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Co-Creating Nature-Based Solutions and Green Spaces in a Nordic Municipality

The Case of Tampere UNaLab

Master's thesis in Civil and Environmental Engineering
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Preface

This thesis is submitted to the Norwegian University of Science and Technology (NTNU). It is the final contribution to the five-year program in Civil and Environmental Engineering. The thesis is a product of the course *TVM4905 Water and Wastewater Engineering, Master's Thesis*. The topic of the thesis is municipal-led co-creation of Nature-Based Solutions (NBS) and green spaces, with the involvement of inhabitants and professionals from the industry and municipality. The study was conducted partly in Tampere and in Espoo in Finland, and partly at the Department of Civil and Environmental Engineering at NTNU, Trondheim, Norway. The study included three visits to Finland, in March, April and May 2018.

The study has been part of a collaboration between the EU project Urban Nature Labs (UNaLab), represented by VTT and the City of Tampere, and NTNU. I would like to express my gratitude to Tone Merete Muthanna (NTNU), Laura Wendling (VTT) and Maarit Särkilahti (City of Tampere) for giving me the opportunity of doing this master thesis. The thesis has given me answers to a question culminating through my studies. The question was how we can work towards local stormwater management solutions and urban spaces that are multi-functional in ways that are fulfilling the users' needs, in addition to providing sound stormwater management.

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Oslo, December 17, 2018



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Sammendrag

Tradisjonell utbygging og økning i andel tette flater skaper utfordringer for byer og tettsteder i møte med konsekvensene av klimaendringene. Det foregår derfor et skifte mot vannsensitiv byutvikling ved hjelp av integrering av natur-baserte løsninger (NBL), for å opparbeide bærekraftige og sosio-hydrologisk robuste byer og tettsteder. NBL er løsninger inspirert av, støttet av eller kopiert fra naturen og som bidrar til å løse samfunnsmessige utfordringer samtidig som de gir muligheter for å oppnå sosiale, miljømessige og økonomiske fordeler. NBL er således en paraplybetegnelse som inkluderer lokal overvannsdiskonering (LOD). Skiftet mot vannsensitiv byutvikling med integrering av NBL krever at flere fagdisipliner samarbeider. Det krever også at mange ulike private og offentlige aktører tilknyttet byggebransjen og vannbransjen hever kompetanse og tilpasser arbeidspraksis. I og med at NBL ofte er over bakken kan de både trigge og tilfredsstillende behov til en bredere gruppe brukere og interessenter enn det tradisjonelle rørløsninger under bakken kan gjøre. Samskapning av NBL og grønne områder med interessenter opplever derfor økt interesse. Et formål med samskapning vil være å bidra til å realisere mer av potensialet til case-spesifikke NBL og grønne områder. Videre vil et overordnet formål være å bidra til et effektivt skifte til en utbyggingspraksis og en vannforvaltning som tar oss mot framtidens bærekraftige, klima-robuste og levbare byer og tettsteder. Det er derimot en mangel på kunnskap og case studier om effektresultater og suksessfaktorer for samskapnings-prosesser om NBL og grønne områder hvor både innbyggere og private og offentlige profesjonelle er involvert. Denne oppgaven søker å bidra til økt kunnskap på dette området.

Utgangspunktet for oppgaven er en samskapningsprosess i Tampere, en by med 230 000 innbyggere i Finland. Samskapningsprosessen var tredelt, i tilknytning til tre byutviklingsprosjekter; i) transformasjon av et 115 ha industriområde i planfasen, ii) utbygging av et 473 ha skogsområde i konstruksjonsfasen, og iii) renovering av en lokal park. Det ble arrangert henholdsvis 3, 3 og 1 samskapningsarrangementer. Oppgaven tar i bruk kvalitativ case studie forskningsmetode med en nedenfra og opp dataanalyse-tilnærming. Data ble samlet inn gjennom 42 mini-intervjuer, 25 korte intervjuer og 18 dybdeintervjuer, gjennom observasjon og deltagelse på alle arrangementene i prosessen, samt gjennom spørreundersøkelser, dokumentasjon og arkivmateriale. Hovedeffektresultater av å samskape NBL og grønne områder ble identifisert og gruppert i 10 kategorier, gjengitt i Tabell 1 nedenfor med tilfeldig nummerering. Effektresultatene ser ut til å bidra til bedre forhold for å kunne oppnå NBL og grønne områder som er suksessfulle i byggeprosjekters leveranse, igjennom bruksfasen og i bransjen og samfunnet på lang sikt, som illustrert i Figur 7.

Nøkkelfaktorer for suksess i samskappingsprosessen viste seg å være varierte samskappingsarrangementer og fokus på å involvere spesifikke interessenter. Dette gjorde at prosessen lyktes i å engasjere mange ulike og viktige interessenter. Profesjonelle deltagerere i samskappingsprosessen inkluderte: kommunale representanter fra relevante avdelinger og fra både strategisk, taktisk og operasjonelt nivå; private representanter fra store utbyggerfirma, leverandører av NBL-relaterte produkter, og konsulentfirma representert av eksperter i ulike fagdisipliner, inkludert arkitektur, landskapsarkitektur, byplanlegging, vann og avløp, geoteknikk, hortikultur, økologi, og miljøteknologi; og representanter fra universiteter og forsknings- og utviklingsselskap. Av innbyggere og brukere inkluderte deltagerne unge, middelaldrende og eldre lokale innbyggere og brukere av områdene, engasjerte studenter, borettslagsrepresentanter, NGO-representanter, representanter fra foreldrerådets arbeidsutvalg, lokale lærere, foreldre, skolebarn og barnehager. 15 nøkkelfaktorer for suksess i samskapning av NBL og grønne områder ble identifisert og utbrodert, gjengitt i Tabell 2 nedenfor med tilfeldig nummerering. Oppsummert ser samskapning av NBL og grønne områder ut til å være en god tilnærming for å oppnå en rekke effektresultater både på kortere og lengre sikt. Dette ser ut til å inkludere å oppnå velfungerende NBL og grønne områder, tilfredsstillende brukeres behov, utnytte potensialene til NBL og grønne områder mer til det fulle, samt å støtte skiftet mot bærekraftige og klima-robuste byer og tettsteder. Suksess i samskapning forutsetter at de nødvendige ressursene for samskapning er på plass og at de resterende suksessfaktorene er ivaretatt.

Tabell 1: Hovedkategorier av identifiserte effektresultater av samskapning av NBL og grønne områder

ID	Stikkord	Effektresultat-kategori
1	Utfordringer og løsninger	Forbedre resultater for NBL og grønne områder gjennom økt bevissthet om utfordringer og samskapning av løsninger
2	Mangfoldige innspill	Forbedre resultater for NBL og grønne områder gjennom mangfoldige innspill, ideer, samskapning og vinn-vinn-synergier
3	Profesjonell kompetanse	Bygge profesjonell kompetanse om NBL, - hvordan å bygge og hvorfor
4	Innbyggerkompetanse	Bygge innbyggerkompetanse om NBL, - hvordan å bygge og hvorfor
5	Prosjekteierkompetanse	Bygge prosjekteierkompetanse om NBL og om brukerbehov, brukeropplevelser og flerfunksjonell bruk
6	Redusere siloer	Redusere profesjonelle siloer gjennom kommunikasjon og dypere forståelse for andre disipliners behov
7	Miljømedborgerskap	Bygge miljømedborgerskap i den unge befolkningen
8	Tillit og engasjement	Bygge tillit, vennlighet, engasjement og eierskap til prosjektet, møte bekymringer, finne felles mål og bygge forståelse mellom interessenter
9	Samarbeid	Fremme kontakt, nettverksbygging og etablering av fruktbare samarbeid
10	Erfaringsgrunnlag	Bygge et lokalt erfaringsgrunnlag for samskapning av NBL og generelt

Tabell 2: Identifiserte nøkkelfaktorer for suksess i samskapning av NBL og grønne områder

ID	Stikkord	Nøkkelfaktorer for suksess
1	Ressurser	Ha de nødvendige ressursene for samskapning av NBL og grønne områder, inkludert et prosjektteam som innehar ekspertise i NBL og overvannspraksis, tjenstedesign/samskapning og prosjektledelse, samt nok tid og ressurser
2	Oppstart	Gjennomgå en ordentlig initieringsfase for en samskapningsprosess
3	Interesent-håndtering	Interessentanalyse og -forvaltning, kommunikasjon og markedsføring for å forsikre om at viktige interessenter deltar, og benytte lokale begivenheter og muligheter for vinn-vinn-løsninger
4	Brukertilpasning	Tilpasse form og innhold til interessentene som er ønsket at skal delta, og til deres behov og motivasjoner
5	Informasjon	Gi tydelig, tilgjengelig og tidsriktig informasjon om prosjektet og samskapningsprosessen
6	Felles grunnlag	Legge et felles grunnlag for diskusjoner og samskapning i arrangementer på en konsis måte
7	Verktøy	Bruke nødvendige, nyttige og funksjonelle verktøy, metoder og materialer i samskapningen
8	Atmosfære	Etablere tillit mellom personene på arrangementet og skape en varm og åpen atmosfære, bruke humor, og ha introduksjonsrunder og navnelister
9	Fasilitatorer	Ha fasilitatorer i workshopgruppene for å holde fokus og sikre at alle får snakke
10	Innflytelse	Gi deltagere reell innflytelse gjennom og som resultat av prosessen
11	Underliggende behov	Spørre, lytte etter og gripe tak i interessentenes og brukernes underliggende behov og utfordringer
12	Avrunding	Avslutte arrangementer på en ordentlig måte med inkluderende oppsummering og reelle muligheter for tilbakemeldinger og spontane refleksjoner
13	Syntetisering	Dra nytte av de profesjonelle kompetansene i prosjekt-teamet for å syntetisere innspill, oppdagede utfordringer og behov med rammer og forutsetninger for å produsere resultater
14	Oppfølging	Videreføring og implementering av resultatene i prosjektet og innad i kommunen
15	Kommunikasjon	Oppfølgingskommunikasjon med deltagere og øvrige interessenter

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Abbreviations

Terms

DT	Design Thinking
GI	Green Infrastructure
JPI	European Joint Programming Initiatives
LID	Low Impact Development
LOD	Lokal overvannsdiskonering [NO], local stormwater management
NBL	Naturbaserte løsninger [NO], Nature-Based Solutions
NBS	Nature-Based Solutions
NGO	A non-governmental and non-profit organization
NVivo	A computer-assisted qualitative data analysis software
OECD	The Organization for Economic Co-operation and Development
SUDS	Sustainable Urban Drainage Systems
TUC	The Tampere UNaLab Co-Creation Process executed in spring 2018
UGI	Urban Green Infrastructure
ULL	Urban Living Lab
UNaLab	The EU Horizon 2020 project Urban Nature Labs
WSUCD	Water Sensitive Urban Co-Design
WSUD	Water Sensitive Urban Design

Abbreviations for referencing

Projects and sub-co-creation processes related to the projects

H	Hiedanranta
LP	Local Park
V	Vuores

Events

H1	Hiedanranta event number 1: seminar workshop
H2	Hiedanranta event number 2: expert seminar
H3	Hiedanranta event number 3: walk tour
V1	Vuores event number 1: evening event
V2	Vuores event number 2: school workshop
V2x	Vuores event that sprang from collaboration established in V2
V3	Vuores event number 3: Vuores-day festival stand and nature trail
LP	Local Park outdoor workshop

Interviewees

O	Organizer
OS	Organizing partner
OSP	Organizing partner and participant
[Event]P	Participant in the given event
PI	Participant who is inhabitant
PT	Participant who is teacher
PP	Participant who is private professional
PM	Participant who is municipality representative

Surveys, documents and archival records

[Event]s	Survey from the given event
[#]*[Survey]	Indicates the number of survey responses referred to
[Event]-obs	Refers to observation made in event
[event/project]d	Refers to a document related to the event/project (see list in Appendix E)
[event/project]r	Refers to an archival record related to the event/project (see list in Appendix F)

Co-creating Nature-Based Solutions and Green Spaces in a Nordic Municipality: The Case of Tampere UNaLab

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Norwegian University of Science and Technology, 2018

Abstract

Traditional urban development and increase in impervious surfaces creates challenges for urban districts in facing consequences of climate change. A shift is happening towards a water sensitive approach, integrating Nature-Based Solutions (NBS) to achieve sustainable and socio-hydrologically resilient districts. This shift requires various professional fields and actors to collaborate, and it requires many actors related to urban development to increase their competences and adapt their way of working. NBS are solutions inspired by, supported by or copied from nature, and which contributes to solving societal challenges while providing opportunities for social, environmental and economic benefits. As NBS are often above ground, they may both trigger and solve needs of a wider array of users and stakeholders compared to traditional underground stormwater solutions. As a result, co-creation of NBS and green spaces with stakeholders is gaining interest. A purpose of co-creation would be to support realization of the potentials of case-specific NBS and green spaces. A long-term purpose may be to support a smooth and successful shift to sustainable, climate-resilient and increasingly livable cities. Currently there is a lack of knowledge and detailed case studies on the outcomes and success factors of municipally led processes involving both professional and non-professional citizens in co-creating NBS and green spaces. This study aims to address this gap. The basis of the study is a co-creation process in Tampere, a city with 230 000 inhabitants in Finland. The co-creation process concerned a planning phase brownfield development, a construction phase greenfield development, and a renovation of a local park, with 3, 3 and 1 co-creation events respectively. The study applies qualitative case study research with a ground-up data analysis approach. Data was collected through 42 mini-interviews, 25 short interviews and 18 in-depth interviews with 43 interviewees, and through direct and participant observation in events, surveys, documentation and archival records. Main outcomes of co-creating NBS and green spaces were identified and grouped in 10 categories. The outcomes seem to create better terms for achieving successful NBS and green spaces in projects, in use phases and in the industry and society in the long term. Key factors for the success of the co-creation process appeared to be the diversity of events and the targeting of specific stakeholders, which enabled the process to engage many different and important stakeholders. 15

key success factors of co-creating NBS and green spaces have been identified and elaborated. Co-creation of NBS and green spaces appears to be a good approach to achieve an array of short-term and long-term outcomes. This includes realizing more of the potentials of NBS and green spaces, adapting to circumstances and fulfilling the users' needs, and supporting the local shift towards sustainable and climate-resilient cities. Success in co-creation of NBS and green spaces requires that necessary resources are provided and that the further success factors are attended to.

Keywords: Participatory processes, stakeholder engagement, LID, SUDS, GI, ESS, WSUD

1. Introduction

Traditional urban development and increase in impervious surfaces gives urban districts challenges in facing stormwater related consequences of climate change (Hirabayashi et al., 2013; Jacobson, 2011; Nielsen et al., 2011). A water sensitive approach integrating Nature-Based Solutions (NBS) with traditional solutions to manage everyday- and larger precipitation events locally and conduct runoff from extreme events downstream safely in open flood ways is established as the way forward to face the challenges and build climate resilient urban districts (Bothner & Aanderaa, 2018; Krull et al., 2015; Lindholm et al., 2008; Wong & Brown, 2009). An important goal is to build socio-hydrological resilience (Mao et al., 2017). As defined by the EU Horizon 2020 Expert Group on ‘Nature-Based Solutions and Re-Naturing Cities’, NBS is an umbrella term for solutions inspired by, supported by or copied from nature that help societies address a variety of environmental, social and economic challenges in sustainable ways (Krull et al., 2015). In the context of stormwater, NBS make use of natural elements and mimics nature’s way of managing water for example by infiltration, evapotranspiration, local storage and slow transport of stormwater (Bothner & Aanderaa, 2018; Krull et al., 2015; Lindholm et al., 2008). This requires more disciplines and actors to be involved than for traditional stormwater management (Kabisch et al., 2016; Ranzato & Bortolotti, 2015). A successful shift to sustainable and socio-hydrologically resilient stormwater management with integration of NBS also requires traditional practitioners to relearn and renew their way of working. Unlike traditional drainage and pipes, NBS are often above the ground. This trigger other needs to be accounted for, and also creates opportunities for NBS to be multi-functional and to solve a variety of societal needs in addition to stormwater management (Bothner & Aanderaa, 2018; Krull et al., 2015). The high value of space in most cities increase motivation for multi-functional solutions. The EU definition of NBS highlights NBS as positive responses to societal challenges with potential to simultaneously meet social, environmental and economic objectives (Krull et al., 2015).

Meeting multiple needs and facing the complex task of transitioning to sustainable and resilient stormwater management, with the involvement and collaboration of numerous disciplines and stakeholders, calls for innovative and stakeholder centered approaches (Frantzeskaki & Kabisch, 2016; Kabisch et al., 2016; Nielsen et al., 2011; Ranzato & Bortolotti, 2015; Udomcharoenchaikit, 2016). Nielsen et al. (2011) emphasizes that “to realize new sustainable urban water designs a project team will need to engage and get acceptance from internal and external stakeholders, and this calls for communication and social skills rather than technical skills”. Traditional urban planning processes where stakeholders can give feedback mainly after the plans are made may lead to heavy complaint cases which may slow down or stop the development. This has been experienced for example in attempts at day-lighting currently piped streams (Borgersrud, 2018; Husby, 2016). In a comparative study on the

integration of NBS into plans and projects in Malmö and Copenhagen, it was found that “the collaboration of various sectors and political support [were] the key social innovations which lead to the successful implementation of the NBS measures to the urban stormwater management plans” (Udomcharoenchaikit, 2016). As leverage points and strategies for scaling up the integration process, the study suggests focusing on communication and knowledge transfer, “which could lead to the shift in the mindset of stakeholders towards stormwater management” (Udomcharoenchaikit, 2016). Kabisch et al. (2016) mapped main needs for future science and policy agendas when dealing with NBS. One of the three main needs identified was the need for adapting for governance challenges in implementing NBS, by bringing together new networks of society, nature-based solution ambassadors and practitioners. Another of the main needs was the need to consider socio-environmental justice and social cohesion when implementing NBS, by using integrated governance approaches that take into account an integrative and transdisciplinary participation of diverse actors. Kabisch et al. presents the following main topics for indicators for measuring effectiveness of NBS for climate change adaptation and mitigation and associated co-benefits (Figure 1).

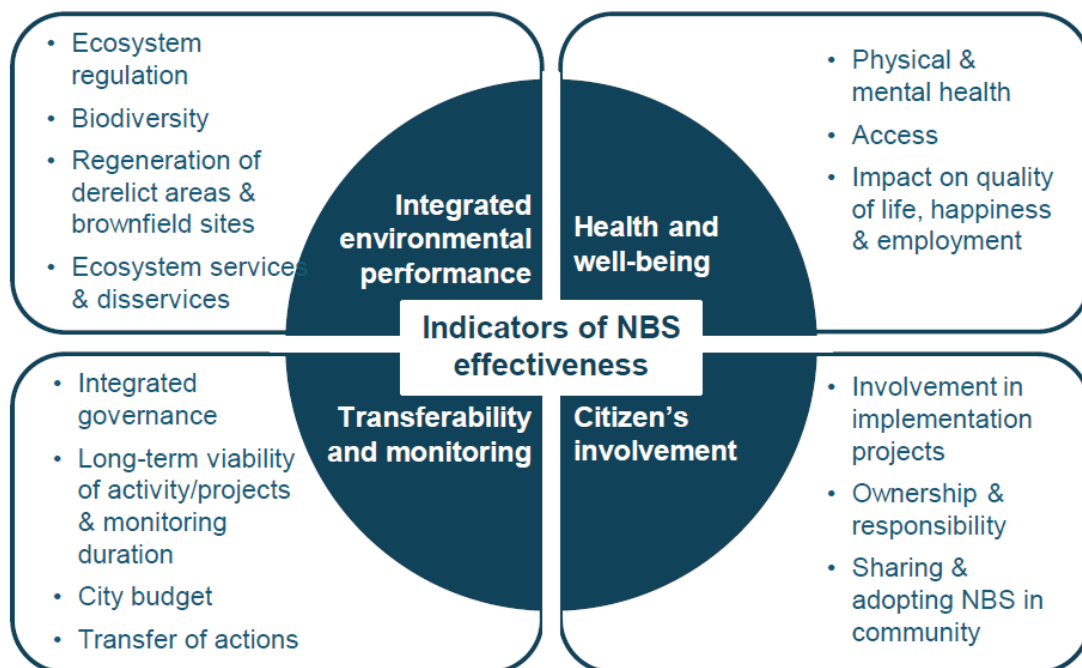


Figure 1: Main topics for indicators concerning the effectiveness of nature-based solutions (NBS) for climate change adaptation and mitigation and associated co-benefits (adapted from Kabisch et al. 2016)

Co-creation is an approach recently gaining attention in relation to urban areas and water for various reasons (Akhmouch & Clavreul, 2016; Puerari, Concilio, & Longo, 2014; Zhang & Kumaraswamy, 2012). Co-creation may be defined as “the collaborative development of new value (concepts, solutions, products and services) together with experts and/or stakeholders (such as customers, suppliers etc.)” (Fronteer, 2018). From the field of participatory design, involving end-users leads to more relevant and usable

products and services, while reducing risk (Ind & Coates, 2013). In the internet technology business, participatory design is becoming increasingly standard in development of products and services (Ind & Coates, 2013). Popular methods include Google Design Sprint (Knapp, Zeratsky, & Kowitz, 2016) and design thinking (Hrovatin, Machtig, & Prekrat, 2008; Lozano, 2018). Design thinking involves the development of quick prototypes as a means of testing user reactions and in order to fully and truly fulfill user needs (Hrovatin et al., 2008; Ind & Coates, 2013; Knapp et al., 2016; Lozano, 2018). There is also motivation for co-creation in order to shift from public-private partnership to public-private-people partnership, in the production of urban services in general, and urban green areas growth and management in particular (Puerari et al., 2014). A goal would be to increase effectiveness of the public spending program in addressing citizen needs, and to increase the quality of urban services and the quality of urban lives (Puerari et al., 2014).

By providing opportunity for citizen engagement in local decision-making and supporting bottom-up processes (Kabisch et al., 2016; Puerari et al., 2014), NBS are linked to the development of and execution of Environmental Citizenship. ‘Environmental Citizenship’ is defined as the responsible pro-environmental behavior of citizens who act and participate in society as agents of change in the private and public sphere, on a local, national and global scale, through individual and collective actions, in the direction of solving contemporary environmental problems, preventing the creation of new environmental problems, achieving sustainability as well as developing a healthy relationship with nature.

‘Environmental Citizenship’ includes the exercise of environmental rights and duties, as well as the identification of the underlying structural causes of environmental degradation and environmental problems, the development of the willingness and the competences for critical and active engagement and civic participation to address those structural causes, acting individually and collectively within democratic means, and taking into account inter- and intra-generational justice (European Network for Environmental Citizenship, 2018).

Outcomes and benefits of co-creation in relation to water management and development of urban and green spaces in general, and climate adaptation and integration of NBS in particular, have been found in several case studies. A comprehensive OECD study on “Stakeholder Engagement for Inclusive Water Governance” included a survey administered to 215 stakeholder groups and 69 case studies of specific stakeholder engagement initiatives on water management (Akhmouch & Clavreul, 2016). Results clustered benefits of stakeholder engagement into four categories, as shown in Figure 2.

