greening?
- I read that you use integrated approaches to engage multiple disciplines in a project? Can you give an example of such an integrated approach?
- At what time in a design process do you use integrated approaches like that?
- What according to you are some challenges and benefits of involving citizens in design projects?
- Do you expect situations where citizens or potential residents do not engage with certain aspects of the space?

Implementation of a technology to determine urban tree benefits:

- For the Project, did you have any control over the choice of species of trees?
- If yes, to maximise the benefits of trees on the quality of life, how did you choose the desired tree species?
- Was there any kind of technology used to quantify the tree benefits?

Communication between municipalities and citizens:

- What are some challenges of working with the municipalities?
- Who is expected to engage with the needs of citizens after the project is completed? (Things like upgradation, maintenance, or changes)?

INTERVIEW GUIDE

Interviewee: Lior Steinberg
Co-founder Humankind, Rotterdam

Main research question:

How can the implementation of i-tree tool help in removing the friction between Dutch city authorities and citizens by combining the two mindsets?

Checklist for start

- Informed Consent form
- Record the session

Introductory script

Hello, I am Deeksha, and I am currently doing my Graduation Project in the topic of "Implementation of the I-tree tool and its impact in the public space development". I am focusing on mapping the citizens' values in relation to urban greening and benefits of trees in their surroundings.

- I was introduced to Humankind by my thesis supervisor Prof. Rebecca Price, and I also came across your TEDx talk "Including Residents in Urban Planning"
- Can I use your name in the report? If yes, I will share the report with the interviewee so they can check if they agree with the insights of the interview
- The interviewee may withdraw from the interview at any point. (Signing the consent form)
- There are no right or wrong answers, we're interested in your opinions and personal experiences
- You are free to interrupt the interviewer at any time
- Ask permission to record

Theme 1:

Mapping and understanding the values of citizens.

Interview questions:

- What do you think is the first step to get people interested and involved in actively being a part of urban greening?
- In what part of the project process do you consider the involvement of citizens should be?
- What according to you are some supporting factors of involving citizens as participants in urban greening?
- Are there any reasons not to involve citizens in the early phases of the project like planning and decision making?
- We did not have a very hot summer this year so it's easy for people to overlook the urgency of climate action and the need for urban cooling. How do you, through your projects, make sure that the people are aware of the urgency of rising temperatures and act accordingly?
- What are some interactive approaches you have adapted to involve public participation?
- In one of Humankind's projects for the (Rotterdam) municipality - PRKLT (modular park near school) how did you convince the parents and other stakeholders of the need of a park instead of parking?

Follow-up questions:

- How do you make climate change more tangible and relatable for public, so they are motivated to participate in the

Theme 2:

Implementation of a technology to determine urban tree benefits

Interview questions:

- In the Project "Quantifying urban greenness" do you envision the data ever being used by city dwellers? If yes how? If not, why not?

Theme 3:

Friction/communication gap between municipalities and citizens

Interview questions:

- How much is the municipality (as a client) involved in the projects involving public spaces redevelopment?
- What are some challenges of working with the municipalities?
- How do you ensure that the municipality is actively engaging the public after the project is completed from your side?

Checklist for closure

- Giving a brief concluding summary
- Checking with the interviewee whether you missed important topics
- If necessary, diffusing the tension that has built up during the interview
- Informing the interviewee about what you will do with the interview and if there will be any follow-up
- Thanking the interviewee

Interview Questions to Resident of Tiny House, Tussentij

- What is it like living so close to the nature especially trees?
- When were the climate arboretum trees planted?
- How did the research team approach you?
- What was your reaction? Did you have a discussion with all the other residents before deciding?
- How much caring do the trees need?
- Who participates in taking care of the trees?
- Was the Dordrecht municipality involved in talking to the residents of the Tiny Houses?

INFORMED CONSENT FORM

Introduction:

You are invited to participate as an interviewee for the research topic of "Implementation of i-tree technology for urban greening and its impact on public space development". The research is being conducted by Deeksha Ramchandani for the Master's Graduation Project, Industrial Design Engineering, TU Delft. We are asking you to participate in this interview because of your relevant experience in the field of urbanism and integrated approaches to tackle spatial challenges. We want to study and understand the design project, the approach used and the learnings along the way.

Please tick the appropriate boxes

Yes No

I consent voluntarily to be an interviewee in this study and understand that I can refuse to answer questions and I can withdraw from the interview at any time, without having to give a reason.

I understand that taking part in the interview involves two forms of data capturing. Firstly in the form of audio-recording, video-recording and transcribed as a text of the video conversation during the interview. The video- and audio-recording will be saved for further research practices.

Use of the information in the study

I understand that information I provide will firstly be used in the publication of Graduation Project report; secondly in possible future scientific research and in the conference or journal publications.

I understand that personal information collected about me that can identify me, such as my name, my face, or where I live, will not be shared beyond the study team unless a formal written consent agreed upon otherwise.

I agree that my information can be quoted in research outputs.

Future use and reuse of the information by others

I give permission for the video and audio recording that I provide be used to be archived in Faculty of Industrial Design of TU Delft so it can be used to assess the Graduation Project.

I give permission for the video and audio recording that I provide, to be used by the researcher who conduct this study and their Graduation Project supervisors so it can be used for future research and learning, excluding the commercial use.

I give permission for the transcribed information in the text format that I provide, to be used to be archived in Faculty of Industrial Design of TU Delft so it can be used to assess the Graduation Project report.

Signature

Name of participant

Signature

Date

I have accurately read out the information sheet to the potential interviewee and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