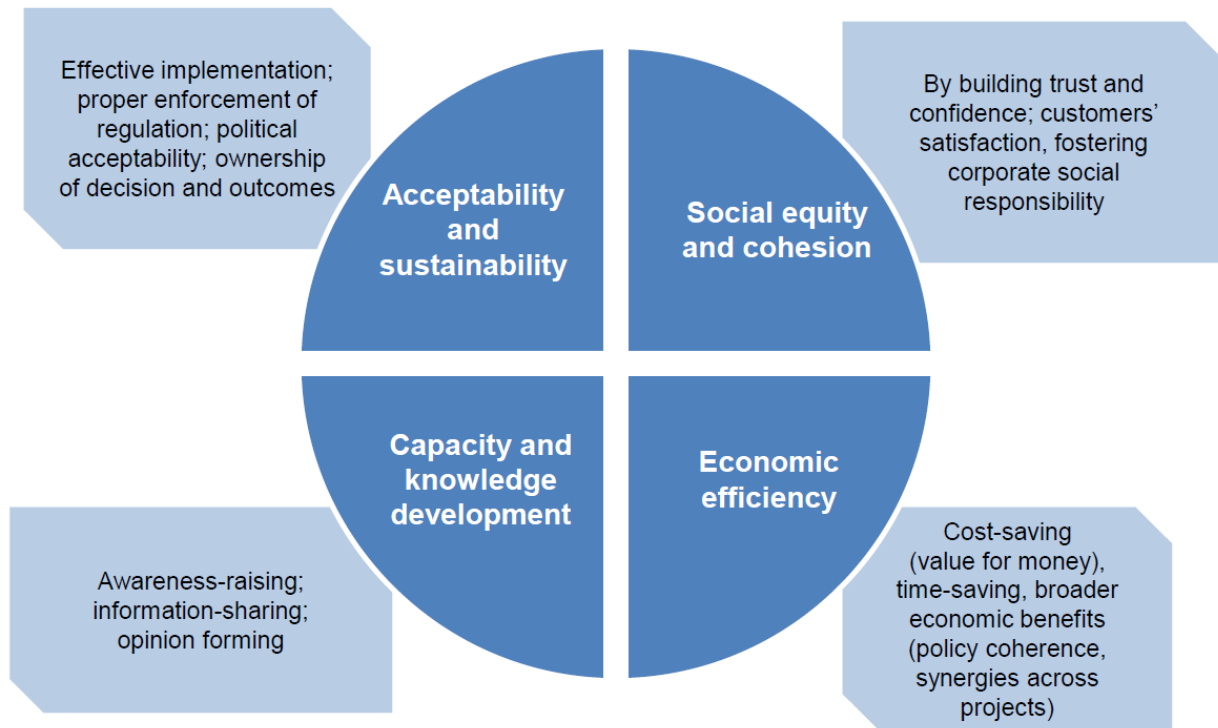


Figure 2: OECD typology of long-term benefits of stakeholder engagement in water governance (reproduced from Akhmouch and Clavreul, 2016)

Outcomes and success factors of co-creation from specific cases are related to the context of the co-creation. Therefore, findings from prominent cases are summarized case-wise with brief elaborations of the co-creation context in the following. Also, an important distinction of co-creation is if non-professional citizens are taking part or not. Hence, the cases are grouped in cases of co-creation involving citizens and cases of co-creation focused on inter-disciplinary professional participants.

Of the cases involving citizens, a case study of Forrest district in Brussels describe a bottom-up initiated co-creation process where inhabitants, designers, urban developers and institutions are engaged in a water sensitive urban co-design (WSUCD) process (Ranzato & Bortolotti, 2015). The bottom-up initiative was triggered by six vacant lots getting ready for development in an area of ground water springs emerging in the day and a local spring being released in the sewage, and where more soil sealing and increased runoff could produce further problems. In the co-creation process, a local NGO guided four collective walks through the Forest landscape, with participatory analysis and diagnosis of the catchment area and the water paths, springs and sink points, and of features of upstream and downstream areas such as soil, paving and vegetation. Designers participated and presented possible best practices for integrated water management that could be adopted in the catchment. Each walk was followed by a participatory co-mapping session using a tool called MAP-it, which “enables designers to moderate participatory design

processes through workshops in which people from different backgrounds collaboratively reflect on and set up new projects”. Afterwards, a public assembly organized by the NGO and local inhabitant organizations and supported by the municipal water department presented results for the regional institutions responsible for water, with experts, researchers and designers also present. After discussions in a public meeting where coming urban developments were presented to the public, the NGO and local organizations also obtained a closed meeting with the urban developers, the municipal water department and the regional institutions responsible for water. The plan proposal was further elaborated based on the reflections that emerged during the co-analysis and co-mapping stages. The plan, which includes the six vacant development lots and the springs of the area, will separate stormwater and spring water from the sewage with implementation of local water management and new urban floodways that will release water into a local watercourse. The plan has entered a phase of detailing and negotiation, where developers, institutions, the NGO and local organizations are in contact about discussing details of solutions and the best way to proceed. (Ranzato & Bortolotti, 2015).

The Forest case study concludes that a strong process of social learning is taking place. The actors have realized that collective action is necessary to achieve sustainable water management. People have recognized their interdependence and that an adaptive attitude is key to achieve synergic action. Also, the co-design stages have allowed participants to learn from each other and acquire the technical knowledge that integrated management of water requires. The co-design process was found to bring a “polycentric, horizontal and broad stakeholder participation”, and to empower inhabitants to find a place in the discussion about water management. Also, the process allowed for the user’s experiences about the local landscape, which normally is inaccessible to experts, to be integrated in the plan. The process was found to allow for the development of a holistic local water management plan, encompassing both the private and public lots, breaking administrative barriers, and “interlacing upstream and downstream areas with mutual benefits”. The study found main success factors to be the presence and expertise of the designers and in the last two stages of participants with design skills. The designers took on different roles as moderators, participants and interpreters during the process. They worked out the design devices needed to allow participants to express their point of views, confront each other, and to advance concrete proposals, and their expertise were found essential to integrate social innovation in the process. The study also found that “collective learning and decision making processes are essential to move from so-called lock-in situations towards the new resource management that the shift towards [sustainable water management] brings with it”. (Ranzato & Bortolotti, 2015).

An Adaptation Planning Support Toolbox (APST) was developed and tested to fill the need for tools supporting implementation of climate adaptation solutions on tactical level in the urban planning and

design practice. The APST supports local policymakers, planners, designers and practitioners in “defining the program of demands, in setting adaptation targets, in selecting from more than 60 blue, green and grey adaptation measures and with informed co-creation of conceptual adaptation plans”. The APST was applied in six cases; three development and redevelopment projects in Mozambique, Mexico and Netherlands respectively, two local research projects in United Kingdom and Netherlands, and a student workshop in Netherlands. The APST was used in design workshops to feed dialogues among stakeholders on where and how which ecosystem-based adaptation measures can be applied. Participants mostly included the municipality, citizens and university, and in some cases also real estate owners, architects, urban water and green experts, politicians, NGOs and state authorities. The study found that i) the APST is a handy tool as a catalogue of possibilities in district zones with different characteristics, ii) it is an effective training tool, and iii) it also can be applied as a quick-scan method to assess for example if green roofs have an added value for specific urban areas. In the case of Mozambique, it was also experienced that workshops including non-professionals demand low tech process tools to be combined with the high tech APST tool. (van de Ven et al., 2016).

A long bottom-up initiated co-creation process in Milan concerned rethinking urban green areas growth and management. A case study of the process shows how the pre-existing Milan “green infrastructure” concept was enriched through the co-creation process, from simply considering the shape and extension of the green infrastructure to include procedural, maintenance and governance elements. The co-creation process led from a simple list of green areas to the mapping of a complex service system including spatial, actors and procedural resources and the ways these can become a value. The study found that while the public green space service is innovated, its governance is reshaped, and the vision behind the service and the way it is created and produced is reframed. The study highlights the role of co-creation in creation of knowledge and in the generation of ideas. It is emphasized that in the Milan case, the urban administration was successful in sensing and capitalizing “the innovative cognitive capital”, and “transformed a bottom-up initiative into an innovation process that is affecting the way the public administration is conceiving the green areas and also the whole urban system of public spaces”. (Puerari et al., 2014).

“The Incubators Method” is a co-creative process and system currently being developed and tested in a funded JPI Urban Europe project. The method uses scenario workshops and a web platform for the co-creation between citizens and various professionals and actors in the regeneration of an Italian neighborhood. A preliminary study concluded that the project fosters the collective creativity of subjects and discovering of ways to adapt spaces to be more effectively used. (Caneparo & Bonavero, 2016).

Of the cases not involving everyday citizens, a comparative case study assessed the way policy-science dialogues achieved knowledge co-production about strategic urban environmental governance actions,

with focus on urban green and blue infrastructure planning and the provision of ecosystem services. With Berlin and Rotterdam as cases, the study found that collaboration and co-creation led to mutual learning between policy officers, urban planners, practitioners and scientists, and the establishment of relationships and trust in both cities. Policy-relevance of research and policy uptake were achieved, and new insights for research blind spots were created. (Frantzeskaki & Kabisch, 2016).

In Denmark, a concept for framing a learning process about “Black, blue green: Integrated infrastructure planning as key to sustainable urban water systems”, named ‘the 2BG platform concept’, was tested three times. The concept consisted of four course days with seminar speeches and workshops, and homework in between. The aim was also to develop multidisciplinary networks within local authorities and disciplinary networks across the country. Multidisciplinary teams from a number of local authorities participated, and included representatives from roads and parks, water and sewage water, urban planning, and “the political and administrative ‘hinterland’”. Participants developed visions and ideas, and did on paper testing of concepts adapted to a specific location in dialogue with peers and experts. The 2BG concept was found to develop organizational competences for an integrated approach in sustainable urban water systems. Also conceptual learning and competence building on sustainable urban water systems took place, where additional values such as social, educational and recreational values were included. Institutional learning was also found, as participants learned how to design and communication with different stakeholders. It was observed that the multidisciplinary teams often did not know each other when they arrived at the first course day, but through the process “they developed a language and a way of being around each other that demonstrated a mutual understanding of each other’s interests and competences”. In the end, municipal representatives formulated insights that “we have underestimated the communication task that is ahead of us. Politicians and citizens need to be engaged too”, and a politician emphasized the importance of the chance to impact; “we politicians like to discuss, and you (the public administration) need to leave something for us to discuss and decide. We know you are cleverer, but give us something to have an impact on”. (Nielsen et al., 2011).



Figure 3 “Stakeholders in the 2BG project, which by experience have a role in the realization of sustainable urban water projects. Human and non-human actors are included.” (Reproduced from Nielsen et al. 2011)

On the same line as the 2BG concept in Denmark, a concept for conducting inter-disciplinary and inter-municipal networks with workshops for local climate adaptation was developed and tested in Norway. The concept was based on evaluations of two other networks for climate adaptation. A study summarizes findings from evaluations of all three networks, and concludes that “networks are an important way of creating change of attitudes and affecting [and motivating] concrete measures and strategies for climate adaptation”. The study also highlights the positive effects networks have on building knowledge about climate and the environment, and in supporting implementation of local adaptation plans. It is concluded that “It is important that the municipalities consider and evaluate what networks to participate in, and how many, to avoid less capacity for daily work tasks in the organization. The aim is that the networks that are established are well planned and to the point. To exploit the advantages of networks, the way the networks are established, organized and operated means a lot. The network should focus on concrete plans on how to implement and anchor new knowledge in the participants' organizations.” (Hauge, Hanssen, Flyen, & Strømø, 2018)

On the same line as the 2BG concept in Denmark and the inter-municipal networks in Norway, a case study involved a co-creation process addressing urban green infrastructure (UGI) with inter-disciplinary teams from three municipalities in Finland (Lähde & Marino, 2018). UGI may be defined as the interconnected web of vegetated spaces like street trees, parks and peri-urban forests that provide essential ecosystem services in densely populated areas (Pearlmutter et al., 2017). The co-creation process of the case study used UGI as an approach to achieve amongst others local stormwater management. The municipal teams consisted of architects, landscape architects, engineers and experts in natural sciences. In addition, researchers in landscape architecture and urban planning participated. The 5-month process consisted of three local “visioning” workshops in each municipality with homework beforehand, follow-up homework, and a final “path forward” workshop with representatives from all three municipalities together. Participants created common visions, identified concrete opportunities for applying UGI at local selected sites, defined focus and approach on how to integrate UGI, discussed obstacles and barriers to UGI development in the planning phases, including strategic planning, master planning and construction phase, and deliberated on new strategies and actions for UGI development within local case sites. Results of the study show that participants gradually built an understanding of UGI, and awareness of how they may use the new competence in convincing their local policy-makers. Challenges and solutions were discussed, for example the need for tactical area plans in between the strategic master plan and detailed plot plans. Also, participants developed common understandings and strategies for the way forward, for example that it is important that municipalities pioneer UGI in public buildings and spaces, as it would be difficult to demand it from private development companies otherwise. (Lähde & Marino, 2018).

While emphasizing that engagement processes cannot be easily replicated from one context to another, Akhmouch and Clavreul (2016) conclude with the following proposed necessary conditions as success factors for stakeholder engagement in water governance (Akhmouch & Clavreul, 2016).

1. *Inclusiveness and equity*: Map all stakeholders who have a stake in the outcome or that are likely to be affected, as well as their responsibility, core motivations and interactions.
2. *Clarity of goals, transparency and accountability*: Define the ultimate line of decision making, the objectives of stakeholder engagement and the expected use of inputs.
3. *Capacity and information*: Allocate proper financial and human resources and share needed information for result-oriented stakeholder engagement.
4. *Efficiency and effectiveness*: Regularly assess the process and outcomes of stakeholder engagement to learn, adjust and improve accordingly.
5. *Institutionalisation, structuring and integration*: Embed engagement processes in clear legal and policy frameworks, organisational structures/principles and responsible authorities.
6. *Adaptiveness*: Customise the type and level of engagement as needed and keep the process flexible to changing circumstances.

(Reproduced from Akhmouch and Clavreul, 2016).

In a comparative case study including the City of Tampere in Finland, the following barriers to uptake of Sustainable Urban Drainage Systems (SUDS) were identified for Tampere (Effenberger, 2018). The notion of SUDS used here includes NBS.

- Not part of overall strategy, vision
- Organizational flaws – disciplines not represented in planning (Nature Conservation Department, Biodiversity staff)
- Expert-driven process of implementations. Difficult for actors outside the expert network to participate
- Visualization of benefits not possible in current budgeting system. View, task and integration of ‘biodiversity’ outdated
- Spatial planning too limited on small plots
- Seen as luxurious add-on. Only for specially branded districts, exempt from the mainstream
- Little private actor involvement, demand driven by public sector
- No regulations on private sector
- City acting passively towards citizens, mainstream of formal networks is not taken up by the citizens, informal networks for particular procedures
- No effective regulation to foster involvement of other stakeholders
- Lack of knowledge: Experience in construction and maintenance, contractors. Technical feasibility in local cold climate
- Little to no political support
- Import of international concepts and knowledge slows down local acquisition of competence

(Reproduced from Effenberger, 2018)

Many of the barriers to uptake of SUDS and NBS in Tampere identified by Effenberger (2018) is related to stakeholder involvement, communication, knowledge, motivation and collaboration. This may indicate a potential for co-creation to benefit local uptake of NBS in Tampere.

From literature it appears to be a lack of case studies on municipally initiated co-creation processes involving both citizens and private and public professionals of various disciplines and roles in co-creating NBS and green spaces. With detailed and real-life case studies of this we can know more about outcomes and success factors for such a type of co-creation. This is important in order to know if and how the transition to sustainable stormwater management and the application of NBS and green spaces can be improved with co-creation. This knowledge may support local municipal and private actors in their work

in relation to sustainable, resilient and multi-beneficial development and management of stormwater, green spaces and NBS.

As part of the EU Horizon 2020 project Urban Nature Labs (UNaLab), Tampere UNaLab performed a process of co-creating NBS and green spaces in two urban development projects and a local park renovation project in Tampere. The process was organized by the municipality and included participants from different levels and departments within the municipality, from various actors in the industry such as development companies, consultants, suppliers, universities and NGOs, and various user groups such as children, middle-aged and senior inhabitants, in the setting of Nordic culture. The co-creation process initiated Urban Living Labs and NBS demonstrations that will be executed in the two development projects, and also went beyond the demonstrations in relation to co-creating NBS and green spaces of the projects in general. (See Chapter 2 for details).

Based on the background and motivation above, the objectives of the study are to address the following research questions:

- 1) What were the main characteristic outcomes from Tampere UNaLab's initiatory process of co-creating NBS and green spaces?
- 2) What are the key ways in which co-creation may contribute to achieving successful NBS and green spaces?
- 3) What are key success factors for co-creation to feed and enhance development of successful nature-based stormwater management and green spaces?

2 Tampere UNaLab Co-Creation Process and Context

2.1 The UNaLab Project and Motivation

The Urban Nature Labs (UNaLab) project was created as a response to EU's call for "demonstrating innovative nature-based solutions in cities" (CORDIS, 2017), under the Horizon 2020 Smart Cities and Communities program. This jointly-funded project will run from 1 June 2017 through 31 May 2022. The UNaLab partner cities aim to develop smarter, more inclusive, more resilient and increasingly sustainable societies through innovative nature-based solutions. The consortium consists of 28 partners, including municipalities, industrial companies, research technology organizations, small / medium enterprises and universities. Main activities are related to the three front runner cities and the 7 follower cities in the project. EU values co-creation of what is to be implemented in projects such as the ones in the Horizon 2020 program. The front runner cities co-create and implement local NBS demonstrations, and follow up with interactive monitoring through local Urban Living Labs (ULLs) during the UNaLab project. In the front runner city of Tampere, NBS demo implementation and ULLs are done in two cases; the planning-phase brownfield development of the Hiedanranta area, and the construction-phase greenfield development of Vuores district. The main goal of the Tampere UNaLab Co-Creation Process (TUC) had two sides, on the one hand "to increase awareness of NBS, and how they can solve problems, and on the other hand to hear the citizen people views to how their neighborhood and city should be developed from the viewpoint of NBS" (O1).

2.2 The Development Projects

Tampere is the largest inland city in the Nordic countries with a population of 232 932 (Statistics Finland, 2018b), and with an estimated population growth to 261 752 by 2040 (Statistics Finland, 2018a), excluding the suburbs. After being an industrial stronghold, the city is going through a transition. The City is investing in several large infrastructure and city development projects, such as Vuores, Hiedanranta, and a tramway currently under construction (OS2, H2PM2). The City owns the land in Vuores and most of the land in Hiedanranta, and wants to make it attractive for private developers to buy or rent the plots (OS2). There are currently strong political voices in the city advocating to "build as many buildings as possible [in Hiedanranta], and create this nice very dense new urban area [...]. And then it becomes the economic benefits versus the environmental benefits, and it's not too difficult to guess which one usually is stronger." (OS2). There are also internal municipal, private professional, other stakeholder and inhabitant forces advocating for focus on environmental and social aspects in the development projects.

2.2.1 Hiedanranta Development Project

Hiedanranta (Figure 4 b)) is a brownfield development area of in total 246 ha (City of Tampere, 2017b) including parts of Lake Näsijärvi, of which 115 ha is land (Levonmaa, 2018), of which 90 ha is owned by the city (City of Tampere, 2015). The area comprises former pulp mill grounds, including historically valuable buildings and condemned rundown industrial buildings, a landfill, and parts of a commercial area including two operating industrial facilities (Levonmaa, 2018). Traces of industrial activities include contaminated soil, leachate water running untreated into the lake, and 1.5 million m³ of waste fibre in the lake, making the waters un-swimmable at the moment (Levonmaa, 2018). The City aims to turn the area into a “Smart and Sustainable City District of the Future” with homes for 25 000 residents and 10 000 jobs (City of Tampere, 2018b). The project started after the city bought the pulp mill grounds in 2014.

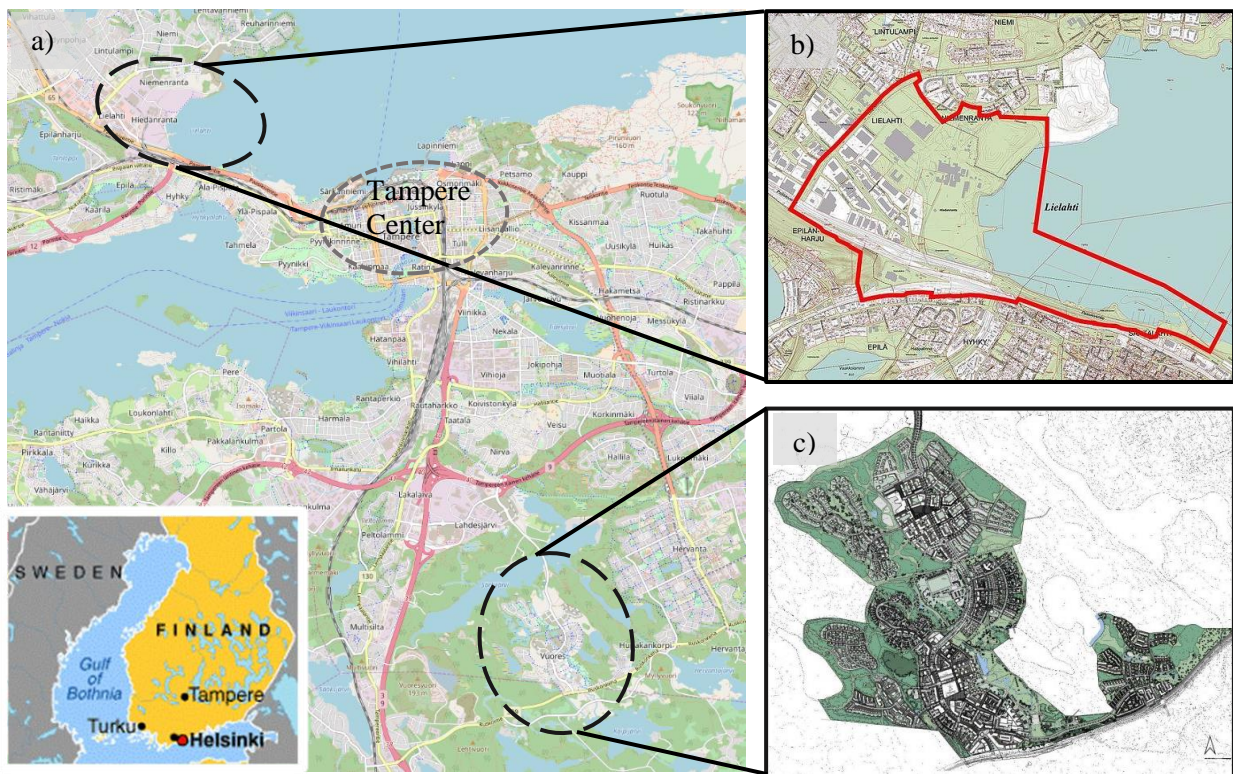


Figure 4 (a) Maps of Finland (Tofan, 2014) and Tampere City Center (© OpenStreetMap contributors), (b) Hiedanranta brownfield development area (Green Digital Charter, 2017), and (c) Vuores greenfield development area (Vuores Portal, 2013)

Tampere is experienced in co-creation and participation activities, and has relatively high participation and engagement for example related to the Hiedanranta project. In 2015, businesses, citizens and experts were involved in giving ideas for developing the district. In 2016 the area was opened to the public and an international ideas competition was held. The competition was followed up with a series of four public workshops in 2017, where citizens discussed and built on the results of the competition together with architects, planners and researchers. (City of Tampere, 2017a). At the moment, 17 local, national and

international R&D projects, including UNaLab, are involved in Hiedanranta (City of Tampere, 2018a). The City's *Temporary Hiedanranta* project encourages activities, cultural events, lessors and citizens to use the existing buildings and the area in various ways (City of Tampere, 2018c; Väliäkainen Hiedanranta, 2018). The result already in 2016 was 12,700 visitors, 47 events and 24 involved companies and organizations.

The first phase of the master plan, the structure plan, was approved by the City Board in December 2017 (City of Tampere, 2018b), see Appendix A. After completion of the master plan and starting local detailed planning, construction is planned to begin in early 2020s. At the moment a stretch of the new tramway is planned to pass through Hiedanranta, however decisions remain to be made. The development work for the entire area is estimated to be completed by 2045. (City of Tampere, 2018b).

Stormwater-wise, Hiedanranta faces challenges of incoming runoff from large areas upstream, small height differences, and polluted and low-permeability clay soil (H2PM3). Problems with basement floodings have occurred in the area (O1). An intertwined green and blue structure is one of the five development strategies outlined together with the structure plan. The blue-green network is envisioned to play a social and ecological key role, and to store, redirect and partly clean the local stormwater (City of Tampere, 2017b). A consultant reflected in relation to the project that “the process usually is that the amount of green sort of reduces on the way. [...] in the final ways, these things they disappear” (H2PP1). It is still uncertain if the overall stormwater management system in Hiedanranta will be nature-based or pipe-based or how much of a combination it will be (OS1, O2). UNaLab preliminary stormwater plans in Hiedanranta, prior to co-creation, was a bio-filtration NBS for stormwater management in a park, and innovation vouchers for housing companies to apply NBS measures in private lots.

2.2.2 Vuores Development Project

Vuores (Figure 4 c)) is a 473 hectares (UPV, 2005) large greenfield development in an area of old forest and farm fields, surrounded by smaller and larger lakes. Construction started in 2008 (Tamminen, 2012), and the first residents moved in in 2010 (Vuores Portal, 2018b). The school was completed in the autumn of 2013, and Vuores had about 4000 residents in spring 2018 (Vuores Portal, 2018b). The goal is that the area will have 14 000 inhabitants by completion around 2025 (Vuores Portal, 2018a).

The area and lakes have good water quality and host strictly protected species (O2). A high groundwater table, almost in the surface of the ground in many places, makes stormwater management and construction in general a challenge (H2PM1). Notable amounts of crushed stone are used to create foundation for construction (H2PM1). Construction pits get immediately filled with dirt water, which has to be pumped away (H2PM1). Temporary onsite filtration treatment of the construction water is constructed from sand

and filter fabric. The city puts effort into following up that construction water is not led directly to the small and vulnerable recipients in the vicinity (O2). Inhabitants have also reported incidents of dirty waters to the city in numerous occasions (O2). Stormwater in the Vuores development is managed by a large open NBS network, designed by the German design office Dreiseitl, see Appendix A. Traditional construction works that have applied pipes for stormwater management in some places are creating some challenges with the overall function of the system, as “it is not one system, it is in fact two systems” (H2PM1). The NBS systems form an integral part of the parks and green spaces created in the development area. With a notable contribution of the Vuores area, the city of Tampere currently has more than 40 NBS on its list of maintenance (H2PM1, O1).

UNaLab preliminary plans before co-creation consisted of NBS in the soon to be constructed Tervaslammen park and Virolaisten park, implementation of green roofs and/or walls, and accessible urban multi-functional spaces. The plans also included performance management, by development and implementation of maintenance measures, and review and optimization of integrated blue-green-grey stormwater management infrastructure performance.

2.2.3 The Local Park Renovation

The local park was being renovated as part of the general city program. The city’s standard participatory process includes publishing information and the preliminary plans on internet and a poster by the park, with possibilities to give written inputs for a certain time. However, since the park is next to the neighborhood’s school and day care center, and are used by the neighborhood children on a daily basis, city officials wanted to more actively ask and hear the children’s views (O1, O2). A steep ditch separates the park in two, and initial renovation plans included widening the ditch next to the playground area into a biofilter puddle area, to make the water more accessible for the children (H2PM4). The Tampere UNaLab team organized the workshop, since the team already have experience with co-creating NBS and green spaces with children. In this way, the Local Park co-creation represents replication of co-creation practices to a normal city renovation situation.

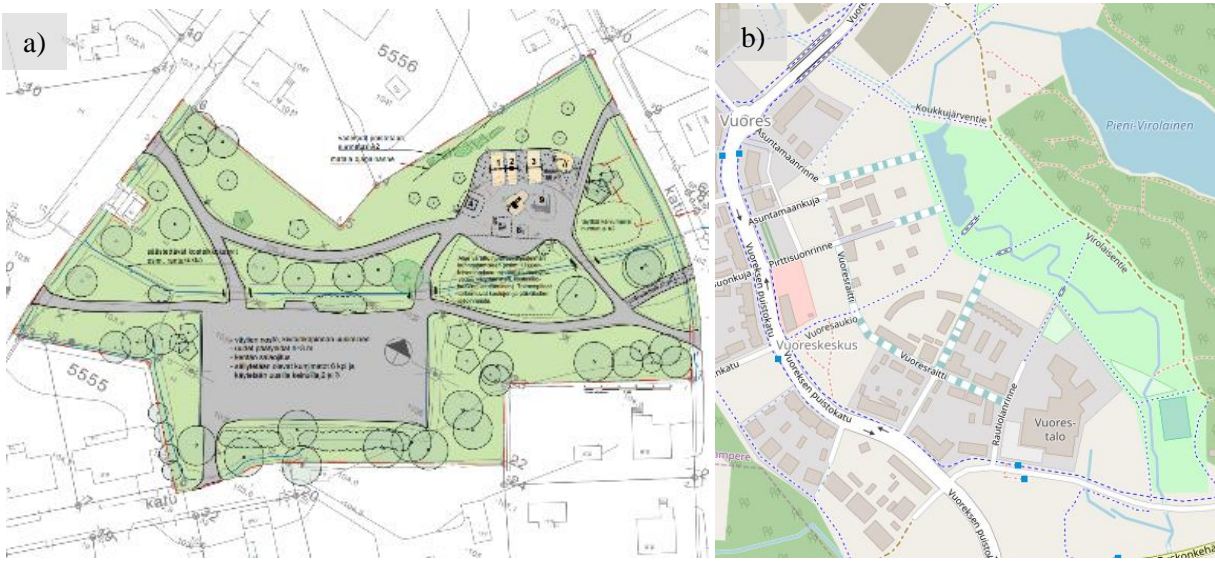


Figure 5 (a) The preliminary renovation plan of the Local Park (anonymized). (b) TUC activities in Vuores was held in and nearby the School (Vuores-Talo), and centered around the NBS solutions of the Central Park (light green colour) (© OpenStreetMap Contributors)

2.3 Tampere UNaLab Co-Creation Process

The TUC consisted of 7 co-creation events; three in Hiedanranta (H1, H2 and H3), three in Vuores (V1, V2 and V3) and one replication activity in a local park (LP), together with some supplying activities, see Figure 6 and Appendix B. Stakeholders were engaged through the existing communication channels of Hiedanranta, Vuores and the City of Tampere, which includes website invitations and Facebook events, by mail, Tamperelainen magazine, stand activities, through acquaintances and word of mouth, and with a map based pre-questionnaire of the Vuores NBS that received more than 40 answers and included an invitation to V1.

Participants were inhabitants (V1, V3, H3), school children, day care and teachers (V2, LP), NGOs and students (V1, H1, H2, H3), private professionals and researchers (H2, H3), and public and city professionals (H1, H2, H3, V1, V2, V3). Private professionals in H2 included architects, landscape architects, urban planners, various technical consultants, building companies, applied researchers and manufacturers of NBS related products. Public professionals included university staff, and city professionals included green areas and stormwater planners, Hiedanranta project managers, a constructor of public areas, a green field maintenance foreman and gardeners.

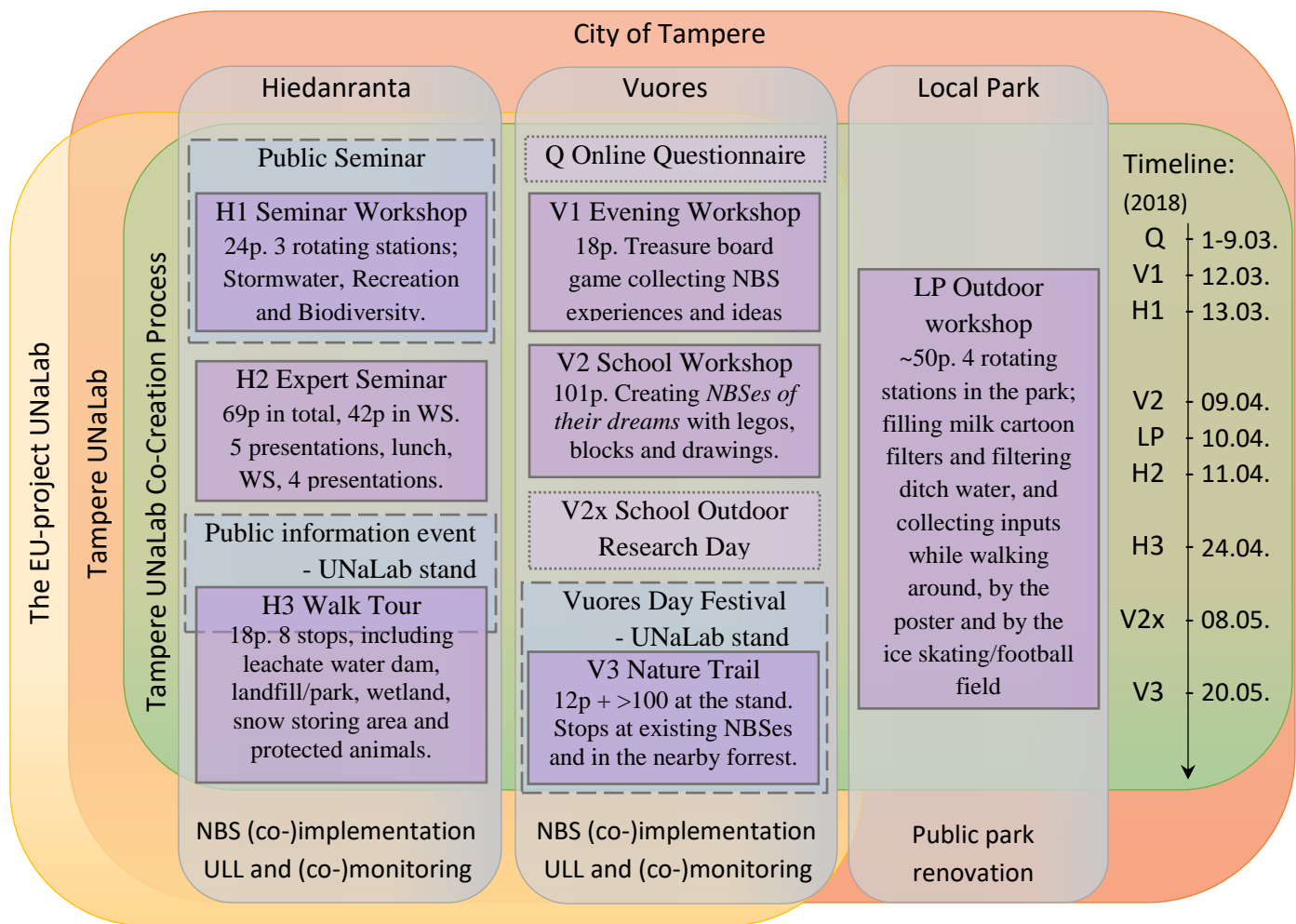


Figure 6 Illustration of the Tampere UNaLab Co-Creation Process (TUC) and its context. The context consists of The City of Tampere, The EU-project UNaLab, the Tampere UNaLab project, the municipal development projects of Hiedanranta and Vuores, the municipal renovation of a local park, and three events which the TUC took part of, namely a public seminar, a public information event and the Vuores Day Festival. The Tampere UNaLab Co-Creation Process consisted of seven main events (H1, H2, H3, V1, V2, V3, LP) and four supplementary events (Q, V2x, a stand before H3 and a stand during V3). (p = number of participants, WS = workshop).

In all workshops except H3 and V3 participants were divided in groups. Facilitators processed visions from H1 and formulated topics and discussion questions for the groups in H2, which became Stormwater, Biodiversity, Lake and Shoreside, Multi-Activity Parks, Green Topics and Playgrounds for Children. Printouts of maps, plans and satellite photos were provided in most events. Information was given about nature-based solutions, water quality, what has been done and plans of the area. Follow-up towards the participants was done by emails after events, and in addition, and also including non-participating stakeholders, with blogposts through City of Tampere website. The blogposts communicated results during and after the TUC, including how the City and involved inhabitants are following up and may follow up further. The results of the TUC were forwarded inside the City in numerous ways. These

included a results list from LP shared with the Local Park renovation responsible, presentations and discussions in internal meetings for land use planning, green areas and the Hiedanranta development project, and a result list of Vuores shared with the maintenance and park officials. The initial Tampere UNaLab NBS demo plans were changed, improved and specified as a result of the co-creation.

The local UNaLab team in Tampere consists of the City of Tampere and Rambøll, with support of the other consortium partners. In the City of Tampere, a UNaLab project manager with background of water and wastewater engineering and a limnologist and nature surveyor work 100% on the UNaLab project, are supported by a handful of officials from the Green Areas and Stormwater Unit and the Local Democracy Unit (eParticipation.EU, 2012). The city team members were involved in the TUC by supporting in planning of H2, holding introductory presentations about plans, and participating in discussions and results collection in the events. From Rambøll, four representatives including an expert in service design and co-creation were involved in the TUC, through planning, facilitation, knowledge provision and results collection mainly in the Vuores case. Two external facilitators were supporting with planning, running and summarizing results of the co-creation events in Hiedanranta.

The Curator of The Museum of Natural History and the environmental godmother of Vuores School joined in the TUC in Vuores, and added value to the TUC and the plans further, especially in relation to outdoor research days with the school children. Also, the Curator provided expertise on insects and biodiversity in V2 and V3, and the Godmother participated in the UNaLab stand in V3, showing results of the first outdoor day and an aquarium of collected water animals. Other external knowledge providers also contributed in the TUC, for example presenters invited in V1, and H2, an expert of biology in the V3 Nature Trail, and a representative of the Hiedanranta development project in H3. Also, the water monitoring and analysis company supporting City of Tampere and UNaLab in Vuores was part of the UNaLab stand in V3 Vuores Day.

Representatives from Rambøll, who is planning open stormwater management for new areas of Vuores, were present in all but one workshop, and collected information on how the participants perceive the NBS solutions and how they could be improved “in terms of the recreational value”. It was done in order to “improve the planning and the communication [...] in terms of these solutions”, and also to “use it in the later stage of development of the features” (OS1, V1d1, V1d2), with the goal “so that [people] like to spend more time there [...] and] that stormwater will be managed in a proper way” (OS3).

3 Methods and Procedures

In this chapter, a description of the study's general approach and reasons why the approach was chosen are outlined, before the study's design, data collection, data processing and analysis methods are presented. Appendix C – H supplement the Methods and Procedures.

3.1 Case Study Research Approach

In order to know how co-creation may affect the achievement of good NBS and green spaces, and what are important conditions and factors for co-creation to contribute to the achievement, it is necessary to look at real-world examples of NBS-related co-creation. It is necessary not only to document what was done and the outputs, but also to understand immediate and longer-term outcomes related to NBS and green spaces, and how the outcomes relate to the outputs and what was done in the co-creation process. To achieve this understanding and answer these how-questions, conducting case studies of real-world NBS-related co-creation processes is necessary. Hence, this study uses case study research as the main method. To increase the quality and quantity of data collected from participants in co-creation events, surveys were conducted within the case study.

The study follows the case study research approach as laid out by Yin (2014). The approach by Yin was chosen for its thorough yet accessible and hands-on approach, based on a comprehensive understanding of case study research and the researcher's needs for knowledge and skills, and drawing on a broad evidence base of previous case studies. As supplementation, the study's approach draws on the design thinking (DT) methodology, especially the first step of how to empathize with the user and understand their point of views and needs (Lozano, 2018). The DT methodology is partially overlapping with the way Yin emphasizes asking good questions and being a good listener (page 73-74). Supplementing the approach with DT was done in order to get a deeper understanding of the stakeholders' needs in relation to NBS, green spaces and co-creation, which is important to better understand potential and actual outcomes and success factors of the co-creation process. Lastly, the research approach in the data processing and analysis stages also draws on the guidelines and approach laid out in official web pages of NVivo, the computer-assisted qualitative data analysis software used in the study. NVivo's guidelines and approaches were used to get the most of out the software in relation to the needs of the study.

Yin (2014) highlights the usefulness of staying adaptive while conducting case study research, for example to "pursue unexpected leads" (page 74) or "to take advantage of changing opportunities, as well as shifts in theoretical concerns" (page 75). To follow up this, an adaptive approach was applied. Researchers stayed adaptive to information and updates about the plans for the events as they became

clearer, for example by adapting the surveys. An alert and adaptive attitude was used during the events and the interviews, to pick up relevant topics and follow up with questions and further investigations. The study was adapted to realizations and deeper understandings derived during the research, for example by adapting and adding questions to the preparatory sheets for the in-depth interviews along the way. Applying adaptiveness in this way was done to increase the data's thoroughness and in-depth coverage of the TUC, the potential and actual outcomes and the success factors.

The study was performed following ethical guidelines and EUs General Data Protection Regulation (GDPR). Interviewees in the study have given informed consent.

The study was performed in close collaboration with the Tampere UNaLab team. During the field work related to the co-creation events, the main researcher was also supported by a co-researcher. As Yin (2014) points out, it's important "to balance adaptability with rigor – but not rigidity", and not to let adaptability "result in any exploitative tendencies" (page 75). To make sure to keep the study on track and within the lines of what is ok, and to account for various needs, regular discussions and consultations were held with advisors, Tampere UNaLab team and co-researchers. The discussions were also held to get different point of views, to explore preliminary findings and ways forward, to avoid research gaps and bias, and to ensure a sound case study along the way.

3.2 Case Study Design

The main case of study is the Tampere UNaLab initiatory co-creation process in spring 2018 (TUC), with embedded cases being the sub-processes of co-creation in Hiedanranta (H), Vuores (V) and a local park (LP) (see Figure 6). The events in the sub-processes (3, 3 and 1 respectively) are embedded units of analysis in the case study. The case was selected based on its potential to show how co-creation may affect the achievement of good NBS and green spaces, in combination with practical circumstances making the study possible, such as the time frame of the TUC and grounds for cooperation.

The case study's propositions were that co-creation may contribute to the achievement of good NBS and green spaces not only directly by the hard outputs contributing to improved plans for the NBS and green spaces themselves and the implementation and maintenance, but also indirectly by building competence, perspectives, attitudes and network in professionals, citizens and project owner. It was also proposed that success factors may be good experiences in the events, feeling of having true influence and good information and communication.

Based on the propositions, the roles of people to be interviewed were planned to be participants and organizers, with participants including professionals with private and municipal background, inhabitants

and other citizens. Organizers were planned to include main organizers, facilitators and partners in organizing. In order to research the various proposed outcomes and success factors, and also to discover non-proposed outcomes and success factors, the topics of the interview questions for participants and organizers were motivations, expectations, outcomes, success factors and evaluation of event(s) and process, together with communication, understandings, attitudes, further involvement and hopes, and views on challenges with suggestions for solutions and impacts. Additional topics for organizers included background, purposes, success criteria, cooperation, stakeholders, resources, usefulness, uptake, forwarding, influence, context and plans further. Together with documents, archival records, direct observation, participant observation and surveys, it was expected that the data would result in evidence on the hard and soft outputs and outcomes of the TUC, the related success factors, and evidence and suggestions on how the outcomes may affect the achievements of good NBS and green spaces.

3.3 Data Collection

In order to provide up close and in-depth coverage of the TUC and the events, data were collected from the six sources of evidence of Yin (Yin 2014) and supplemented with surveys, listed below in order of importance.

3.3.1 Interviews

In order to collect fresh data in relation to events, mini-interviews (1-5 min) and shorter interviews (5-20 min) were held with participants and organizers before, during and after events. To collect more in-depth data and also to collect data at various times in the process, shorter and in-depth interviews (typically 45 min – 1,5 hours) were held before, during and after the TUC. The interviews were semi-structured, meaning that there was room to follow up new or interesting topics arising. Interviews were also slightly adapted to the context, researcher's experiences of the event(s) that the interviewee had participated in, and the background of the interviewee. This was done to increase relevance. In order to achieve in-depth coverage, a total of 43 interviewees were interviewed, in 42 mini-interviews, 25 short interviews and 18 in-depth interviews. 26 hours of voice recording were collected.

Table 3: Number of interviews held according to interviewee background

Interviewee background	Number of interviewees	Number of interviews		
		Mini (1-5 min)	Short (5-20 min)	In-depth (~ 45min - 1,5hrs)
<i>Participants</i>				
<i>Municipal professionals</i>	9	3	6	4
<i>Private professionals</i>	2	1	1	1
<i>Teachers</i>	2	2	0	2
<i>Residents in Vuores</i>	12	13	2	2
<i>Residents near Hiedanranta</i>	3	3	0	0
<i>NGOs, researchers, students</i>	5	5	3	0
<i>Participants Total</i>	33	27	12	9
<i>Organizers</i>				
<i>Main Organizers</i>	2	9	5	5
<i>Local UNaLab Partner</i>	4	5	6	1
<i>External Facilitators</i>	2	0	0	1
<i>External Partners</i>	2	1	2	2
<i>Organizers Total</i>	10	15	13	9
<i>Total</i>	43	42	25	18

3.3.2 Direct Observation and Participant Observation

Data collection by direct observation and observing while actively participating was done through participating in the seven co-creation events, and for some of the events also by participating in preparations before the events. Observations, together with preparations for the study, was also done in the preceding UNaLab consortium meeting, which included preparatory workshops, meetings and presentations. Direct observation was also done in situations where participation was not natural, for example in a meeting with the teachers after V2.

The quality of observation data was strengthened by having two observers (main researcher and co-researcher) participating in all events except for the local park. Data were collected through written notes and pictures taken by the two observers, and by sharing observations after events. Pictures were collected of the events, the environment, the interaction, various situations for example along the stops in the walks, of the workshop materials as they were prepared right before the workshops, and of outputs immediately afterwards. Impressions from the events and interviews, together with realizations and thoughts related to the study, were documented by the main researcher with written and voice memos following interviews and in the evenings and days following events.