Researcher Name

Signature

Date

Deeksha Ramchandani

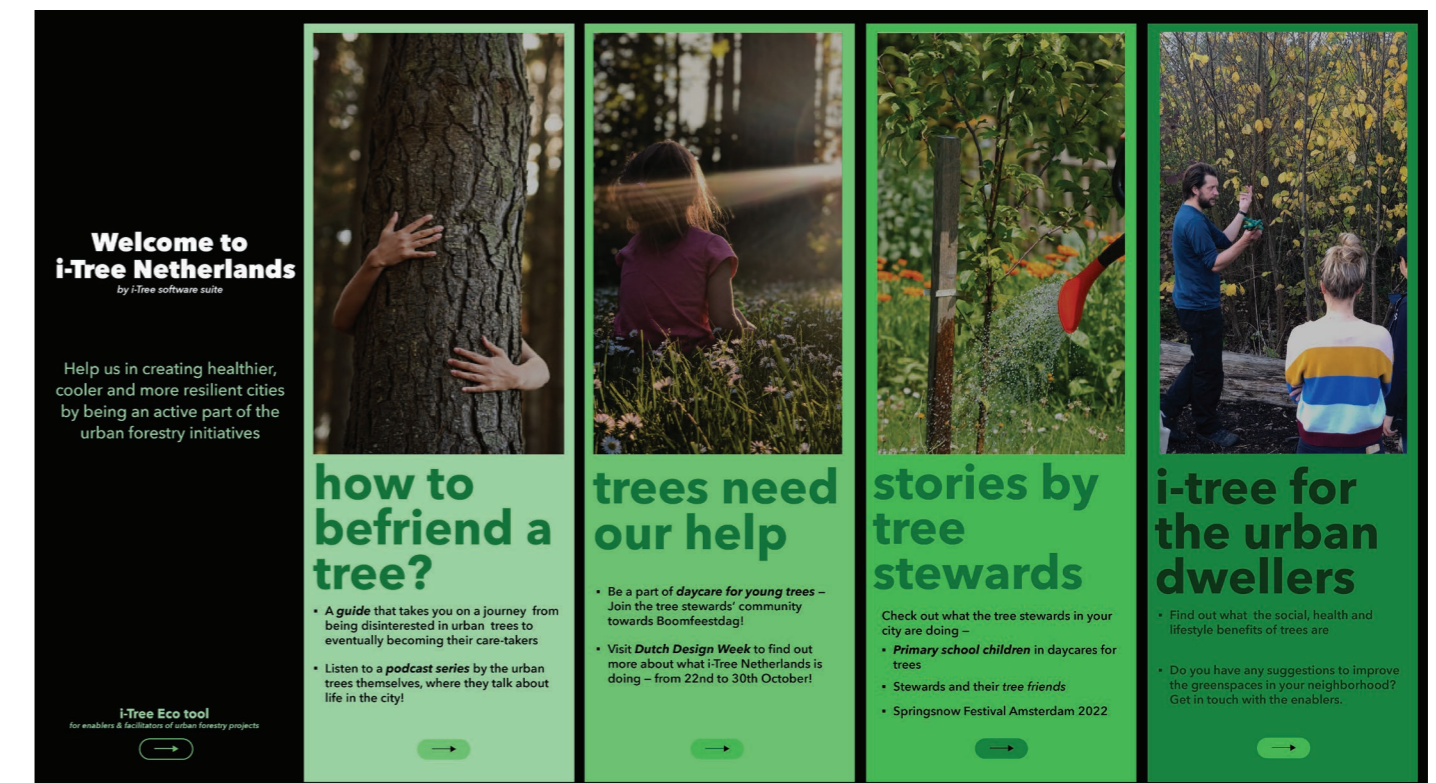
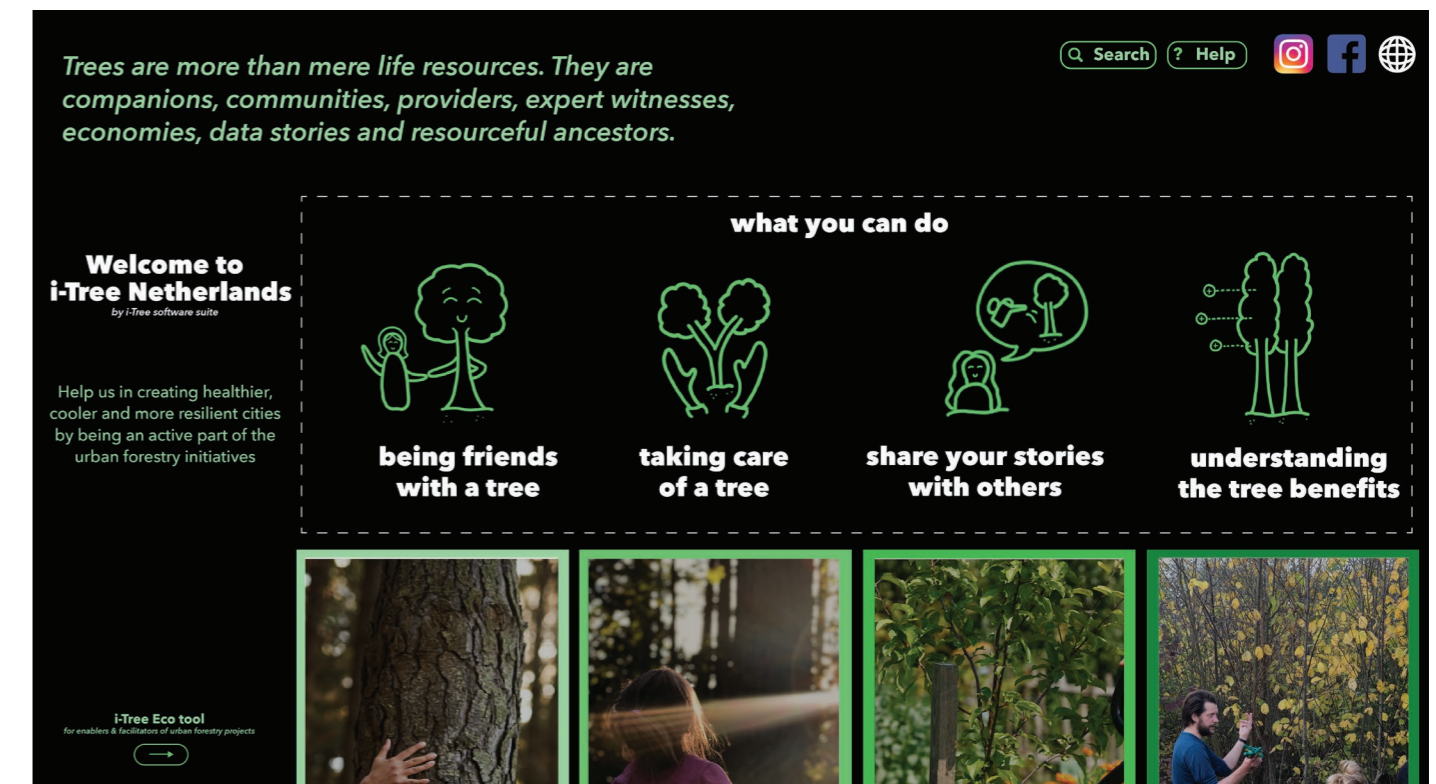
Deeksha R.