3.3.3 Documentation

The main documentation was

- Internal reports and topic-based lists of inputs and results for Vuores and the Local Park
- UNaLab pre-workshop planning sheets and post-workshop reporting sheets filled out by the facilitators of the respective events
- Dissemination material, especially three PowerPoints summarizing results for Hiedanranta, Vuores and the TUC overall, respectively
- Preliminary plans for the TUC and the workshops beforehand
- Preliminary plans for UNaLab NBS demos and related investments before co-creation (UNaLab grant sheet)
- Updated plans for UNaLab NBS demos and related investments after co-creation (internal document)
- Meeting minutes from the V2 planning meeting with teachers in Vuores.

3.3.4 Surveys

Surveys in combination with feedback forms were used within the case study to collect data about participants background, motivations, their experiences and outcomes of the events, and suggestions for improvements. In the H2 Expert Seminar the survey also included questions about participants views of the usefulness of a community of practice and willingness to participate regularly in one.

3.3.5 Archival Records

The main archival records were four blogposts about the TUC written by the organizers, the public information and preliminary park plans related to the renovation of the Local Park, online co-creation event invitations on Facebook and Eventbrite, and the official websites and Facebook pages of Hiedanranta development project and Vuores District. Of the blogposts, two were published during the TUC, the first one about V1, H1 and the first results, and the second one about V2 and children's urban nature lab in Vuores. Two blogposts were published after the last events of the TUC, summarizing the results and follow-up of the UNaLab workshops in Hiedanranta and Vuores respectively.

3.3.6 Physical Artifacts

Physical artifacts collected during the study include pictures of the areas and the existing stormwater management, pictures of the models and drawings developed by the children in V2, pictures of the six group sheets with handwritten names of participants in each group in H2, handouts in the events, such as seminar program, plans and laminated maps, and promotion gadgets.

3.3.7 Verification of Data

Data was verified with triangulation between multiple sources. During data collection it was strived towards having enough data for triangulation, for example by following up topics that arose in interviews or event observations by adding questions about those topics to the interviews to be held.

3.3.8 Unexpected Difficulties in Data Collection

Mini-interviews in the H2 expert seminar was more difficult to conduct than expected, due to inexperience of the main researcher, who didn't realize the degree of detailed planning and aligning that would be optimal for such an event with a full program and complex organizing situations. Attention was needed for aligning the research work with how the rest of the event unfolded, such as distribution and collection of surveys, and making sure that signatures and the needed workshop documentation was collected and so on. Increased skills in planning and aligning in relation to the events was attained during the study. In addition, the planned in-depth interview with a consultant from H2 got delayed and then canceled, and it was deemed to be too late to find a replacement. It would have been desirable with more interviews with private professional participants. The unexpected difficulties mean that there may be more outcomes for private professionals than are included in the results of this study. However, as two private and 9 municipal professionals were interviewed, and many private professionals answered the survey in H2, the main important outcomes for professionals are deemed likely covered by the study.

3.4 Data Processing and Preparations

Data processing and preparations was done to have all data relevant for further analysis on textual form in the chosen analysis software. Preparations for transcribing voice recordings included investigating various transcribing alternatives. After understanding that correcting automated transcripts would take at least the same amount of time as transcribing from scratch, the last approach was selected. NVivo was found to be a suitable computer-assisted qualitative data analysis software, due to its wide range of well-developed functions, such as user-friendly transcribing, coding and query interfaces, and also due to its thorough online guidelines and support. After a week of preparations, including familiarizing with NVivo and solving technical audio file and hardware issues, three high intensity weeks were spent transcribing the interviews. Transcribing directly in NVivo allowed for the use of handy keyboard shortcuts and produced time stamped interview transcripts with audio directly available for potential later use. Hand-written notes were also transcribed into NVivo, and scanned and digital notes were uploaded. TUC-related documents in internal shared drives were reviewed, and relevant files from the drives and from mails were uploaded into NVivo. Archival records were collected from online sources and also included in NVivo.

3.5 Data Analysis Methods

The analysis strategy was to use the case study propositions together with preliminary impressions from the field work as a starting point, and then work the data from the ground up. This was done by pouring through the data, and categorizing, sorting and comparing the data, with support of the analytical techniques of pattern matching and cross-case synthesis between the three sub-cases of the TUC. Due to the vast amounts of data, data was first read through and roughly sorted into the main categories of i) outcomes of the TUC, ii) success factors of co-creation, iii) general challenges for NBS and green spaces, iv) challenges to co-creation, v) potential outcomes and impacts of co-creation, vi) stakeholders, and vii) context in general and for Hiedanranta, Vuores and the Local Park. Focus was put on the first two main categories. In NVivo, sorting is done by coding, meaning marking and copying text to nodes. Nodes are topical containers of the coded references, and are created, given custom names and arranged in a hierarchy of mother-nodes and child-nodes by the user. Initial mother topics under the outcomes node were created by synergizing the case study propositions with preliminary impressions from the field work and data processing. During initial coding, some initial mother topics grew large, passing 100 references, and were sub-divided with child topics. Quite quickly practice became to refine mother topics and create and refine child topics in an iterative process while reading through the data. In order to make up for improvements in coding practices with the increased experience, all initial outcome coding was reviewed and updated. Following NVivo's advice, nodes were pruned regularly, meaning going through the nodes, re-arranging, merging, splitting, creating new and re-naming nodes. By iteratively developing and pruning nodes, the categories of outcomes were developed using an iterative and ground-up approach while getting deeper into fine-coding the data. The same approach, however in less detail due to time constraints, was applied for success factors. With more time for analysis, it is likely that more success factors may be found. However, based on the understanding developed and the quite in-depth relation with the data, it is deemed that the most prominent and important success factors are covered.

The developed categories of main outcomes are dependent on case specific characteristics. The evaluation method and categories provide structure for the results part. The categories (Table 4) are given short names for easy referencing. The categories are numbered randomly.

Table 4: Categories of main outcomes of co-creation of NBS and green spaces developed based on the Tampere UNaLab co-creation process by using an iterative and ground-up approach

ID	Short Name	Outcome Category
1	Challenges and solutions	Improving results in relation to NBS and green spaces through awareness of challenges and solution-finding
2	Diverse inputs	Improving results in relation to NBS and green spaces through diverse inputs, ideas, co-creation and plus-sum game synergies
3	Professional competence	Building professional competence on NBS, - how to build and why to build
4	Citizen competence	Building stakeholder and citizen competence on NBS, - how to build and why to build
5	Project owner competence	Building project owner competence on NBS and on user needs, user experiences and multipurpose use
6	Reducing silos	Reducing professional silos through communication and deeper understanding of other disciplines' needs
7	Environmental citizenship	Building environmental citizenship in the young population
8	Trust and engagement	Building trust, friendliness, engagement and ownership to project, meeting concerns, finding common aims and building understanding between stakeholders
9	Collaboration	Fostering contact, networking and establishment of fruitful collaborations
10	Evidence base	Building a local evidence base for co-creation, in NBS and beyond

Following NVivo's advice, a research journal and coding journal was kept in NVivo. Realizations and thoughts about the data during the data processing and analysis were documented in the research journal, which was later coded. The coding journal was used to keep track of coding practices and what was done in which sequence, to help make the final coding result consistent. In total for outcomes, the references in each of the mother topics including their children sum to slightly more than 1000 references, of which some references were coded to more than one mother topic. References coded to success factors are about 500 in total.

Many outcomes were found in the data, and they were found brought up separately by different people, in relation to the same and different events, and in relation to the same and different sub-cases. Multi-sourced, prominent and characteristic outcomes and outcomes with stronger indicators of importance for achieving good NBS and green spaces were prioritized when writing up the results. In addition to

triangulation of data, findings were subject to the criteria that they had to seem likely based on researcher's observations and impressions. The rival explanations that were considered were if outcomes came from other sources than the co-creation events and processes, such as pre-existing plans and ideas, other events and other contact and cooperation interfaces internally in the municipality or externally. To get a systematic understanding of how the outcomes may affect the achievement of good NBS and green spaces in the longer term, a logic model was developed. The model is partly hypothetical, as a basis for further studies. The hypothetical nature of the model is due to this study's time frames. Further studies may wish to follow how the preliminary outcomes affect the achievement of good NBS and green spaces in the long-term picture.

4. Results and Discussion

This chapter first presents main findings for each of the ten characteristic outcome categories found in the Tampere UNaLab co-creation process. Further, a logic model presenting three key ways in which co-creation may contribute to achieving successful NBS and green spaces is proposed. The ten characteristic co-creation outcomes and the three key ways of contribution are then discussed in the light of each other, together with a brief discussion on challenges of co-creation. Finally, 15 key success factors found in the case study is presented, and backgrounds and reasons for their importance are briefly elaborated and discussed for each success factor. Appendix I – L provide background for the results and discussion.

4.1 Main Characteristic Outcomes of the Tampere UNaLab Co-Creation Process

4.1.1 Challenges and Solutions

Results in relation to NBS and green spaces were improved through awareness of challenges and solution-finding. In the H2 expert seminar, both the group workshop and the plenum discussions seemed to be good occasions for bringing up both practical and overarching challenges and discussing solutions. In the group workshop, participants realized the challenge of “is there enough space for all, if we want to have good recreation areas, sport fields, playgrounds, [stormwater management and] nature in this area. how can we manage this all” (H2PM4). Possibilities for synergies where discussed; “Then we were talking about these solutions, (..) we are finding there, how you can put this stormwater and playgrounds to cooperate or, is it supposed to be separated. What does it mean, is it some safety risk, or is it possibilities for different kinds of playground areas” (H2PM1). A participant appreciated the interactive approach to solving the problems that the co-creation allowed for. “That instead of being “a professional of my way, and keeping very tight, ‘that facts, and money, and that’s how we are gonna do’, - it’s quite square this. [It is better] now we talk, it can be nicer” (H2PM1).

During the plenum discussion, “this very important question” was raised to the private construction firms about “how you can make them cooperate, and how you can do this [...] timing of building”, in relation to neighboring construction lots and aligning the work in a dense construction area with limited space (H2PM1). A point would be to make sure that there is proper treatment of the stormwater during the construction phase, as “it maybe takes 10 years before the area is ready”. Another point is to preferably build the temporary stormwater solutions in a place and in a way that they can be used in the final situation, so that “it’s almost ready, just do some cleaning and fixing and the finalizing” (H2PM1). Good communication about construction seems important because one “have to figure [the construction phase stormwater management] out somehow. Every case is different” (H2PM1).

Workshop discussions in H2 also brought awareness of the site-specific stormwater challenges in Hiedanranta, to participants' appreciation. Large amounts of stormwater come to Hiedanranta from upstream areas, and the area has small height differences, low permeability and contamination of the soil (H2PM3). A city planner commented that "it was a very good thing that we noticed that Hiedanranta is very complicated concerning stormwater. So I think it was useful that we could speak it out to the city plan architect, and she responded, she was in the table beside, and she said that they have noticed themselves that they need more green space to be able to handle the stormwater, [...] it was a very useful conversation." (H2PM3). In the H1 visioning workshop, the importance of streams, of keeping private yards green and of the need for a stormwater network which could be open were also emphasized (Hd1, TUCd1).

Another challenge raised in the plenum session of the H2 seminar was why the private development companies are reluctant to build green roofs (OS5, OS6). The question was raised directly to a representative of a large development company after their presentation. The question was building on earlier presentations by researchers, where "it had just come of, that [building green roofs] isn't that difficult, that we have already the knowledge and expertise" (OS6). Facilitators reflected that occasions like the seminar day gave "people from big construction companies, and people from municipalities and consulting agencies, and architects [...] a bit more free kind of place to maybe communicate. [...] One can ask maybe sensitive, you feel more brave to ask certain questions" (OS5). The development company explained their reluctance with fear of the green roofs leaking and causing damages to the building underneath, and that there is still a lack of knowledge and experience with green roofs in cold climate (OS6, O1). The challenge of transferring knowledge from the applied research stage to the real construction world, and the need for performing demonstration projects (demos) to verify solutions for large scale green roofs in cold climate, were discussed (OS6, O1). The raised awareness of the reasons behind the company's resentment to building green roofs contributed to shape a Tampere UNaLab green roof demo in Hiedanranta. An example of this is that UNaLab will focus on testing and verifying waterproofing solutions for green roofs in cold climate (O1). The green roof discussion also led to a collaboration between the main development company and Tampere UNaLab about the green roof demo, as elaborated in Chapter 4.1.9. In general, participants found that there was "good discussions and good questions" during the plenum discussions in the H2 seminar (H2PM2, H2PM1, H2PM4, H2PM3).

Challenges of vandalism of NBS were brought up and addressed thanks to the multiple event series in Vuores, which allowed for various participants to contribute in various settings. The stormwater dam and stream in Vuores central park are exposed to vandalism by children, who play and add plastic sheets, tubes and warning markers taken from the building areas to the waters (V1PI1). Also, the children enjoy

throwing things on the ice of the dam in the winter, such as toys, plastic bottles, metal cans, and building materials, which sink into the dam or go flowing with the stream in the spring (V1PI1). One of the ideas of the 6th graders in the V2 school workshop was to make a youth-driven park café with green roof and green walls and a wooden dance floor by the stormwater dam in the central park, to have something fun to do (OS2). In an internal City meeting following up the co-creation in Vuores, the City's green team and maintenance responsables appreciated the idea and started discussing how it can be implemented. The idea was appreciated because it may both improve the user experience and the amount of use of the park, provide something positive for the youth to do in the otherwise quiet district, and reduce the vandalism (H2PM1, O2). By reducing vandalism it would also help in maintaining the function of the NBS solutions, and reduce maintenance needs (H2PM1, O2). Also in relation to the vandalism issues and trashing in the park, inhabitants in the V3 walk tour wished for more dustbins in the park (V3d3).

Vandalism was also brought up as a challenge in relation to the local park renovation. Earlier, municipally funded renovations of the neighborhood school yard and public spaces have been subject to vandalism by neighborhood youth (LPPT). Children in the local park outdoor workshop (LP) brought up the issue that the park is “only for younger children”, and that the park should have something to do also for older children, - and brought an array of suggestions for improvements. The teacher reflected that nowadays when some of the older youth are playing basketball in the school yard in the evenings, the younger youth are maybe thinking “oh the old ones are using it” and then they don't vandalize it (LPPT). This ties to renovation of the local park and the creek as discussed bellow.

4.1.2 Diverse Inputs

Results in relation to NBS and green spaces were improved through diverse inputs, ideas, co-creation and plus-sum game synergies. Both participants and organizers thought it was good to hear from different point of views and different aspects, and highlighted the value of versatility of participants (O2, H2PM1, H2PM2, H2PM4, H2PM3, OS2, H1PP2, 2*H2s). “Participants thought that discussions were good due to [other] participants awareness about the subject” (H1d1). A researcher and activist highlighted that the other participants and ideas and the group was good, so that he learned, and appreciated that there were people from the City of Tampere in the group (H1PP2). “It was many experts there, and NGOs and also residents, and people from the municipality, like land use planning and stormwaters and so and so, it was really nice to vision together, get those different aspects.” (O2). The Curator of the Museum of Natural History also found the co-creation process good “as I learn from different people” and that it was “nice to discuss with kids”, and reflected that some kids are used to discussing, listening and telling their thoughts (OSP7).

The events that centered on walking outside, H3, V3 and LP, fostered concrete site-specific inputs and co-creation. Especially V3 and LP resulted in long lists of concrete ideas for improving the usability and user experiences of the NBS and green spaces (LPd1, V3d3). The V3 walk in Vuores gave ground for good discussions about “making it more accessible, more interesting [...] to bring it more value for the people” (OSP7, O2, V3-obs). Participants brought up the issue that the central park feels quite open, windy and unsheltered most of the year, as it has no large trees. They were hoping that some of the pre-existing trees will be kept during construction of the remaining green-field areas of Vuores, to shelter and make it cosier to be in the outdoor areas. This issue was also brought up in LP, which is also quite open. The children in LP wished for more shelter and hiding places such as more bushes. A Vuores inhabitant often going for walks emphasized that “in the park, I like forms, and when I’m going I don’t like to see straight, I want to go, some kind of form, and after that I see, what’s there.” (V1PI1). It was realized that the recent times construction habit of cutting down all the trees while developing an area has unfortunate effects for the inhabitants going to live in the area in the following decades. As part of the following up of co-creation results, organizers forwarded within the city to increase the focus on keeping some of the existing trees in remaining greenfield development areas.

In Vuores, inhabitants bike and walk to work and to school through the central park, and use the park for recreation, such as sun tanning and play. Activities in the vicinity of the NBS increase the value of the NBS by making use of their recreational potential. Furtherance of activities in the vicinity were wished for by inhabitants and teachers in V3, who thought for example that it would be nice with more benches, and an outdoor fire place near the water, where the teachers could bring the pupils (OSP7, OSP8, O2, OS2k, V3PI7). Another issue raised was that trails in the area experience stretches of wetness and mud. A collaboration was established between the City and a participant in V3, who happened to be in the board of the neighborhood society. The City will provide duckboard material and the inhabitants will mount the duckboards to improve the trails (V3d3, O2, V3PI7).

In H3, professionals and organizers reflected that the walk made the discussions more concrete and the ideas more fresh, when “we can actually both know what we are discussing about” and “look at the same thing” (H3PP1, O1). This was for example experienced in relation to discussing the pre-existing wetland in Hiedanranta (H3PP1, H3PP2, O1). It was discussed how the wetland could be incorporated in the future stormwater management, and also be a “new kind of area where we produce future biodiversity” (H3PP1, H3PP2).

In the local park, the children had many concrete ideas of improving the use and accessibility of the steep ditch with a creek that runs through the park, and also of the park in general. The ditch has two small bridges crossing it. It works as a barrier when playing chasing games, and as a hiding place for games

such as the flag game (LPPT). The children thought that “it’s nice to play in the ditch when it is wet!” (LPd1). They wished for a pump and a water chute to play, a terrace at the edge of the ditch where you can dive boats in the ditch, and stones in the ditch that you can pace along. Also, it was wished to make the edges less steep and to make the ditch more aesthetic. In regards to the existing vegetation, a cluster of low-branched twisting birch trees in a corner of the park “were to be preserved because they are nice climbing trees” (LPd1). This was also a concern for a cluster of bushes with tasty berries (LPPT). Currently the park is perceived as being only for young children. The organizer reflected that an “important feedback was that the park should have activities both for small children and youth” (O2). The 6th graders wished for for example a kiosk, frisbee golf, roses and other flowers, beautiful benches, painting the wooden bridges white and turquoise, and events for youth (LPd1).

In general, there was focus and much output related to social benefits. This included improving user experiences, better answering to users’ needs, health and livability aspects and community activities (O1, O2, OS3, OS2). The value of large rocks for climbing, jumping and sitting on near the water where highlighted by many, both children and adults (V2, V1PI1, H1, H3, LPd1). Children’s ideas for interacting with water in the V2 school workshop resembles the ideas in LP. The ideas emphasized accessible water for wading, toy floating, play and exploration, also in combinations with animals and insects. Some also suggested to have a swamp area as playground. The idea was that the area could be flooded every now and then, to play “rough football” in the mud. In Hiedanranta, co-created visions combined the industrial heritage with NBS and active recreation. Ideas included bee’s hives and urban farming on green roofs on top of the old industrial buildings, hands-on nature experiences for children, recreation beside and in the lake, and meadows in the old landfill.

Ideas of using NBS and green spaces for health and livability benefits were shared and developed both in Hiedanranta and in Vuores. The ideas had approaches from different viewpoints. In H1, young citizens emphasized the value of having nature in vicinity of housing, within reach in the everyday life. The wish was to have opportunities to spontaneously enjoy natural areas and to be alone in peace in a natural environment during a hectic everyday life (H1d1). This tied to biodiversity, as a more natural state of the NBS and green areas would provide a stronger sense of nature and of relaxation while also providing more biodiversity (H1d1). An NGO representative brought up the practice of leaving cut-down trees to rot on-site, being applied in English parks. The idea was to combine the lush biodiversity of rotting trees with opportunities for play and recreation in a more nature-like environment (H1PP2). The importance of avoiding weeds and using native typical plant species and wild-like trees and bushes in combination with water, rocks and logs were emphasized (H1d1, V1, V3). The Curator of The Museum of Natural History reflected that while it’s important for our health and thriving to be in the “more wild nature” every now

and then, contact with “more manmade nature” such as NBS in the city may provide an important contact point with nature in citizen’s everyday lives. A V1 participant studying environmental psychology also emphasized “the enormous health benefits of being in touch with nature and involved in nature”, and the importance of informing people of the health aspects, while pointing out that when health improves, economy improves (V1PI2). The participant suggested to combine co-creation and co-implementation of NBS with campaigns informing people of the health benefits of contact with nature. The wish was to inspire more people to be in contact with nature more often during their everyday life. This was also a goal behind the Curator’s and the Vuores School Environmental Godmother’s work and involvement in the Tampere UNaLab project.

Participants said they developed new ideas from listening to workshop discussions (H2PP2, V1PI1, H1PM1). For example, a participant working with heating and cooling in new buildings in Hiedanranta said that the discussions gave him ideas about using the rainwater for geothermal heat collection or cooling (H1PM1). A solution provider in H2 observed that “this kind of task makes you think yourself on these things and maybe getting some ideas, it really makes you work with that” (H2PP2).

4.1.3 Professional Competence

Professionals were picking up knowledge, attitudes and interest (H2PP2, H2PM3, O1). They obtained more confidence in NBS and competence on how and why to build NBS (H2PP1, H2PM1, H2PM3, H2PM4, O1). Especially from the H2 event, which was targeted specifically for professionals, participants were happy “to have so much together about NBS in one day” (H2PM3, O1). They expressed appreciation learning in detail about NBS and related issues (3*H2s, H2PM4, H2PM1, O1, O2, H2PM2, H2PM3, H2PP1). Participants emphasized learning from other NBS projects and “what they have done and why they made that plan that way and what was good and what they may be change to next project” (H2PM1). It was appreciated that the knowledge was “very near the practical work”, and found interesting for example that it doesn’t matter if it is “50 mm or 2 mm” in the green roofs (H2PM1). The day gave ideas of how to do things to a construction manager who “have some orders of NBS in already” (H2PM1, H2PP1).

A participant reflected that “[Organizers] have made a very good job when they have invited such a large variety of different kinds of people, - those who work in Tampere City and those who are private planning companies and also construction people. Because the city and the society on the whole is the combination of all those things. So all of us has to realize the meaning, and how do we get to the aim, to the target.” (H2PM3). When asked further, “- do you feel that this event today, that there is a common idea, or is it still a bit vague, this target?”, the participant reflected that “ye we are now more conscious about the things, and we are also realistic people and we realize that more studies have to be done, and we need to start somewhere to get real examples. Those old-fashioned engineering people, they are very, they don't

want to build [green roofs on top of] big buildings, because they may do something wrong, and it will cost something, and they have to rebuild maybe. But now when we start little by little, and we learn more, and we make exams, so we will get good results little by little.” (H2PM3).

Meeting and exchanging knowledge and attitudes seems important for creating changes in attitudes and mind sets. A professional reflected that “when we discuss with all people who have different backgrounds and different knowledge, when we meet in these kind of meetings and discuss about things, and hear the university people and those who have been making studies, so we become more aware of things, and maybe our attitude changes more positive, to all kind of things, and we continue to give our knowledge that we have learned here, away to other people in other situations. So little by little in Finland we will start thinking that it’s an everyday thing to take care of stormwater, or green walls or green roofs, this kind of thinking, it becomes really everyday thinking. So I think it is important to put it on the table, so we can see it [...] like today” (H2, urban planner in city). A private consultant with expertise in ecology reflected that “the process usually is that the amount of green sort of reduces on the way. [...] In the final ways, these things they disappear. So that’s why you have to keep reminding about the urban NBS all the time, during the process of the planning, and also during the construction phase. But I think during the [H2 Expert Seminar] that we had, I think they kind of switched a little bit to thinking that the diversity could mean also diversity in planning. For example in the sense that the stormwater planning here [in Hiedanranta] can include both nature-based parts, and traditional and structured parts.”

4.1.4 Citizen Competence

Citizens and other stakeholders built competence on NBS and on how and why to build NBS. In all workshops, participants expressed appreciation learning about and discussing NBS and related issues, (H1d1, 3*H2s, V1d1, V2d1, 8*V3s, V3PI4, V3PI5, V3PI6, V3PI7, V1PI1, V1PI2, V2PT, LPPT, O1, O2, H2PP2, H2PM1, H2PM3, H2PM2, H2PM4, OSP7, 4*H3s). In Vuores this especially included water quality, monitoring, biodiversity and the functioning of the existing NBS of the area (V1d1, V2d1, V1PI1, V2PT, *V3s, V3PI4, V3PI5). A student of environmental psychology in V1 was happy with the lectures. He said it was “the most concrete I have ever heard” about water management and chemistry, while still accessible (V1PI2). Participants in the V3 nature trail were thankful for learning about NBS, nature and biodiversity in such a direct experienceable way and from such good experts (V3PI4, 7*V3s, OS3, O2). Participants expressed that they got many ideas from the presentations (V1PI2, V1PI1), which they could share in the discussions afterwards (V1PI1). Surveys in H2, H3 and V3 confirm that participants had learning outcomes.

Vuores inhabitants demonstrated increased knowledge and engagement by eagerly explaining how the NBS systems work when asked after workshops (OS2k, V3PI6, V1PI1, V3PI7). They expressed

ownership and pride of the “cool systems” of NBS in their local Central Park (OS2k, V1PI1, OS2). As stated, “it kind of feels interesting to me [...], they are using natural ways of dealing with the stormwater, instead of building a lot of drainage and pumping systems and facilities [...]. So I thought it was a really cool system. And it continues the Vuores eco theme. And also as an additional benefit there is this large park now, that functions both as a park and as a utility, and I find the dual purpose of it really intriguing or interesting” (OS2k). The inhabitant, who newly moved to Vuores, usually takes friends to show them the park when they come visit. He was happy that now he can show and explain to them about the NBS systems also. Other participants stated that “walking in Vuores now will be a new experience” (V1d1) and that it is “so interesting!” (V1PI1).

Discussions raise awareness of challenges and create engagement and meaningfulness. “After [name] said their horses will drink of the water, - that water that is coming from Vuores, I didn’t know. But now I know, and I’m starting to think. But it’s not enough that I think, all must think.” (V1PI1). When asked about the main outcome of the event, the inhabitant answered that “I feel like I’m part of something, to get to the Vuores” (V1PI1).

4.1.5 Project Owner Competence

Project owners in various roles in Tampere municipality built competence on NBS. The competence included how and why to build NBS, and competence on user needs, user experiences and multipurpose use. Regarding competence on how and why to build NBS, projects owners in the Tampere UNaLab project team built competence on this through the co-creation process. As stated, “also I have increased my awareness of the nature-based solutions. I’m an engineer in water management, and what I learned in university was also mainly gray infrastructure. So I have learned a lot about new solutions in stormwater management” (O1). And “I have learned a lot, I think my awareness of NBS has gone through the roof!” (OS2). Organizers reflected that the presentations and discussions about the new Finnish research on green roofs in H2 were useful for preparing for the UNaLab green roof demo in the next phase (O1, O2), (see elaborations in Chapters 4.1.1 and 4.1.9). It was observed that project owners’ view of the importance of NBS increased through the co-creation process.

Project owners in the roles of strategic and tactical city officials, with stronger or weaker links to the UNaLab project, and with involvement in the municipal development projects of Hiedanranta, Vuores and/or the Local Park, also built competence on NBS through the co-creation process. The co-creation events gave city officials ground for advocating NBS on the strategic level towards politicians. A city official working towards politicians to achieve funding for park developments and renovations stated about H2 that it was “good lectures, good professions, good to hear from other cities, good to hear from science, and [company name], and the studies what is going on with stormwater and green roofs. Because

we must have tested and science proofed arguments when we talk about this issue, [in order to be believable towards the city's politicians and the decision makers in the municipality]" (H2PM4). The co-creation events also gave city officials ground for advocating NBS on the tactical level for example in relation to the city plan and in the land use planning meetings. A City planner stated after H2 that "we are now more conscious about the things", and that "when we concern about the city plan, so I can tell, I have more knowledge now, that it is worth going to that target [of NBS]" (H2PM3).

During the co-creation process, more awareness and a positive attitude change towards NBS developed in the municipality. This manifested in engagement to do an excursion to another Nordic city with NBS after the summer. "Quite many people want to join" the NBS excursion, both from different tactical departments in the municipality, and also influential officials in the strategic level (O1, H2PM2).

Organizers reflected that city officials with strong influence in the Hiedanranta development project developed increased interest and engagement in NBS, and that the UNaLab co-creation process seemed to be an important contribution to that (O1). The officials took part in H2 and H3. An official who could not attend H3 also asked for a tour repeating the H3 walk. The official wanted to hear what had been discussed in the different stops of the walk. Regarding possible long-term impacts of the co-creation process, organizers reflected that "they build more gray infrastructure and traditional parks. But then the same people could build NBS, more, they are already building NBS, but maybe they could, develop their work to that direction, if there would be more knowledge, more political pressure, more clear aims, something like that" (O1).

The Tampere UNaLab team and city officials also built directly applicable competence on user experiences and user needs in relation to NBS and green spaces during the process. In Vuores, increased understanding of residents' worries and attitudes helped the City in making relatively small adjustments to improve the situation. For example, through discussions with the residents in V3, it was realized that the residents had mixed feelings towards the large plants, called Common Cattail (*Typha sp.*), spontaneously growing in the stormwater stream. The residents thought the stream with the plants looked "messy" and not so park-like (O2, OSP7). However, when residents learned about the park's NBS systems and that the Common Cattail had important functions to bind Nitrogen and clean the water before it entered the local lake, the feelings changed to accepting the Common Cattail and being proud of the park's NBS systems (V1P11, OS2k, O2). Residents "thought it would be really important to give the same information to the other residents as well" (O2). As a result, the idea came to place information signs next to the NBS-systems. The signs would both explain the overall function of the NBS systems and the function of the Common Cattail. The organizer taking part in the discussion thought this was important and effectively

brought the idea forward inside the city (O2, V3d3). As stated, “that was something that really was needed, and we hadn't noticed it earlier. It was a really good idea from the residents.” (O2).

Another easily satisfiable user need that was discovered was the need for information about the monitored water quality in Vuores. Environmental concerns were high both in V1 and V3. Inhabitants are concerned that construction work pollutes the vulnerable local lakes and streams. Concerns relate to effects on the environment, on the use of the lakes for swimming and recreation, and on use of streams as drinking water for the local horses. Through the co-creation discussions in V3, it was realized that communicating the water monitoring results in an easily accessible way would improve the situation. Following up, the City decided to make the already digital and continuous monitoring data available for the public online in real-time (O2, O1). Residents will also keep helping the city in controlling construction work pollution by warning the city when they see bad water quality on site (O2). Other notable user needs and solutions surfaced through discussions, questions and answers, and through inhabitants sharing personal experiences of commuting along the NBSes and of spending time in their vicinity (V1PI1, V3PI7, OS2k, OSP7), as elaborated in Chapter 4.1.2.

4.1.6 Reducing Silos

Professional silos were reduced through communication and deeper understanding of other disciplines' needs. The multi-disciplinary and private-public mix in workshop groups gave ground for fruitful exchange of knowledge and perspectives between professionals of different backgrounds. A city official involved in the Hiedanranta project went to the table with biodiversity as topic in H2 because she felt adding biodiversity hadn't been a big goal from the city side this far. The official found that “it was really good to start that discussion in the workshop, around the same table”. The discussion gave new perspectives for the planning, and valuable information for example about what species are using the wetland. It was valuable because the surveys that the city does focus on endangered species and not so much on the regular species. (H2PM2). At the H2 table with stormwater as topic, various companies doing consultancy, construction, and operation & maintenance were represented together with various municipal officials. At the table, “[the discussion] was very vivid, [...], technical engineer or general engineer, and geology-persons, and stormwater persons, and [...] horticulture, the green areas, so it was interesting in that way. [...] not really that they would fight each other, of course when someone told some point of view, I think we all could appreciate it” (H2PM3). A participant at the table reflected that “it is also very nice to combine all the opinions and knowledge with other people” (H2PM3). This corresponds to experiences of participants at other tables, who reflected that “when you work on your profession, you just go deep on this profession, and it's good to have some opinions of other people, how they find it, and what kind of opinions they have, and to learn some more.” (H2PM4). A private professional found it interesting

because of going “outside from my field or things that I mostly do. Interesting maybe to share others’ views [...], people working in different companies and, green roofs and types of topics” (H2PP2). He appreciated the chance to “broadening my knowledge in different topics” and “sit on the same table with experts in the field that maybe I’m working in in the future” (H2PP2).

The co-creation process was found valuable also to increase perspectives-sharing, discussion and understanding in between departments inside the municipality. A city official thought that “these kinds of workshops are very good and useful” because instead of having separate “green area people are meeting, stormwater people are meeting, [...], so it’s gonna be some mix, and it’s good to get some new different views and opinions”. It’s good for example because “I can make some simple question, because I don’t know, if it can’t be done, or it’s not allowed, or something. I can make maybe some idea also, and then, we have to re-evaluate, is it worth it, is it working, can we make it or will it.” (H2PM1). The discussions were found valuable to increase awareness about others points of views, “even inside our organization, its so many departments and perspectives to the same matter, so it’s really good to start those discussions. And then there’s of course in addition this private-public sector discussion” (H2PM2).

4.1.7 Environmental Citizenship

Environmental citizenship was built in the young population. Environmental citizenship is defined as “the responsible pro-environmental behavior of citizens who act and participate in society as agents of change [...] achieving sustainability as well as developing a healthy relationship with nature. [...] and] the development of the willingness and the competences for critical and active engagement [...]” (European Network for Environmental Citizenship, 2018), (for full definition see Chapter 1). In the co-creation process, the value of educating children, “who are still more receptive” and “open-minded”, where emphasized by the organizing team (OS2, O1, OSP8, O2). As stated, “it was surprising how carefully they listened to our presentations and learned. I think teaching was so important, it is important that already from a young age, children learn about these environmental protection issues and water quality things” (O2). An important goal behind involving the pupils in water monitoring as “nature cops” is to build environmental citizenship and long-term care and ownership of the local waterways and NBS in the area (O2). This is also a means to fight the prevalent vandalism and trashing (see Chapter 4.1.1 and bellow).

The co-creation process actively and directly built environmental citizenship in the young population. It was built in primary school pupils and day care children directly in three ways, and grounds for further development of environmental citizenship was laid in three additional ways. It may also have been built in adult participants during the co-creation process, however that is outside the scope of this study. One way that environmental citizenship was built directly was through traditional educational activities. In V2, introductory PowerPoint presentations about stormwater, NBS, biodiversity and water animals were held

with the whole school attending. Both organizers and teachers expressed appreciation noticing that the children picked up much from the presentations, which they used to form their own “NBS of their dreams” in the following workshop (OSP7, H2PP2, OS2, V2PT, O1, O2, V2d1). The teachers were also happy that it wasn’t “some doll theater”, but actually some more difficult information to the children, while still being reachable with many pictures (V2PT, O1). In LP, the teacher took initiative to follow up the outdoor workshop and “thought I would tie this to ecology”. Back in the classroom, he blew an online map of the area up on the board. Together with the children he followed the creek all the way from the park through the urban area and a duck pond to the recipient. They were thinking about how pollution, or a message in a bottle, would go all the way from the park to the lake. The teacher reflected that “Some of the children saw the light, and AH!”. (LPPT).

A second way environmental citizenship was built was through participatory educational activities. A pilot outdoor research day with pupils, V2x, was held in between V2 and V3. In V2x, pupils were collecting water animals with dip nets to investigate water quality in the central park stream running right past the school. Organizers and teachers expressed appreciation of the excitement and the eye-opening experiences of the children (OSP8, OSP7, V2PT), quoting “wow there are so many bugs under the water! And large ones too!” (OSP8). Organizers were also happy to notice that while a purpose was to teach the teachers to use the school’s insect microscopes, the microscopes proved also easy to use for the pupils (OSP8). In LP, one of the workshop stations was about investigating filtration effects on the water quality in the creek. Children were given milk cartons with holes in the bottom and were asked to fill them with any filter material they could find. The children eagerly went about and filled the cartons with everything they could find, from snow, moss, sticks and leaves to sand and gravel. The children collected the dirty water from the ditch in a big glass jar, and could see a notable difference when filtering it into a new glass jar. Organizers noticed that “the children got excited and wanted to do it many times, to improve the filters” (O1, O2, LP-obs). The teacher emphasized that “the more learning experiences we can have outside the school walls, the better” (LPPT).

A third way environmental citizenship was built was through co-creating concepts and designs of new NBS and of improvements in the park and neighborhood. Organizers and teachers both in Vuores and in the Local Park observed that children were excited to get the chance to impact and innovate something that might come to their neighborhood (V2PT, LPPT, OSP7). “The kids were very motivated, they got lots of ideas, and got excited about planning things” (OSP7). In LP, the teacher noticed that the children were talking in the corridor after the workshop. The children were wondering what may come to the park, and which of their wishes, if any, would come true (LPPT). The environmental godmother of Vuores school and the teacher in the Local Park thought the co-creation events represent an important way of making a

good foundation for the generations of citizens to come, seeing as they will be the ones in charge in a couple of decades (OSP8, LPPT). Together with the Vuores teacher they all emphasized the importance of informing the children afterwards of how their inputs are included in the process further. It was highlighted that “that is when the true learning happens”, - when the children experience that their input have been listened to and has an impact (LPPT).

Grounds for further building of environmental citizenship was laid in one way by teacher uptake. The importance of teacher uptake was emphasized, as teachers may support environmental citizenship building in pupils for generations to come (OSP8, OS2). In V2, teachers were also present in the introductory presentations. They learned about stormwater issues, biodiversity and the local NBS, which they didn't know about from before (V2PT, OSP8). A teacher participating in the V3 nature trail was very happy for the trail, because she learned so much that she could teach further to the children. The trail included both fun biologist knowledge about plants, birds and traces of animals in the nature, and technical knowledge about the local NBS. Also the teacher was happy to know where she could take the children. She wished to have the same trail for all the teachers. V2x organizers reflected that teachers got the experience that it is doable to take a class of children outside, and hoped that the children's excitement of being in contact with nature and water animals would inspire to repeat the activity. Beforehand, teachers had expressed positive feelings about the plans that “the pupils will be little scientists 😊” (V2PT). The teachers had also made plans to use the research activity outputs further, for calculations in math diagrams and in other courses (V2PT). In LP, the teacher was already focused on and experienced in building environmental citizenship in the pupils (LPPT). The co-creation event seemed to lay ground for fruitful further building, such as the class further exploring the ecology of the creek (see above) and using the park renovation in applied teaching further (see bellow).

A second way grounds for further building of environmental citizenship was laid was in relation to using cost figures of the local park renovation for applied teaching. The teacher had earlier used the costs of school books in math exercises. The pupils would calculate how much it costed to fill their backpack with books, and hopefully be inspired to take better care of the books (LPPT). As parks also are prone to damages and vandalism, the teacher suggested that the municipality provide cost figures of the renovation of the park and the creek. The teacher would like to use the figures to calculate how much the park renovation costed, in order to build pupils' ownership and care of the renovated park (LPPT). Organizers thought it was a good idea and said they will look into providing the figures (O1).

A third way grounds for further building of environmental citizenship was laid was through a cooperation formed in the V2 event (see Chapter 4.1.9). The children will send results of the water animals research to the Museum of Natural History for filing and further use. It was reflected that it is good for children to feel

that they can do something that someone else, even grown-ups, can use (OSP8). Teachers thought “the museum part is very nice, I’m very like, happy about that” (V2PT). A potential fourth way that grounds for further building of environmental citizenship may have been laid was through parent uptake, for example at the UNaLab stand in V3 Vuores-day. Parent uptake may be important for example in relation to preventing vandalism. It was considered outside the scope of the study to investigate to what degree, if any, uptake in parents happened.

The potential of co-creation and of giving youth influence in society as a means to build environmental citizenship were emphasized by teachers both in Vuores and in the Local Park (V2PT, LPPT). The teachers focused on the pupils becoming responsible and taking care of their physical environment both outside in public spaces and inside the school (see Chapter 4.1.10). As in Vuores (see Chapter 4.1.1) , the neighborhood of the local park also experiences problems with vandalism in public spaces. The teacher reflected that co-creation is a good way of teaching citizenship in practice, instead of reading from some book (LPPT). The children can learn to be peacefully involved in society and in the development of their local neighborhood, “instead of screaming on the barricades” (LPPT). The teacher also pointed to that the LP workshop gives leverage to say “I was part of planning this, - so don’t you break it!” (LPPT).

The importance of involving the pupils through co-creation in order to increase ownership and reduce vandalism was also emphasized by a Vuores teacher participating in V2. The teacher reflected that co-creation would be important also in relation to the construction of the remaining parts of the school, which would house the pupils reaching secondary level. The teacher thought that it would be useful if the pupils could be involved in the planning of the school yard and the play areas, and also of the interiors, including the classroom furniture and the teaching materials. It would be useful “because it is SO important that they are, - if the children are involved in the planning and they can make decisions about this learning environment, they respect it, and they take care of it. But if it’s all adults that plan, and give the environmental learning environments, they don’t feel like home so much, and they are not, it’s not so easy to build the responsibility of taking care of the environment. So, is it about stormwater or is it about school environment, the same thing, if they are involved in planning, they will grow to take care of it.” (V2PT).

4.1.8 Trust and Engagement

Trust, friendliness, engagement and ownership to the project were built, together with meeting concerns, finding common aims and building understanding between stakeholders. Trust, friendliness and engagement were built through involvement and competence building as elaborated above, and by thoroughly informing and including participants. Both in Vuores and in Hiedanranta events, information was highly appreciated by many participants (H1p3, H3p1, H3p2, H3p3, V1d1, V3s, OS2k, OSP8, V1PI1). The information appreciated was about the respective municipal development project and the

Tampere UNaLab project, including what has been done so far in the area and the plans for the area further. The participants were for example people who like to spend time in the area (H3PI1, H3PI2), who like to know what's going on in their neighborhood community (V1PI1), and who are hoping for a more "green" Hiedanranta (H3PI3, OS2).

The co-creation process fostered increased understanding and trust between the municipality and citizens, and between the municipality and private professionals. As an organizer reflected, "there is maybe little bit gap between this top-down and grassroot activities, I don't know if it's a gap, but at least that interaction was improved". A city official present in V1 and H2 reflected that "it was like training about this, how you talk with people and what kind of things the normal people think, what kind of thoughts they have on the stormwater system. Because it was very different kind of people in our group. When you are talking all the time with professionals, you maybe don't notice some simple things that somebody else from outside can see." (H2PM1). The co-creation events gave city officials opportunities to explain why things are done the way they are. An official reflected that "it's quite healthy to have these kind of situations, so you can hear some other opinions, [...] [and explanations] from the others work" (H2PM1). "Maybe there is some orders, or, law, which is why it has to be like that. [...] because quite often people ask something like, 'why don't you do like this'. So, if I have an answer to that, so maybe they are thinking like, 'ok, I didn't know that'. [...] because we have some specific orders, in every part, and every one in our own work" (H2PM1). When reflecting on the co-creation process afterwards, an organizer noted that "[the co-creation] was good interaction and we created trust and more communication. So that it always a good thing, and it can lead to many outcomes also, later" (O1).

The co-creation events gave city officials opportunities to meet citizen concerns on a personal level and in an empathic way. In V1, local inhabitants and other people who are concerned of the natural areas and the development in Vuores brought their concerns to the people from the City of Tampere (OS2, O1, V1d1, V1-obs). An organizer noted that "[a city official] told me that he was talking with some guy that was maybe angry about something, and they were discussing about it. At the end he was ok, and they have found a common understanding there." (O1).

Common definitions of NBS and clearer aims regarding NBS and green spaces were developed through the co-creation process. During the process an organizer reflected that "[we are] learning about the NBS together, what is the NBS, what it means to everybody, and do different stakeholders have different views to that. And what it would mean in Hiedanranta, which is a brownfield area." (O1). After the last co-creation events the organizer reflected that "I think that it's a quite big task to find a common definition for NBS, so already that is a good achievement from the co-creation. But also in the different topics, that were, because so many NBS require inputs from so many city units, and also different stakeholders. So I

think that, small steps in creating common understandings were taken in many rooms.” (O1). Changes in attitudes and mind sets in relation to using NBS and green spaces for stormwater management were developed through the co-creation process (see Chapters 4.1.3 and 4.1.4).

Teachers expressed engagement, ownership and pride of the co-creation project activities held in the Vuores school in collaboration with Tampere UNaLab. The school building works as a community center in Vuores. In the V3 Vuores-day festival, which was held in and around the school, teachers had put children’s drawings of “the NBS of their dreams” from the V2 workshop on the interior school walls. The teachers felt that “it’s nice that we have this team work with UNaLab”. They were also happy that it could be shown in Vuores-day, as “it is a good example of our teaching methods and our school overall, [...], of how we run this school” (V2PT). Teachers also expressed excitement about the further plans of the children being nature scientists (see Chapter 4.1.7) (V2PT).

4.1.9 Collaboration

The co-creation process and events fostered contact, networking and establishment of fruitful collaborations. In H2, participants appreciated the opportunities to connect and network (2*H2s, H2PP2, H2PM2, H2d1, OS6). For example, an environmental consultant and an NBS manufacturer answered “Contacts” and “Networking, influence” as benefits of the day in the survey(H2s). A solution provider got the chance to talk to an influential city official, and “mentioned about permeable pavements, if he’s interested in connecting” (H2PP2). A participant reflected that “maybe during the groupwork, it’s good to have the groupwork so that you can network and meet, especially me that don’t know anyone there” (H2PP2). In H1, an NGO representative appreciated new connections with city officials and talking about possible cooperation (H1PP2). In the H3 walk, an NGO representative and an environmental consultant found the event valuable for talking. They found it valuable because “we cooperate, but we don’t have that many possibilities to discuss together, and we’re both interested in this area and the possibilities of this area, and good chance to network” (H3PP1, H3PP2).