8th October 2021

Contact details for further information:

Deeksha Ramchandani, +31685314457, d.ramchandani@student.tudelft.nl

Proposed Landing page for i-Tree Netherlands Digital Platform



Proposed Wireframes for i-Tree Eco Tool

Choose the boundary of your area

City, Neighbourhood, Park, Others

Choose the type of inventory

Complete inventory, Plot-based inventory

PHASE 1
Planning for your Project

Gathering your data

Species, Location, Precipitation, Pollution, Valuation

PHASE 2
Setting up your Project

Data Collection

Choosing your data, Deciding how to record data, Preparing for the field, Going out in the field

PHASE 3
Collecting your field data

Choosing your data

Required, General, Tree Details, Management

Data Variables: Maintenance required, Maintenance task, Sidewalk conflict, Pests (IPEP)

PHASE 3
Collecting your field data

Specifying the data collected

Data fields, Define plots, Project strata, Inventory data, Inventory value, Report classes

PHASE 4
Working with i-Tree Eco

Specifying the data collected

Data fields, Define plots, Project Strata, Inventory data, Inventory value, Report classes

Data fields: Land use, Ground cover, DBH Classes, Crown health, Maintenance, Custom fields

PHASE 4
Collecting your field data

Reports

for facilitators and enablers, for care-takers

PHASE 5
Reports

For caretakers

Summary, Composition & Structure, Individual level results, Pest Analysis, Caretakers Report

Facilitator's Report

PHASE 5
Reports

Proposed Wireframes for i-Tree Community Tree Map

City-wide Tree map – Amsterdam

Legend: Top 15 Most Common Species, Other species - 42.700, Unknown species - 2.607

Your Tree: Angela (Cherry (Prunus))

Community Tree Map, Your Tree Health, Your Status

PHASE 1
Community Tree Map

City-wide Tree map – Amsterdam

Legend: Top 15 Most Common Species, Other species - 42.700, Unknown species - 2.607

Your Tree: Angela (Cherry (Prunus))

Your Tree Health: Trunk wounds, Mushrooms, Surface roots, Leaf color and appearance, Co-dominant branches, Mulch

PHASE 2
Your Tree Health

City-wide Tree map – Amsterdam

Legend: Top 15 Most Common Species, Other species - 42.700, Unknown species - 2.607

Your Tree: Angela (Cherry (Prunus))

Your Status: Role, Progress, Badges

PHASE 3
Your Status

Complete Guide– How to befriend a Tree?