Contact and networking in the V2 co-creation event led to fruitful collaboration for the local partners and the Tampere UNaLab project further. An advisor about to end her role as an environmental godmother at Vuores school was planning to teach teachers to use the school’s microscopes as part of her last activities. As a result of meeting in the V2 workshop and the after-meeting, a collaboration was formed between the environmental godmother, the curator of the Museum of Natural History, Vuores teachers and the UNaLab organizers. The children will do environmental research in collaboration with the Museum, as an extension to the UNaLab water quality monitoring. Following the teachers’ suggestions, the plan is that 6th graders twice a year will have outdoor research days, where they measure various water quality parameters with UNaLab toolkits and collect water animals from the NBS stream. With the help of

microscopes, the animals are compared with sheets presenting which animals need clean water to live, and which ones can also live in dirty water. In this way, the pupils can determine the water quality based on the types of animals they find. The pupils will report the results to the Museum. Also, fruitful ad-hoc collaborations about conducting the V2x event and about activities in the UNaLab stand in V3 were made. The collaborated stand activities included presenting an aquarium with water animals collected in V2x. The aquarium attracted many children and their parents to the stand. This gave good opportunities to tell the parents about the ongoing environmental education activities, while the children were absorbed with the water animals.

Discussions about green roofs in H2 (see Chapter 4.1.1) fostered the establishment of a collaboration between a major private development company and Tampere UNaLab regarding the co-created UNaLab green roof demonstration project going to come in Hiedanranta. The demo sprang from co-created visions in H1, of combining urban farming on green roofs on top of the old industrial buildings (see Chapter 4.1.2). The focus of the demo was further developed by discussions in H2 (see Chapter 4.1.1). During the co-creation process it was realized that the green roof demo has the scope of a sub-project, and that it would be good to have an own steering group for the demo where construction companies are included. It would be good “to bring the different ideas in and make sure that we produce the right kind of data for for example construction companies to support their decision making in terms of green roofs” (O1). The construction company representative who was involved in the discussions about green roofs in H2 “already said that she can join” the steering group (O1). It will be a short-term steering group meeting three times, as “it needs to be something defined and right enough” (O1).

The co-creation process also fostered communication, network building and collaboration internally in the Municipality. This was done both through communication and collaboration about organizing the co-creation events and the external communication, and also through the internal follow-up meetings and sharing of results of the co-creation process.

4.1.10 Evidence Base

A local evidence base for co-creation was built in relation to NBS and beyond. Both citizens and professional participants built experiences of co-creation being fruitful. Professionals participating in the group workshop in H2 experienced that it was useful with multi-disciplinary, multi-departmental and private-public co-creation, as elaborated in Chapters 4.1.2, 4.1.3, 4.1.5 and 4.1.6 (H2PM2, H2PM3, H2PM1, H2PM4, H2PP2, H1PM1, H3PP1, H3PP2). Citizens participating in Hiedanranta and Vuores events experienced that it was fruitful to co-create with municipal representatives (H1PP2, V3PI7), to hear other inhabitants’ points of views (V1PI1), and to get information in such an accessible and concrete way, as elaborated in Chapters 4.1.4 and 4.1.8.

Organizers, including facilitators and partners, got good experiences of co-creation through the co-creation process. As a partner stated about V1, “that we had the people there, engaged in a really good dialogue, and discussion, that was something that was very very nice and interesting for me to observe. It was also really easy, as a facilitator, they didn’t need to be facilitated, they more or less kept the discussion going, which is always a good sign.” (OS2). In V1, organizers were happy to notice that more inhabitants showed up to the event than had registered (O1, OS2). Organizers also experienced that “it was so nice to see that some people were committed, that they came to Hiedanranta walk and then they came to Vuores walk as well!” (O2). After events, organizers received numerous good feedback from participants orally (O1, O2). This happened especially from the inhabitants in V3 and from the professionals in H2, of which some came by the organizers’ office the next day to express their appreciation of the event (O2, O1). Organizing partners found the co-creation process to be a good experience. They appreciated that the main organizers were engaged and “welcoming to others’ ideas”, and felt the co-creation process established and strengthened a good contact and atmosphere between the involved people in the project (OS2, OSP7).

Through the co-creation process organizers built engagement, positive attitudes towards and skills in co-creation. The process went above organizers expectations, as stated, “it’s been really surprising that people actually have a lot of ideas. Maybe they don’t have ideas about [the functioning of the water purifying techniques], but they have ideas about how the environment should look like. Like how it would be more suitable for recreation and so on. I think it has gone over my expectations you know, I didn’t expect to get this much input from the citizens and the stakeholders” (O2). Through the process organizers demonstrated increased eagerness, confidence and skills in collecting inputs and needs from residents and other participants. In relation to the Local Park and Vuores, and the issue of children and youth having different needs in relation to green spaces, organizers reflected that “I think it is important that we listen to both and integrate them. That we can have something to do for the older ones, and something to do for the smaller ones.” (O2). Organizers built experience about which methods are better to collect input. For example with the children in the local park, “it was better just to interview the children, and walk around the area and hear their opinions and write them down.” (O2).

Organizers developed ideas of how to apply co-creation and interactive communication further in the Tampere UNaLab Urban Living Labs. For example in relation to the green roof demo (see Chapters 4.1.1 and 4.1.9), “hopefully we will have three different patches of green roof. And [...] anyone who comes and sees them, we could already ask, which of these three do you prefer. If you were a resident here, or if you owned a building, would you go for, the patch a or b or, and why, - so we could gather in this evidence-based information also. Because of course in the long run we want to have more green roofs in Tampere

and Finland and all over the world! So it would be quite useful to have the feedback already in the pilot phase, like, what kind of green roofs are more appealing to the residents, to company representatives, to NGO representatives, [...]" (OS2).

The co-creation competence developed by the city officials in the Tampere UNaLab team where appreciated and drawn upon by other city officials. An example is the local park renovation. Plans for the renovation included making the water in the creek more accessible for the children to play. The responsible city planner, knowing that many neighborhood children use the park, wanted to include the children more actively in the renovation planning, as an addition to the standard participatory procedures. Having heard of the Tampere UNaLab team's work, the city planner asked if the team could organize a co-creation workshop. Taking co-creation competence beyond NBS and green spaces, all aspects of renovating the park were included in the workshop. This included co-creation of new play apparatus and improvements to the football and ice-skating area.

Local evidence base for co-creation beyond NBS was also built in participants and partners in the co-creation process. After the V2 school workshop, a teacher reflected that co-creation would also be important in relation to the parts of the school remaining to be built (V2PT). The teacher thought that it would be useful if the pupils could be involved in the planning of the yard and the play areas, and also of the interiors, including the classroom furniture and the teaching materials (V2PT). On the same note, a facilitator being an expert in service design shared transferrable lessons learned from co-creation processes for property development of office building complexes and schools. The projects began with studying the needs of the users and other stakeholders, as well as the preconditions, for example in maintenance, costs and objectives. Detected needs and preconditions were interpreted and ideated into solutions and finally plans in co-creation processes. This was done together with the current and potential key users, property owners, local authorities, maintenance staff and so on. The users were involved in every phase of the planning and construction process. "For example in the building processes, also the building's culture and atmosphere is constructed at the same time when the building is being built" (OS4). In some processes the participants also pointed out solutions that they didn't actually need anymore, in contrary to planners' assumptions. In this way, significant cost savings were accomplished (OS4). The facilitator reflected that "if the users are part of the planning process, and they have a possibility to follow how for example the building is being built through regular information flow, participation possibilities and construction site visits, they will more likely engage to use the spaces in innovative ways, get enthusiastic and take care of the spaces and equipment better" (OS4). Also, the co-creation fostered fruitful technology uptake in users. "In relation to building processes for schools and development of learning environment, we noticed that the teachers involved in the planning phase have learned faster

and developed a more creative use of the new teaching equipment, such as new technology. The teachers involved in the co-creation process also more actively made use of the possibilities that the new spaces are offering in teaching activities” (OS4).

4.2 Key Contributions of Co-Creation to Achieving Successful NBS and Green Spaces

This chapter proposes a logic model for how co-creation may contribute to achieving successful NBS and green spaces. Further, the ten co-creation outcomes elaborated in chapter 4.1 and three key contributions proposed below are discussed in the light of each other. Finally, some reflections on challenges of co-creation are discussed.

4.2.1 Logic Model Proposition

Findings in the case study indicate that co-creation may contribute to achieving successful NBS and green spaces in three key ways. These are: i) by creating better terms long term; ii) by creating better terms for the project; and iii) by creating better terms for the use phase. These three key contributions may be seen as intermediary impacts towards the long-term impact of achieving successful NBS and green spaces, as defined introductory wise. The logic model bellow (Figure 7) illustrates this concept of how co-creation through the ten characteristic outcomes and the three key contributions may contribute to achieving successful NBS and green spaces. The concept is a proposition, due to the limited time frame of the study. The time frame did not allow for following up how and if the characteristic outcomes of the co-creation actually contributes to the intermediate and long-term impacts as proposed. The proposition is intended as a basis and hypothesis for further studies. The logic model also illustrates case study findings on necessary inputs to co-creation (see Chapter 4.3), experienced activities and outputs (see Chapter 4.1 and 4.3), and main characteristic outcomes of co-creation of NBS and green spaces (see Chapter 4.1).

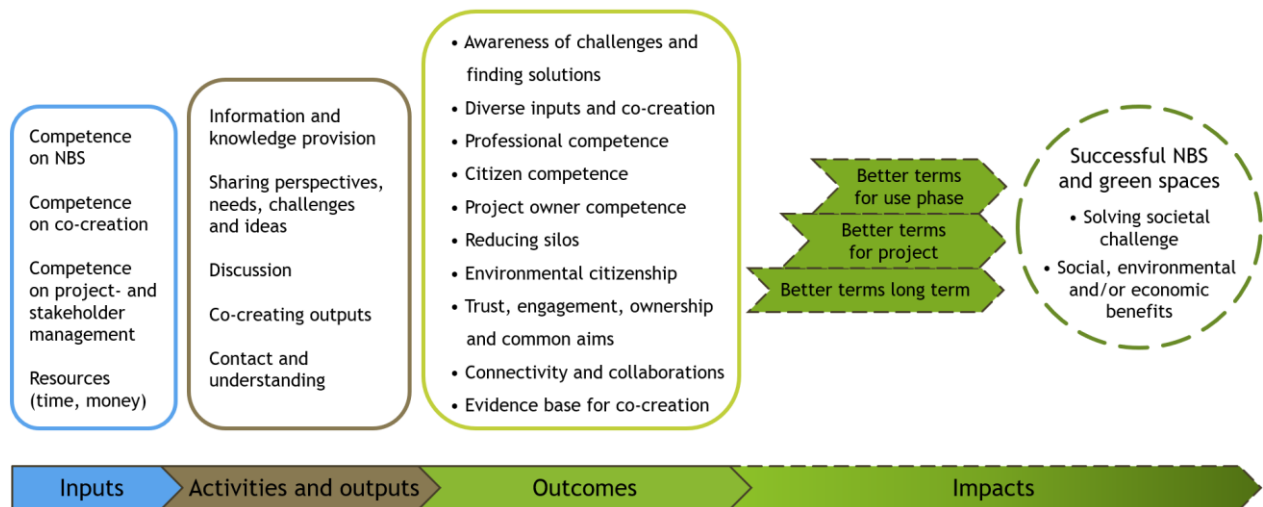


Figure 7: A logic model illustrating findings on a) inputs that seem to be necessary for co-creation of NBS and green spaces, b) experienced activities and outputs, and c) main characteristic outcomes, together with a proposition of how the outcomes contribute to successful NBS and green spaces through intermediary impacts of three key contributions.

4.2.2 Discussion of Outcomes, Key Contributions and Challenges

Better terms for achieving successful NBS and green spaces long term (key contribution i) is thought to include better terms in society, in the private and public parts of the industry and in related stakeholders. Better terms long term seem likely to be achieved through most of the outcome categories found in the case study. Outcome 1, awareness of overarching challenges and finding long-term solutions, may contribute in numerous ways. Examples from the case include discussions about how to combine stormwater management with other types of land use such as playgrounds, about solving the issue of industry stakeholders' reluctance to build NBS such as green roofs, and about how one can improve cooperation and alignment in construction phase. The last point was with regard to the order of construction work, and also the placement of temporary stormwater solutions at sites where the final stormwater solutions will be, in order to reuse the solutions in the final use phase. Diverse inputs (outcome 2), also seem likely to contribute to better terms long term. Examples include ideas about using NBS and green spaces to increase citizens contact with nature in their everyday life, in order to improve health and economy. The ideas included combining co-creation with campaigns to inform citizens of the health benefits and increase citizen engagement in nature.

Building professional competence on NBS, including how and why to build NBS (outcome 3), seem likely to contribute to better terms long term in numerous ways. Increased competence in private and public professionals seem likely to give master plans, area regulation plans and plot plans, consultancy and detail design, building application processes, construction and maintenance that are better in relation to NBS and green spaces. Also, increased professional competence may foster in general stronger driving forces

towards successful NBS and green spaces in the private and public spheres of the industry. Building stakeholder and citizen competence on NBS (outcome 4) also seem likely to contribute to better terms long term. It may contribute for example through increased awareness about the challenges and reasons to build NBS, increased engagement for and appreciation of NBS, respectful treatment of local NBS, and increased pressure towards politicians. The last may result also from increased professional and project owner competence. Increased pressure towards and quality of information towards politicians may contribute to developing a clearer political direction, and better laws, rules and regulations with respect to NBS and green spaces. This appears essential in the long term.

Building project owner competence on NBS and on user needs, user experiences and multipurpose use (outcome 5) seem likely to contribute to better terms long term in four main ways. One seems to be through public project owners acquiring the leverage to put pressure for NBS. This includes officials on tactical level acquiring leverage to put pressure for NBS in internal land use planning processes (H2PM3), and officials on strategic level acquiring the leverage to put pressure towards local politicians “from the inside” (H2PM4). Another way may be through the municipality developing better regulations and guidelines with respect to NBS. A third way may be through private and public project owners making more informed orders with regard to NBS and green spaces in their projects. A fourth way may be through more competent private and public project management regarding planning, constructing and maintaining NBS.

Reducing professional silos and creating deeper understandings of other disciplines needs (outcome 6), seem to contribute long term by fostering multi-disciplinary understanding and grounds for good collaboration. This seems essential in order to achieve successful NBS, given the multi-disciplinary nature of NBS. Examples from the case include multi-disciplinary understanding both between private professionals of different backgrounds, between different municipal departments and units, between the tactical and strategic levels, and between the private and public sphere.

Building environmental citizenship in the young population (outcome 7) seem likely to contribute to NBS and green spaces long term in the society and industry. This may happen through increasing responsibility of the environment. It may also increase the foundation in the decision-makers of the coming decades in relation to making healthy and sustainable decisions regarding NBS and green spaces. Building a local evidence base for co-creation in NBS and beyond (outcome 10), also seems likely to contribute long term. It may contribute by fostering more and more successful co-creation of NBS and green spaces in the contexts where it is applicable and rewarding. For example, both participants and organizers become more confident and skilled in co-creation, including sharing, seeking to understand and finding solutions to concrete or overarching challenges. Organizers and project owners may develop a good grasp of when and

how it is rewarding to do co-creation. By fostering more and more successful co-creation, a local evidence base may foster more of the benefits that co-creation may provide for NBS and green spaces in the long term.

Better terms for achieving successful NBS and green spaces in the scope of a project (key contribution ii) is thought to include better terms for delivering NBS and green spaces which solves the societal challenges in question, and also delivers social, environmental and/or economic benefits desired from the NBS and green spaces in the project. Better terms for the project seem likely to be achieved through most of the outcome categories found in the case study. Awareness of challenges and solution-finding (outcome 1) seem to contribute for example through participants raising awareness of and discussing solutions to the site-specific stormwater challenges in the projects. Diverse inputs (outcome 2) seem likely to contribute to better terms for projects in numerous ways. One example is concrete ideas about how to use pre-existing conditions for future stormwater management, biodiversity production and multi-purpose use. Another example is ideas about plus-sum games, such as using rainwater for cooling of buildings. Further, diverse inputs about how to make NBS and green spaces more accessible, interesting and valuable in use for people of different ages and different needs seem likely to make the projects more successful. This may be in terms of fulfilling users' needs, and in terms of achieving social benefits in relation to user experiences, health and livability. Diverse inputs also seem to benefit projects by bringing in innovative and multi-beneficial ideas and solutions that otherwise wouldn't have surfaced. An example of this is the Vuores 6th graders' idea of opening a youth run café and dance floor in the central park. It would both fight vandalism of the local NBS and provide something useful and fun to do in the mostly quiet park and district. Picking up local ideas like this and forming collaborations with the inventors to carry out the ideas may create local ownership and engagement, while solving challenges of the municipality. This may create fruitful grassroot – top-down synergies in projects.

Furthermore, better terms for achieving successful NBS and green spaces in projects are likely achieved through building professional competence on NBS in private and public professionals involved in the projects (outcome 3). This was done for example in H2, where directly applicable and project-specific competence was built in professionals involved in Hiedanranta. Building competence in project-related stakeholders and citizens (outcome 4), may increase support of the project and contributions in developing or maintaining the local NBS and green spaces. Building project owner competence (outcome 5) may support a clearer direction for the project. It may be clearer as to how to achieve successful NBS in the project, and how to solve societal and user needs while providing further social, economic and environmental benefits. It seems likely that a project's chances of succeeding with regards to NBS and green spaces grows when the project owners know more about NBS and about the users and stakeholders.

The last includes what user and stakeholder needs to meet, and what benefits to provide and how. As an example, the green roof demonstration in Hiedanranta seem likely to become more useful to users and to development companies as a result of co-created visions, discussions, competence building and collaborations made in the co-creation process (see chapters 4.1.2, 4.1.3, 4.1.5 and 4.1.9). Another way increased project owner competence seem to contribute to the project is by identifying pressing user needs that are easy to satisfy. An example of this is the identified need for accessible on-site information about the NBS in Vuores central park. This surfaced as important in order to reduce skepticism and build positive attitudes to the NBS locally. Another example is the identified need for accessible information on the water quality monitoring results in order to relieve local concerns.

Another way project owners' competence building seem likely to contribute to the project is through building competence on communication needs and communication opportunities. This seem likely to contribute to the project by keeping important stakeholders satisfied and by contributing to achieving outcome 8. Building trust, friendliness, engagement and ownership to the project, meeting concerns, finding common aims and building understanding between stakeholders (outcome 8) seem likely to give important contributions to projects. For example, it may decrease resistance and increase good will, commitment, support and contributions of important stakeholders to the project. This may ease project execution and support project- and stakeholder management. It may also improve the progress and efficiency for the City. This may be done by reducing resistance, negative responses and slow-down in the traditional participatory steps of the municipal planning processes. By providing contact between the municipality and grass-root initiatives, co-creation also seems likely to increase efficiency and positive results of grass-root initiatives. This may happen when initiatives can more easily get the needed municipal support and collaboration, for example to get permissions do urban farming in public places. By making it easier to get things done, the contact may also help preventing initiatives from burning out. From the case examples (chapter 4.1) it seems like engagement in and commitment to NBS and green spaces is built through co-creation in two main ways. One way appears to be through interacting with others and creating a common mission and feeling of meaningfulness based on inter-personal trust. Another way appears to be through spending time with the subject of NBS and green spaces, and building competence and own ideas and understandings.

Fostering contact, networking and establishment of fruitful project collaborations (outcome 9) seem to create widened opportunities and impact of the project. This seems to be both through increased contact and collaboration inside the project owner organization, - here the municipality, and externally. Examples of co-creation-initiated collaborations contributing directly to better terms for the projects are the collaboration formed about outdoor research days with pupils in Vuores, and the collaboration with

industry representatives about the establishment of a green roof demo in Hiedanranta (see chapter 4.1.9). Building a local evidence base for co-creation (outcome 10) seem to contribute to better terms for involvement further in the projects. In the case this happened for example in relation to executing Urban Living Labs and in relation to testing and collecting feedback on the green roof demo (see chapter 4.1.10).

Better terms for successful NBS and green spaces in the use phase (key contribution iii) is thought to include better terms for sustaining technical, social, environmental and economic functions. It is also thought to include better terms for operation and maintenance, and better terms for sustaining intended and responsible use. Better terms for the use phase seem likely to be achieved through a number of the outcome categories found in the study. Awareness of challenges and finding solutions (outcome 1) seem likely to contribute in relation to vandalism and to the use of the NBS and green areas. Building competence in contractors (outcome 3) and in project owners (outcome 5) who are following up in the use phase seem likely to contribute by increasing awareness, motivation and competence for operation and maintenance. Building stakeholder and citizen competence (outcome 4) may contribute by fostering inhabitant involvement in local maintenance. It may also contribute by fostering involvement in improving the accessibility and usability of the local NBS and green spaces, and increasing the desire to actively take them into use (see chapter 4.1.2). Building environmental citizenship in the young population (outcome 7) seem likely to give better terms for the use phase in numerous ways. It may give better terms by increased awareness, care and responsibility of the local environment and NBS, by reduced vandalism and trashing, and by increased positive user experiences of the NBS and green spaces. Project collaborations (outcome 9) with local citizens and organizations seem likely to increase ownership, care and use of the NBS and green spaces. An example is the collaboration about improving accessibility and usability of local NBS and green spaces (see chapter 4.1.2). Co-planning, co-design and co-implementation seem likely to foster more use. One reason for this may be that the results become more the way the users want and need it. Another reason may be that when people feel ownership and pride of something, they are more likely to want to use it, and to use it with care.

Reflecting on how the outcomes in the ten outcome categories contribute to better terms in the long term, for the projects and in the use phases, it may seem like the outcomes constitute a “cocktail mix” in which outcomes impact and amplify other outcomes in relationships that are not one to one. Sorting the impacts of the outcomes into the three main contributions as above may be but one way one can organize how the outcomes create impacts towards successful NBS and green spaces. Other models or ways of systemizing might be more beneficial depending on the context to be used in. Both the ten outcome categories and the three key ways of contribution must be understood as “results so far”. This is due to the limited time frame of the study. As more time pass it will be possible to document the actual impacts and effects. The actual

contributions and impacts towards successful NBS and green spaces may be different than what has been possible to predict or support this far.

The Tampere UNaLab co-creation process had strong focus on user experiences and social benefits. The process also focused on the environment and on the technical functions of the NBS. Economic benefits of NBS and green spaces was on the other hand not in focus. The focus seems to be a reason why the co-creation process gave much and good output in relation to social benefits and user experiences, and also in relation to environmental issues and technical functions of the NBS in order to solve the societal challenges (see chapter 4.1), while there was not notable output in relation to economic benefits. There was only recorded two economic-related outputs. One was comments about NBS and green spaces improving personal and societal economy when improving health. Another was reflections that the NBS systems and green eco theme of Vuores was used to promote the young district to potential buyers. The results indicate that the focus of the co-creation set by the organizers is important, as it defines what types of outputs and outcomes will be yielded.

The Tampere UNaLab co-creation also had strong focus on involving children, who are a major user group of the local NBS and green spaces. The results show that involving day care and primary school children gives many varied, concrete and directly applicable inputs. The inputs related to how to design and supplement NBS and green spaces so that they will provide high user value. Organizers also reflected that 6th graders have different needs than 3rd and 4th graders who again have different needs than day care children. The experiences give ground for hypothesizing that involving youth in secondary school and high school may also give uniquely valuable input to co-creating NBS and green spaces. It may also have the potential for further building environmental citizenship, engagement, ownership and trust, as elaborated in the outcomes (chapter 4.1) and discussion above.

A challenge of co-creation seems to be that when opposing opinions can confront each other, people may feel criticized, brushed aside, or other unpleasant feelings. This happened in one instance, when a participant brought up a suggestion that was largely disregarded by a representative. The participant was feeling upset afterwards, however the participant got the chance to air the experience with another participant and organizer in the wrapping of the event, and seemed to feel ok and light hearted after that. Co-creation events may be demanding socially and emotionally when they involve many new people and discussion of topics that are close to people's heart in different ways for different stakeholders. Opportunities to process experiences in a given co-creation event towards the end or right after the event, for example by reflecting on the event with the sideman for a couple of minutes, may be useful to ensure that people are leaving the event with a light heart and a feeling of being included and part of the process in a good way.

Another challenge and risk one may expect from co-creation is that if some of the necessary inputs to co-creation are lacking or go away in the process, the involvement of stakeholders may become too much and lead to an increase in discontented and demanding stakeholders. This didn't appear to happen in the Tampere UNaLab co-creation process. A dedicated project team and partners, good communication, and good invitation strategies recruiting many good-hearted participants seemed to be important to avoid such situations (see details in Chapter 4.3).

4.3 Key Success Factors for Co-Creation of NBS and Green Spaces

This chapter presents key success factors and outputs found in the case study. Backgrounds and reasons for why the success factors seem important are then briefly elaborated and discussed for each success factor.

Success factors are here regarded as factors important for performing co-creation that yields outcomes beneficial for achieving successful NBS and green spaces, as defined introductory wise. The success factors found and presented in Table 5 must be seen in context of the case, and other factors may apply when doing co-creation in different ways. The success factors have been numbered randomly.

Table 5: Key success factors for co-creation of NBS and green spaces found in the Tampere UNaLab study

ID	Short Name	Success Factor Description
1	Resources	Having the resources required for co-creation of NBS and green spaces
2	Initiation	Performing a proper initiatory phase for a co-creation process
3	Stakeholder management	Stakeholder analysis, management, communication and marketing to ensure that important stakeholders participate, and utilization of other local events and circumstances for plus-sum games
4	User adaptation	Adapting the form and content to the desired participants and their needs and motivations
5	Information	Providing clear, accessible, on-time information about the project and the co-creation process
6	Common ground	Laying a common ground for discussions and co-creation in events in a concise way
7	Tools	Using necessary, helpful and functional materials, tools and methods
8	Atmosphere	Establishing inter-personal confidence and a warm and open atmosphere, using humor, having introductory rounds and providing name lists
9	Facilitators	Having facilitators in the workshop groups to keep the focus and ensure everyone get to speak
10	Influence	Giving participants a real chance to influence
11	Underlying needs	Asking, listening and grasping the underlying needs and challenges
12	Rounding up	Properly rounding up events by inclusive summarizing and real chances to feedback
13	Synergize	Making use of the professional competences of the project team to synergize inputs, discovered challenges and needs with frames and prerequisites to produce results
14	Follow-up	Forwarding and implementation of results within the project and the municipality
15	Communication	Follow-up communication

Common for many of the success factors given in Table 5 are that they seem to contribute to achieving one or more of the outputs listed in Table 6 below. The outputs appear important in order to achieve the ten main outcomes elaborated in Chapter 4.1.

Table 6: Outputs important for achieving the ten characteristic outcomes

ID	Key Outputs	Importance for Outcome(s) [Outcome ID]
a)	Important stakeholders show up to events, are content about events and about the process, and contribute to the project	1), 2), 3), 4), 5), 6), 7), 8), 9)
b)	Focused and useful discussions, co-creation and written outputs	1), 2), 6)
c)	Deeper understanding of other's points of views and needs	1), 2), 3), 4), 5), 6), 7), 8), 9)
d)	Competence and attitude building	3), 4), 5), 7)
e)	Contact, networking and collaborations	6), 9)
f)	Good experiences and feelings	8)
g)	Through the above, experiences which builds a local evidence base for co-creation	10)

4.3.1 Resources

Having a project team with expertise both in NBS, stormwater management and green spaces and also in service design and design thinking seems essential in order to plan and execute a co-creation process that gives useful results for NBS and green spaces and for the stakeholders involved. As a project team partner stated, “the concept of co-creation that, what it means in practice, and how can we implement it. I don’t think it was that clear also for [the main organizers, in the beginning], so therefore it was really good that we could bring [the service designer] onboard, to say that, ‘*ok, this is what you need to do*’. So that everyone will be happy in the end.” (OS2). In addition, project management expertise is important in all projects, and especially in projects involving many stakeholders, such as co-creation, in order to achieve a smooth project, as elaborated in literature for example by Hussein (Hussein, 2016). In addition to having the required expertise, team members having enough dedicated time to the project, together with resources for locations, food and co-creation material also seem important. Enough time seem important for example for ensuring proper communication with participants and other stakeholders through the process.

4.3.2 Initiation

A proper initiatory phase is important for any project’s success in general, as highlighted and elaborated in literature by for example Hussein (Hussein, 2016). In the case of co-creation, such as in Tampere UNaLab, it have seemed important to

- Define the purpose and aims of the co-creation process together with important stakeholders for the process – such as the municipality, any other project owners or partners involved, the project team, hired facilitators, and other relevant stakeholders
- Develop plans that are realistic and embedded in the parties – with enough time for co-creation during events and for project work throughout the co-creation process
- Establish clear divisions of responsibilities

Defining the purpose and aims together seem important to ensure that outcomes of the co-creation are relevant for the project and according to project owners' needs, that everyone knows what they are supposed to do and why, and to foster engagement. Developing plans and time schedules together with the involved parties seem important to ensure that the plan and time is adapted for the various tasks, for example in relation to the amount of time for co-creation activities.

4.3.3 Stakeholder Management

Stakeholder analysis, management and communication together with marketing to ensure that important stakeholders participate appears essential for a successful co-creation process. Making use of local events and circumstances for plus-sum games with co-creation events are useful for involving stakeholders. Having all the important stakeholders participating seem essential to maximize fruitful outputs and outcomes. Which stakeholders are important will vary depending on the purpose of the co-creation event. For example, the H2 expert seminar focused on building professional and project owner competence, reducing professional silos, networking, and achieving outputs to improve NBS and green spaces both through awareness of challenges and solution-finding and through diverse inputs in co-creation. Organizers thought it was important to include construction companies in the co-creation “because NBS are partly in the public area, and that’s easy for the municipality, but then to be a functioning overall system some of them should be in the buildings and plots, and that’s where the construction companies make the decisions and invest.” (O1). It seemed essential for the success of the event that a wide specter of important stakeholders were present, including the private construction companies, private consultants of various technical backgrounds, manufacturers, city officials both from strategic, tactical and operational levels and from various relevant departments, applied research solution providers and university representatives. The varied stakeholder composition and high attendance were achieved through strategic marketing and invitations and through making the event attractive for the stakeholders, as elaborated in Chapter 4.3.4. For examples of outputs and outcomes of H2 see Chapter 4.1. A variety of stakeholders were also achieved in other events, giving ground for good discussions, as elaborated in Chapter 4.1.2.

Private consultants responsible for planning NBS and stormwater management in Hiedanranta and Vuores were heavily involved in the co-creation process, participating in all but one workshops, and collecting

“information on how [the inhabitants and citizens] perceive these solutions, and how we could improve the planning and the communication [... and] how people would like to improve [the NBS] in terms of the recreational value, or whether they are seeing the systems as functioning or not [...], and use it in the later stage of development of the features, and also for the nature” (OS1).

Co-creation events were combined with other local events when applicable, making win-win situations, as illustrated in Figure 6. Marketing of co-creation events were extended through the general communication channels of Hiedanranta and Vuores development projects, consisting of homepages and facebook pages, and in the specific marketing of Vuores-day and the other local events. Traditional media like the local newspaper “Tamperelainen magazine” were also used, together with Tampere municipality’s events homepage and blog. The varied marketing and combination with other events were essential for the relatively high turn-up of citizens and of local residents with busy jobs and family lives in the H3 and V3 walks (H3s, V3PI1, V3PI2, V3PI4, V3PI6, V3PI7).

During the co-creation process, the challenge of involving citizens in busy jobs and family lives were encountered and solutions discussed. A suggestion for a solution that surfaced in the context of Vuores was to make use of the window of opportunity when soon-to-be inhabitants are in the process of buying or have just bought a residence in the district – and their curiosity of their new neighborhood and neighbors are high. Co-creation of the NBS and green spaces of the various district neighborhoods could be co-created with the citizens that are going to move in and become residents, before the area is finished and they have moved in. This was also seen as a potential solution in overcoming current challenges experienced in Vuores regarding a lack of community feeling and lack of engagement in taking care of common outdoor areas. As stated by a participant in V1 who is active in the neighborhood society, “I don’t know how we can get people from these houses to come and talk with you and with us, and, I don’t know, I don’t have this kind of, I have no work tools to activate them. [...]. I have been at [former neighborhood] about 18 years in that house, and every neighbor in area of us, say ‘*HIII there, how are you doing, and hii children has grown*’, and others, we know so much, and here everybody goes home and that’s it. It’s not, because perhaps because it’s so young area, I think also, and here is many young people also, they have their own going, studying or something. I don’t have any ideas to how to [improve the situation]. It’s good that somebody tells what they are doing there, and then [the inhabitants] give ideas, and then [the Tampere UNaLab project team] take our ideas.” In the V3 event, inhabitants reflected that weeds are growing and starting to overtake in some of the green areas, and were afraid that the beautiful meadow flowers planted in the park will be gone in some few years (observation).

4.3.4 User Adaptation

The form and content of co-creation events were adapted to local conditions and to the desired participants and their motivations. For example in H2, organizers built the event as a tightly packed seminar day with many high quality speeches about NBS (Tampere UNaLab, 2018), and with a co-creation workshop in the middle, and held the event in a central location next to the municipality offices, in order to attract private and public professionals. Organizers reflected that “it was the lectures or the speeches, they were really good. I think everybody were so happy, they said ‘*ooh that you have such nice speeches there, that real specialists where there*’, and they got lots of new information and knowledge. [...]. We actually knew it was gonna be really good, because those people that we chose [to invite] there, we knew them, they have lots of experience and everything.” (O2).

In relation to the V2 event in Vuores school, the children’s high learning outcome from the introductory presentations seemed to be supported by presenters adapting to the audience, for example by often asking questions of the type “how many of you have seen...”, and the children eagerly raising their hands. Also, the importance of many pictures in the presentations were highlighted, - which also better included the learning-disabled children (V2PT, OSP7). Organizers reflected that it is important “to listen to [the teachers, for planning the school workshop and the outdoor research activities], because I don’t have ideas how it would be good for them to do it, to make it concrete” (O2, OS2).

4.3.5 Information

Providing clear, accessible, on-time information about the project and the co-creation process appears to be an important success factor. Many of the citizens and local inhabitants’ main motivation for attending the events, especially H3 and V3, where to get information about what is going on, what has been done and what are the plans of the area (H3s, V3PI3, V3PI4, V3PI7). Participants highlighted that it is good to get information in advance of events, and also that the plans of the area and other background material is useful to get in advance to look at (H3). It seems important to give information about the project and the co-creation process, including what has been done so far and plans further for the project and the co-creation process, and information about what roles and responsibilities the stakeholders may take. Such information on-time in a clear and accessible way seems important for participation, good-will and engagement towards the project and the co-creation process.

4.3.6 Common Ground

In order to achieve as fruitful co-creation as possible, it appears important to lay common grounds for discussions and co-creation in events in a concise way. Introductory presentations were appreciated by participants, as elaborated in 4.1.3 and 4.1.4. V1 presentations, while receiving praise for their educational and accessible content (V1PI2), drew long, and reduced slightly the time for workshop. Some participants and team members in V1 reflected on the importance of keeping introductory presentations concise (V1PI2, OS2). In the remaining events, introductory presentations were focused and concise. Organizers reflected that it was important to have “the educational part” in co-creation events, “because most people don’t have an idea about what NBS means [...] and even for municipality people it is not common for everyone” (O2), and that it gave a “common ground for discussions. [So] that we were talking more or less about the same issues” (O1). Laying a common ground through introductory presentations, including defining the scope, frames, limitations and possibilities of the co-creation, seem important for keeping a right focus and for fruitful co-creation and outputs. Using workshop material were also an important part of laying the common ground for discussions and co-creation, as elaborated in 4.3.7.

4.3.7 Tools

Necessary, helpful and functional materials, tools and methods seem important for achieving fruitful co-creation. Material essential for discussing solutions for stormwater management, NBS and green spaces were provided in the workshops. For Hiedanranta the material included maps and satellite photos of the current area and the master plan for the future development recently approved in the city council. For Vuores the material included overview of the existing NBS and of areas where new NBS will or may come. For the local park, a preliminary suggestion for renovation plan was presented, where “everything could still be changed” (O2).

A variety of tools and methods were used in the workshop and in the co-creation process, with varying focus and outputs. Preceding the first event, V1, an online questionnaire was held in Vuores, gathering more than 40 replies. The questionnaire asked about inhabitants’ experiences with the green areas, the existing NBS and with stormwater in the neighborhood, and about wishes and suggestions for improvements, and also invited participants to attend the V1 event. Organizers reflected that “I think that from [the questionnaire] we got, I hope we got feedback from the people who didn’t come to the workshop. Because as we know many people won’t come to workshops, they are busy.” (O1). The inputs from the questionnaire was printed on “NBS Identity Cards” and used as initial inspiration for further discussion in the V1 workshop. The workshop centered around a board game inspired by “The Lost Diamond”, with A1 sized paper boards on the tables, showing Vuores and the existing and potential future

NBS. Participants moved from one NBS to the other, discussing and writing their experiences and suggestions on the NBS cards. In this way, many experiences and ideas were effectively collected.

In V2, LEGO bricks, building blocks and drawing equipment were used by the children to portray the “NBS of their dreams”. The result were many concrete and diverse ideas and inputs, that were solving specific needs and wishes of the children. The ideas were easily conveyed by the children, through showing and explaining their innovations. The method appeared effective for children to innovate solutions both together and in their own thoughts, and proved to be a highly effective method.

In H1, participants were divided in three groups rotating between three tables with topics “stormwater”, “biodiversity” and “recreation”, and discussed visions, priorities and solutions for future Hiedanranta. Participants were writing on post-its, giving time for own thinking, and then explaining to the group and placing and sorting post-its on a big paper. Facilitators had prepared questions and facilitated so that everyone got to talk, and experienced that “some kind of magic” happened (OS5), as elaborated below. The workshop was part of a larger event and had a limited time duration. The method seemed efficient to give a high variety of different visions and suggestions from different point of views and on the different topics in the limited time available.

In the walks in V3 and H3, laminated maps of the walk tour and stops were handed out to participants and were actively used. In H3, A3 sheets with plans were also brought and seemed useful for on-site discussion. When having a walk where there is not much built already, as in H3, it seems important to provide participants with the common ground of plans, frames and possibilities for the development of the area before and during the walk (see Chapter 4.3.6).

V3 and LP showed that walking around with inhabitants in their local green areas with existing NBS, asking questions about their experiences, needs and wishes in the different places, are a highly effective way of collecting concrete input and suggestions for improving the user experiences and social value of the NBS and green areas. (V3d3, LPd1, O2). In V3, laminated posters with ideas and suggestions for improvements from V1 and V2 were mounted by existing NBSes. V3 participants and other passersby could vote with stickers, and write their additional comments. Some humorous ideas were included on the posters, and it was popular to put the stickers on the posters. It was also reflected that it was nice that you can put your opinions there anonymously (OSP7).

4.3.8 Atmosphere

Establishing inter-personal confidence and a warm and open atmosphere appears important for co-creation. It was done for example by using humor, having thorough introductory rounds including personal motivation for participation, and by using games or a playful approach in the co-creation. When

asked how they experienced the communication before and after the workshop, a Vuores inhabitant participating in V1 reflected that “before, this is good that every person could come and shake us, my name is ‘...’” (V1PI1). In some events a more thorough introductory round where held, where participants presented themselves and their background and motivations. This seemed to foster a good and easy atmosphere for further discussions. A participant noticed that even a typically quiet person talked in the V1 workshop, about experiences of commuting past the local NBSes, and “said what he want, and he has seen there that, and I would like to have here that” (V1PI1). The participant reflected that it was maybe thanks to “the atmosphere, was, so warm, and because we talk in groups after the other people had presented what is the background of this. So perhaps it gave some ideas, in that time, to him also.”

An inhabitant in Vuores participating in V1 reflected that it would be useful with a name list, to get overview of the people presenting and representing, and also the other participants and inhabitants from the neighborhood, and what the different presenters and participants say. As stated, “I can’t remember their names, perhaps, only, good thing for other meeting is perhaps that you have the name list to give, who came [...], so when you speak, I see your name, and when I see, for example the other men, I can’t remember his name. Perhaps when I have name list and also a piece of paper where I can note down, take notes. What he or she said.” The participant was motivated for example to hear “after [name] said their horses drink from the water, that water that is coming from Vuores, I didn’t know, but now I know, and starting to think. But it’s not enough that *I* think, all must think. But they are very good persons who talked there, I liked them.”

A facilitator reflected in relation to H1 that “it worked like on a personal level, that somehow, I don’t know, some kind of magic, that some groups work really well. Small groups” (OS5). The participants bonded over ideas, and also “of course sometimes they disagreed, [... you can often] have a really functional group of people and they completely disagree on some things, but it’s the understanding [...] and make fun of it and everything, so it’s some kind of relaxed fun situation, even fun yes. And like people feel comfortable enough to make jokes” (OS5).

4.3.9 Facilitators

Having facilitators in workshop groups seem important to keep the focus on track and ensure that everyone get to talk and are included. As a professional participant in one of the groups in H2 reflected, “there was one person who was kind of leading this, workshop [group], the focus on the topic. Otherwise if there is no people you just have a chitchat and talk about this and that and you forget the topic and when the bell is ringing you have five minutes time, you are in a hurry and you have to concentrate again and go on the topic.” “ - So you were happy that there was one person who had the focus?” “Of course. Otherwise you don’t have it, you loose.” (H2PM4).

4.3.10 Influence

As expressed by numerous participants and involved partners and organizers (V1, H1, H1PP2, OSP7, OSP8, OS2, OS3, O1, O2, V1PI1, OS2, V2PT, LPPT, OS5, OS6, V1PI2, H2PP2), it is essential that participants both feel they have influence and actually have influence for the co-creation process to be experienced as meaningful and successful. As stated, “I think it’s unfair if it’s like you are just listening but not doing anything. I think it’s, what I mean is that already listening is very much. It’s not done always. When planning is done by architects and specialists doing, and no-one listens to normal people, and you have to do it. If you don’t take the opinions of ordinary people into plans, then it’s unfair, it’s stupid, it’s arrogant, and I think something should be done. But of course, then maybe someone should decide what is realistic and how much you want to pay for it.” (OSP7).

In order for participants to both experience that they have influence and to actually have a real influence, the success factors elaborated in Chapter 4.3.11, 4.3.12, 4.3.13, 4.3.14 and 4.3.15 seem essential.

4.3.11 Underlying Needs

In order to maximize useful output and outcomes of co-creating NBS and green spaces, it seems essential to ask in detail about, thoroughly listen for and aim to grasp the underlying needs of stakeholders and overarching challenges of implementing successful NBS and green spaces, such as elaborated for outcomes in Chapters 4.1.1 and 4.1.2 and in the example of the V2 children’s workshop in Chapter 4.3.12.

4.3.12 Rounding Up

As part of showing respect and appreciation of the time and effort spent by the participants, gaining their trust, and fostering further engagement, properly rounding up events by an inclusive group-based or individually based summary round and by real chances to feedback seem essential. For example, in V2, thanks to planning the school workshop together with the teachers, the workshop was rounded up in a good and proper way for the children. There was enough time to go through every group, and let every child with an individual idea and group of children with a collaborated idea explain in detail their ideas and innovations of NBSes. The explanations included how the ideas would solve their needs and create good user experiences, and also how they took into consideration environmental, biodiversity, health and security and stormwater purification aspects. The round gave every child and group of children time to shine and be listened to by the rest. The Tampere UNaLab organizer actively took notes and asked the children clarifying questions, making sure to understand the ideas correctly, and giving the children a sense of being listened to, respected as equals and having an important say. This, together with the innovative method of LEGO building and drawing ideas, and the high level introductory presentations, seemed to be essential in making the event good. As the teacher reflected, “the children’s point of view,

[...], we have this box, like joy box, and every Friday we read what good and nice learning experiences we have had during the week, so after the workshop, few of the students went straight to the joy box and wrote down that it was nice that we could be creative and make something new, innovative. It was a joy. Many of the students wrote down it was nice to be creative. [...]. they like could picture in their mind that my neighborhood it could be like this, so it made it meaningful for them.”

The teacher in LP contributed with a suggestion on how to give participating pupils a chance to feedback on co-creation events. The suggestion was based on experiences with a feedback form he and his class had received after participating a day at an outdoor nature school. “Instead of me filling out the form and trying to think what the kids thought of it, I blew [the feedback form] up on the big screen in the classroom, and went through the questions with the class... Every question, what should I fill in here? And the pupils answered, and I filled it in on the big screen, so that all could see, and comment, and input.” (LPPT). The teacher suggested that instead of the questions being framed towards the teacher, the questions in a feedback form should be formulated towards the pupils directly, so that they feel that they are the ones being asked (LPPT). Also the form should be provided immediately, to be filled in the same day or the day after the co-creation event, when the event is still a fresh experience (LPPT).

4.3.13 Synergize

Making use of the professional competences of the project team to synergize inputs, discovered challenges and needs with frames and prerequisites seems important to maximize fruitfulness of results. Based on literature review and experiences from the Tampere UNaLab co-creation process, the design thinking methodology appears to be a useful approach when doing co-creation. As emphasized by Lozano (Lozano, 2016), the goal of a design thinking approach is to find and to solve the real needs or challenges. Challenges may be complex and often one may not know the whole picture and may not know the best way to solve the needs. Stakeholders may propose something according to their understanding of the world, but this may not be the optimal solutions to solving their and others’ needs. That is why the aim of design thinking is to investigate and build an understanding of the underlying needs of the various stakeholders, and also an understanding of the context, situation and frames. Understanding underlying needs are done through empathizing with the stakeholders through an array of methods (Lozano, 2018), of which co-creation play a substantial role as emphasized by Lozano (Lozano, 2018) and found in the case study (see Chapters 4.1.1, 4.1.5, 4.1.6, 4.1.7, 4.1.8 and 4.1.9). The project team can then synergize the width and depth of understandings to come up with new and sometimes revolutionary solutions to solve underlying or numerous stakeholder needs. In relation to NBS and green spaces, solutions may be related to the design and functions of the NBS and green spaces, or to other aspects in relation to the NBS and green spaces. An example of the second from the case is that the project team together with the green team

and maintenance in the city have initiated city-funded cultivated species and seed mixes to be distributed, planted and followed up together with Vuores residents in spring 2019 (Vr1). The initiative was launched in a blogpost communicating results of the co-creation process in Vuores (Vr1). The idea was based on a synergy of earlier experiences in the city and the needs for caring for the local green spaces and building community, which crystalized in the Vuores process (V1PI1, O2, V3). Another example along the line of solving the needs for vandalism prevention and environmental citizenship building in Vuores is the idea developed of pupils as “Nature Cops”. The idea was developed seemingly partly based on earlier experiences in the city and partly on co-creation in Vuores. It includes the pupils doing water quality monitoring with traditional equipment and by monitoring the water animals in the local stream, as elaborated in Chapter 4.1.7.

4.3.14 Follow-Up

Forwarding and implementation of co-creation results within the project and the municipality is essential for the co-creation to be successful. Results of the co-creation process were forwarded within the municipality both through presenting results in various meetings on tactical and strategic level, and through following up directly with relevant city officials. Results were for example presented for the steering committee of the Hiedanranta development project, and a large Green Team meeting with various city officials related to the green spaces and natural values (O1). Also, a meeting dedicated to discussing implementation of the co-creation results were held with a smaller group of park-, stormwater- and maintenance- representatives (O1). Important city officials from the park, stormwater and maintenance units had also been participating in many of the co-creation workshops, something which seemed to support the uptake and processing of inputs and implementation of results. The latter also seem to be supported by city officials seemingly being eager and dedicated to creating good experiences for the inhabitants and good NBS and green spaces solutions. Inputs and results were also forwarded internally through long bullet point lists, especially for Vuores and the local park, where many concrete inputs and actions were formulated in relation to the existing NBS and green spaces. In relation to Hiedanranta, organizers focused on grouping the results from the facilitators reports and their own notes “so that they are easier to digest for many people” (O1). Also, efforts were taken to put the results forward as quickly as possible, and they were presented in a Hiedanranta meeting already in May, “because Hiedanranta is going so fast forward, so we better put the results now so that they actually have any input to the land use planning” (O1). This focus of the organizers seemed important in order to increase the impacts of the co-creation process beyond the scope of UNaLab and up to the large development project scale.

4.3.15 Communication

As highlighted by numerous participants (V2PT, LPPT, H2PP2, V1PI2, V1, H3, V3) and emphasized by organizers and partners (O1, O2, OS2, OSP7, OSP8), follow-up communication is essential. It was reflected that it is important in order to avoid leaving participants with a feeling of being exploited, or that their inputs are not being considered and included further in the process, but rather to let participants know how their efforts are contributing, and thereby showing respect and appreciation of their contributions (OSP7, OSP8, O1, O2). Also, follow-up communication seems important to keep participants and partners informed of what is going to happen next, how they may involve in the process and project further, and what they can expect. Organizers published results and information of the coming plans in four blogposts at the municipality's website, two blogposts during the co-creation process (TUCr1, V2r1) and two summarizing blogposts 1,5 months after the last workshop (Vr1, Hr1). The last blogposts thoroughly went through the main inputs in the workshops and how the municipality and UNaLab are following up, and explained for some inputs why they will not be followed up further (Vr1, Hr1). Further plans and possibilities for involvement were also communicated (Vr1, Hr1). The message was put forward about the published results in the previously used communication channels of Hiedanranta and Vuores, and the blogposts were shared through networks of the project team (O1, OS2).

5 Conclusion

Co-creation of NBS and green spaces appears to be a good approach to achieve an array of short-term and long-term outcomes. This includes realizing more of the potentials of NBS and green spaces, adapting to local circumstances and satisfying user needs, and supporting the local shift towards sustainable and climate-resilient cities. Successful co-creation requires that necessary resources are provided, and that the further success factors are attended to. Outcomes in the case of the Tampere UNaLab initiatory co-creation process were identified and sorted in ten main characteristic outcome categories. The categories are as follows:

- 1) Improving results in relation to NBS and green spaces through awareness of challenges and solution-finding
- 2) Improving results in relation to NBS and green spaces through diverse inputs, ideas, co-creation and plus-sum game synergies
- 3) Building professional competence on NBS, how to build and why to build
- 4) Building stakeholder and citizen competence on NBS, how to build and why to build
- 5) Building project owner competence on NBS and on user needs, user experiences and multipurpose use
- 6) Reducing professional silos through communication and deeper understanding of other disciplines' needs
- 7) Building environmental citizenship in the young population
- 8) Building trust, friendliness, engagement and ownership to project, meeting concerns, finding common aims and building understanding between stakeholders
- 9) Fostering contact, networking and establishment of fruitful collaborations
- 10) Building a local evidence base for co-creation, in NBS and beyond

The study found three key ways in which the outcomes seem to contribute to achieving successful NBS and green spaces. In this context, NBS and green spaces are successful when they solve a societal challenge, for example managing stormwater and mitigating stormwater related health hazards and damages, and in addition provide social, environmental and/or economic benefits. The three key ways found are: creating better terms for successful NBS and green spaces i) in the long term, ii) in the project, and iii) in the use phase. Better terms long term seemingly include better terms in society, in the private and public parts of the industry, and in related stakeholders. Better terms in projects seemingly include better terms for delivering NBS and green spaces that solves the societal challenges in question, and better terms for delivering social, environmental and/or economic benefits desired from the NBS and green

spaces in the project. Better terms in the use phase seemingly include better terms for sustaining technical, social, environmental and economic functions. This includes better terms for operation and maintenance and better terms for sustaining intended and responsible use.

Key factors for the success of the Tampere UNaLab co-creation process appears to be the diversity of events and the targeting of specific stakeholders, which enabled the process to engage a large variety of stakeholders. Professional participants in the co-creation process included: municipal representatives from relevant departments at both strategic, tactical and operational levels; private professionals from real estate development and construction, solution providers, and consulting firms represented by experts in various disciplines such as architecture, landscape architecture, urban planning, water engineering, geotechnical engineering, horticulture, ecology and environmental technology; and, representatives from universities and research and development companies. On the inhabitant and user side, the participants included young, middle aged and elderly inhabitants and users of the areas, engaged students, neighborhood society representatives, NGOs, local teachers, school pupils and day care centers. Having an event dedicated to professionals and with a high quality seminar on NBS and green spaces (H2) seemed fruitful for attracting professional stakeholders to the process, which appears essential for achieving the outcomes identified, especially outcomes 1, 2, 3, 5, 6, 9 and 10. Having events were municipal and private professionals, inhabitants and other users join forces in co-creation (H1, V1 and H3) also appears essential for achieving the outcomes identified, especially outcome 2, 4, 5, 8 and 10. Having events dedicated to the young population (LP, V2, V2x) seem essential for mapping the needs of this important user group, and appears important for achieving outcome 1, 2, 3, 4, 5, 7, 8, and 10. Having events based on walking around in areas of existing NBS and green spaces, and sharing competence on the NBS while mapping user experiences and needs (LP, V3) seems highly fruitful for developing competence on how to meet the needs of important user groups when planning, implementing, rehabilitating and maintaining NBS and green spaces, and for achieving outcomes 1, 2, 4, 5, 8, 9 and 10. Fifteen specific key success factors of co-creating NBS and green spaces were found in the case study, as listed in Table 5.

Further research seems valuable both in relation to Tampere UNaLab and in relation to other cases.

Following Tampere UNaLab through the implementation and into the use phase could document effects of the co-creation outcomes on the achievement of successful NBS and green spaces in the long term.

Further research following other cases of co-creation of NBS and green spaces seems useful in order to investigate how varying contexts affect characteristic outcomes and key success factors of co-creating NBS and green spaces. It also seems valuable with further research about how the outcomes and resource use compare between different types of co-creation approaches. One approach is to have main focus on face-to-face co-creation workshops with a limited number of people. Another approach is online crowd-

sourcing potentially reaching thousands of people over the internet. A third approach is design thinking, mainly performed by a team of professional design thinkers and NBS and industry experts. The team would research the needs of users and stakeholders and circumstances in the field, synergize the results within the team, and then make quick prototypes or sketches of solutions and test the solutions with users and stakeholders back in the field. Also, it may be interesting to look at what may be beneficial approaches or combinations of approaches for various goals related to NBS and green spaces. For example, what may be a beneficial approach or combination of approaches to support the development of a good municipal stormwater plan, for developing master plans and area plans for large or small developments, for using co-creation in following up NBS in development and construction going on over a decade, for park renovations, or for improving the care for and use of NBS and green spaces in the use phase. Following cases of co-creation through the implementation phase and into use phase seems in general useful in order to investigate and document the effects of co-creation in a longer time span. However, this case study shows that even within a limited time-span it is possible to find substantial outcomes of co-creation and indications of further outcomes and key ways of impact.

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References

- Akhmouch, A., & Clavreul, D. (2016). Stakeholder Engagement for Inclusive Water Governance: "Practicing What We Preach" with the OECD Water Governance Initiative. *Water*, 8(5), 17. doi:10.3390/w8050204
- Borgersrud, A. (2018). Kan Mærradalsbekken ødelegge dette? Retrieved from <https://www.dagsavisen.no/oslo/kan-merradalsbekken-odelegge-dette-1.1146467>
- Bothner, V., & Aanderaa, T. (2018). Før Flommen - bærekraftig overvannshåndtering for økt klimaresiliens i norske byer og tettsteder. *VANN*(01), 31-53.
- Caneparo, L., & Bonavero, F. (2016). NEIGHBORHOOD REGENERATION AT THE GRASSROOTS PARTICIPATION: INCUBATORS' CO-CREATIVE PROCESS AND SYSTEM. *Archnet-Ijar International Journal of Architectural Research*, 10(2), 204-218.
- City of Tampere. (2015). Lielähti factory area converted to Hiedanranta district. Retrieved from https://www.tampere.fi/en/city-of-tampere/info/current-issues/2015/05/28082015_4.html
- City of Tampere. (2017a). From ideas competition to citizens' visions - Planning Hiedanranta in follow-on workshops. In.
- City of Tampere. (2017b). Hiedanranta Structure Plan. Retrieved from https://www.tampere.fi/tiedostot/h/Pq7B5MCph/20171207_Hiedanranta_Structural_Plan_Booklet_Updated_30Mt.pdf
- City of Tampere. (2018a). Innovative Hiedanranta. Retrieved from <https://www.tampere.fi/en/housing-and-environment/city-planning/development-programs/hiedanranta/innovative-hiedanranta.html>
- City of Tampere. (2018b). Planning of the city district. Retrieved from <https://www.tampere.fi/en/housing-and-environment/city-planning/development-programs/hiedanranta/planning.html>
- City of Tampere. (2018c). Temporary Hiedanranta. Retrieved from <https://www.tampere.fi/en/housing-and-environment/city-planning/development-programs/hiedanranta/temporary.html>
- CORDIS. (2017). SCC-02-2016-2017 - Demonstrating innovative nature-based solutions in cities. Retrieved from https://cordis.europa.eu/programme/rcn/701974_en.html
- Effenberger, N. (2018). *Which Governance Aspects Promote and Inhibit the Uptake of Nature-Based Solutions in Cities? - Sustainable Urban Drainage Systems in Tampere, Finland and Eindhoven, the Netherlands* (Master of Science in Bioeconomy), University of Hohenheim, Germany.
- eParticipation.EU. (2012). The Local Democracy Unit of Tampere. Retrieved from <http://eparticipation.eu/2012/10/the-local-democracy-unit-of-tampere/>
- European Network for Environmental Citizenship. (2018). Defining Environmental Citizenship. Retrieved from <http://enec-cost.eu/our-approach/enec-environmental-citizenship/>
- Frantzeskaki, N., & Kabisch, N. (2016). Designing a knowledge co-production operating space for urban environmental governance-Lessons from Rotterdam, Netherlands and Berlin, Germany. *Environmental Science & Policy*, 62, 90-98. doi:10.1016/j.envsci.2016.01.010
- Fronteer. (2018). What is Co-creation? A definition, some background and how it's done. Retrieved from <https://fronteer.com/what-is-co-creation/>

- Green Digital Charter. (2017). Hiedanranta, Tampere's smart and sustainable city district of the future. Retrieved from <http://www.greendigitalcharter.eu/hiedanranta-tampere-smart-and-sustainable-city-district-of-the-future>
- Hauge, Å. L., Hanssen, G. S., Flyen, C., & Strømø, E. (2018). *Nettverk for å lære klimatilpasning - Hvorfor og hvordan?* Retrieved from Trondheim, Norway:
- Hirabayashi, Y., Mahendran, R., Koirala, S., Konoshima, L., Yamazaki, D., Watanabe, S., . . . Kanae, S. (2013). Global flood risk under climate change. *Nature Climate Change*, 3(9), 816-821. doi:10.1038/nclimate1911
- Hrovatin, J., Machtig, S., & Prekrat, S. (2008). *DESIGN THINKING - MULTIDISCIPLINARY WAYS OF SOLVING PROBLEMS IN WOOD INDUSTRY*. Zagreb: Univ Zagreb, Fac Forestry.
- Husby, K. (2016). Tema: Fredlybekken. Retrieved from <https://www.adressa.no/tema/Fredlybekken/>
- Hussein, B. (2016). *Veien til suksess: Fortellinger og refleksjoner fra reelle prosjektsaker*: Fagbokforlaget.
- Ind, N., & Coates, N. (2013). The meanings of co-creation. *European Business Review*, 25(1), 86-95. doi:<https://doi.org/10.1108/09555341311287754>
- Jacobson, C. R. (2011). Identification and quantification of the hydrological impacts of imperviousness in urban catchments: A review. *Journal of Environmental Management*, 92(6), 1438-1448. doi:10.1016/j.jenvman.2011.01.018
- Kabisch, N., Frantzeskaki, N., Pauleit, S., Naumann, S., Davis, M., Artmann, M., . . . Bonn, A. (2016). Nature-based solutions to climate change mitigation and adaptation in urban areas: perspectives on indicators, knowledge gaps, barriers, and opportunities for action. *Ecology and Society*, 21(2), 39. doi:<http://dx.doi.org/10.5751/ES-08373-210239>
- Knapp, J., Zeratsky, J., & Kowitz, B. (2016). *Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days* (1 edition ed.): Simon & Schuster.
- Krull, W., Berry, P., Bauduceau, N., Cecchi, C., Elmqvist, T., Fernandez, M., . . . Tack, J. (2015). *Towards an EU Research and Innovation policy agenda for Nature-Based Solutions and Re-Naturing Cities - Final Report of the Horizon 2020 Expert Group on 'Nature-Based Solutions and Re-Naturing Cities'*. Retrieved from Brussels:
- Levonmaa, A. (2018). Hiedanranta Future City as NBS Platform. Retrieved from https://connectingnature.eu/sites/default/files/images/inline/Hiedanranta_Coruna_NBS_160518_opt.pdf
- Lindholm, O., Endresen, S., Thorolfsson, S., Sægrov, S., Jakobsen, G., & Aaby, L. (2008). *Veiledning i klimatilpasset overvannshåndtering*. Retrieved from Hamar:
- Lozano, F. (2016). Part II: Define / Synthesis. *TMM4220 Innovation by Design Thinking, Course at NTNU*. Retrieved from <https://static1.squarespace.com/static/5981d9bbbe6594bd65db01c1/t/5b9fb0e140ec9abc477e35b6/1537192178214/TMM4220+17+Sept-compressed.pdf>, collected from <https://www.pracademy.co/tmm4220>
- Lozano, F. (2018). Design Thinking is Taking the World by Storm. Retrieved from <https://www.pracademy.co/design-thinking/>
- Lähde, E., & Marino, M. (2018). Multidisciplinary collaboration and understanding of green infrastructure - Results from the cities of Tampere, Vantaa and Jyväskylä (Finland). *Urban Forestry & Urban Greening*. doi:<https://doi.org/10.1016/j.ufug.2018.03.012>
- Mao, F., Clark, J., Karpouzoglou, T., Dewulf, A., Buytaert, W., & Hannah, D. (2017). HESS Opinions: A conceptual framework for assessing socio-hydrological resilience under change. *Hydrology and Earth System Sciences*, 21(7), 3655-3670. doi:10.5194/hess-21-3655-2017
- Nielsen, S. B., Jensen, M. B., Øhlenschläger, N. W., Jensen, E. H., Andersen, H. K., & Dengsøe, N. (2011). *Disconnecting the autopilot in urban water projects: creating an innovation platform for sustainability*. Paper presented at the Cities of the Future: Sustainable Urban Planning and Water Management, Stockholm.
- Open Street Map Contributors. (2018). Vuores.

- Pearlmutter, D., Calfapietra, C., Samson, R., O'Brien, L., Ostoić, K. S., Sanesi, G., & del Amo, R. A. (2017). *The Urban Forest: Cultivating Green Infrastructure for People and the Environment*: Springer.
- Puerari, E., Concilio, G., & Longo, A. (2014). *Knowledge co-creation for urban services innovation*. Matera: Ikam-Inst Knowledge Asset Management.
- Rambøll. (2018). Vuoreksen sinivihreät aarteet. Retrieved from https://query.eharava.fi/data/questionparameter/2680/Avaa_isompi_kuva.pdf
- Ranzato, M., & Bortolotti, A. (2015). *Towards Water Sensitive Co-Design in Brussels: The Forrest Case Study*. Paper presented at the True Smart and Green City? 8th Conference of the International Forum on Urbanism (IFoU).
- Statistics Finland. (2018a). Population projection 2015 according to age and sex by area in 2015 to 2040. Retrieved from http://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin_vrm_vaenn/statfin_vaenn_pxt_003.px/?rxid=f01842c1-73d5-4558-8128-4a2c7a36376e
- Statistics Finland. (2018b). Preliminary population by month, sex and area 2018. Retrieved from http://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin_vrm_vamuu/statfin_vamuu_pxt_001.px/?rxid=6c2b3d86-5c9d-4be3-8fc3-6008576380c4
- Tamminen, P. (2012). *Urban sustainability in Vuores, a new Housing Development in Tampere*. Paper presented at the FIG Working Week 2012 - Knowing to manage the territory, protect the environment and evaluate the cultural heritage, Rome, Italy. https://www.fig.net/resources/proceedings/fig_proceedings/fig2012/papers/ts05d/TS05D_tammin_en_5717.pdf
- Tampere UNaLab. (2018). Program for expert seminar and workshop on NBS and green spaces. Retrieved from https://www.eventbrite.com/e/luontoperustaiset-hulevesijarjestelmat-seminaari-rakentamisen-kiertotalous-tyopaja-tickets-44274565417?utm_source=eb_email&utm_medium=email&utm_campaign=event_reminder&utm_term=eventname
- Tofan. (2014). A David Archuleta fan to the Finnish revisited. Retrieved from <https://snowangelzz.com/2014/01/07/a-david-archuleta-fan-to-the-finnish-revisited/>
- Udomcharoenchaikit, P. (2016). *Nature-based solutions for urban stormwater management: Experiences in Malmö and Copenhagen*. (Master of Science in Environmental Sciences, Policy & Management (MESPOM)), Lund University, Lund, Sweden. (IIIEE Theses 2016:14)
- UPV. (2005). ECOCITY Tampere - Vuores. Retrieved from <http://www.upv.es/contenidos/CAMUNISO/info/U0511279.pdf>
- van de Ven, F. H. M., Snep, R. P. H., Koole, S., Brolsma, R., van der Brugge, R., Spijker, J., & Vergroesen, T. (2016). Adaptation Planning Support Toolbox: Measurable performance information based tools for co-creation of resilient, ecosystem-based urban plans with urban designers, decision-makers and stakeholders. *Environmental Science & Policy*, 66, 427-436. doi:10.1016/j.envsci.2016.06.010
- Vuores Portal. (2013). Observations of Vuores. Retrieved from <https://vuores.fi/yhteiso/galleria/99-joku-muu/30:yleista-vuoreksesta?picid=53>
- Vuores Portal. (2018a). Vuores. Retrieved from <https://vuores.fi/in-english>
- Vuores Portal. (2018b). Vuores - Construction. Retrieved from <https://vuores.fi/in-english/construction>
- Väliaikainen Hiedanranta. (2018). Temporary Hiedanranta. Retrieved from <https://valiaikainenhiedanranta.fi/in-english>
- Wong, T. H. F., & Brown, R. R. (2009). The water sensitive city: principles for practice. *Water Science and Technology*, 60(3), 673-682. doi:10.2166/wst.2009.436
- Yin, R. K. (2014). *Case Study Research: Design and Methods* (5th Edition ed.): SAGE Publications.
- Zhang, J., & Kumaraswamy, M. M. (2012). Public-Private-People Partnership (4P) for Disaster Preparedness, Mitigation and Post-disaster Reconstruction. *University of Hong Kong*, 407-416.

Appendix A – Supplementary Context

Hiedanranta Structure Plan



- Alueellinen viheralue
District parks
- Viherkäytävä
The green corridor
- Kartano puisto
The Mason Park
- Järvipuisto
Lakefront park
- Vihreä katu
Green streets
- Taskupuisto
Pocket parks
- Kaupunkiviljely
Productive green
- Viheryhteys
Green connections
- Viherkatto
Green roofs
- Vihereinä
Green facades
- Hulevesipainanne
Stormwater fields



- Keskustakorttelit - Keskustatoimintojen alue
Central Blocks - Centre functions
- Kortteli
Blocks
- Viherkäytävä - Pää viheryhteys
Green corridor - Main green connection
- Viherkadut - Toissijaiset viheryhteydet
Green streets - Secondary green connections
- Pääkadut
Central axis
- Järvikaupungin julkinen katutila
Canal city public spaces
- Joukkoliikennekäytävät
Public transport corridor
- Autoilun pääreitit
Main car route
- Pyöräilyn pääreitit
Bicycle route
- Älyliikenneväylä
Smart transport route
- Bussi
Bus
- Historialliset elementit
Historic Elements

Figure 8: An “Intertwined green and blue structure” (top) is one of the five strategies outlined together with the structure plan of Hiedanranta (bottom) (City of Tampere, 2017b). The structure plan and the five strategies guide the development of the Hiedanranta Masterplan (City of Tampere, 2017b).

Hiedanranta current situation



Figure 9: Satellite image showing the current situation of the Hiedanranta area (Google Maps 2018). A stream conveying runoff from developed areas upstream of Hiedanranta runs open into the lake in the southern part of the Hiedanranta area.

Vuores plan

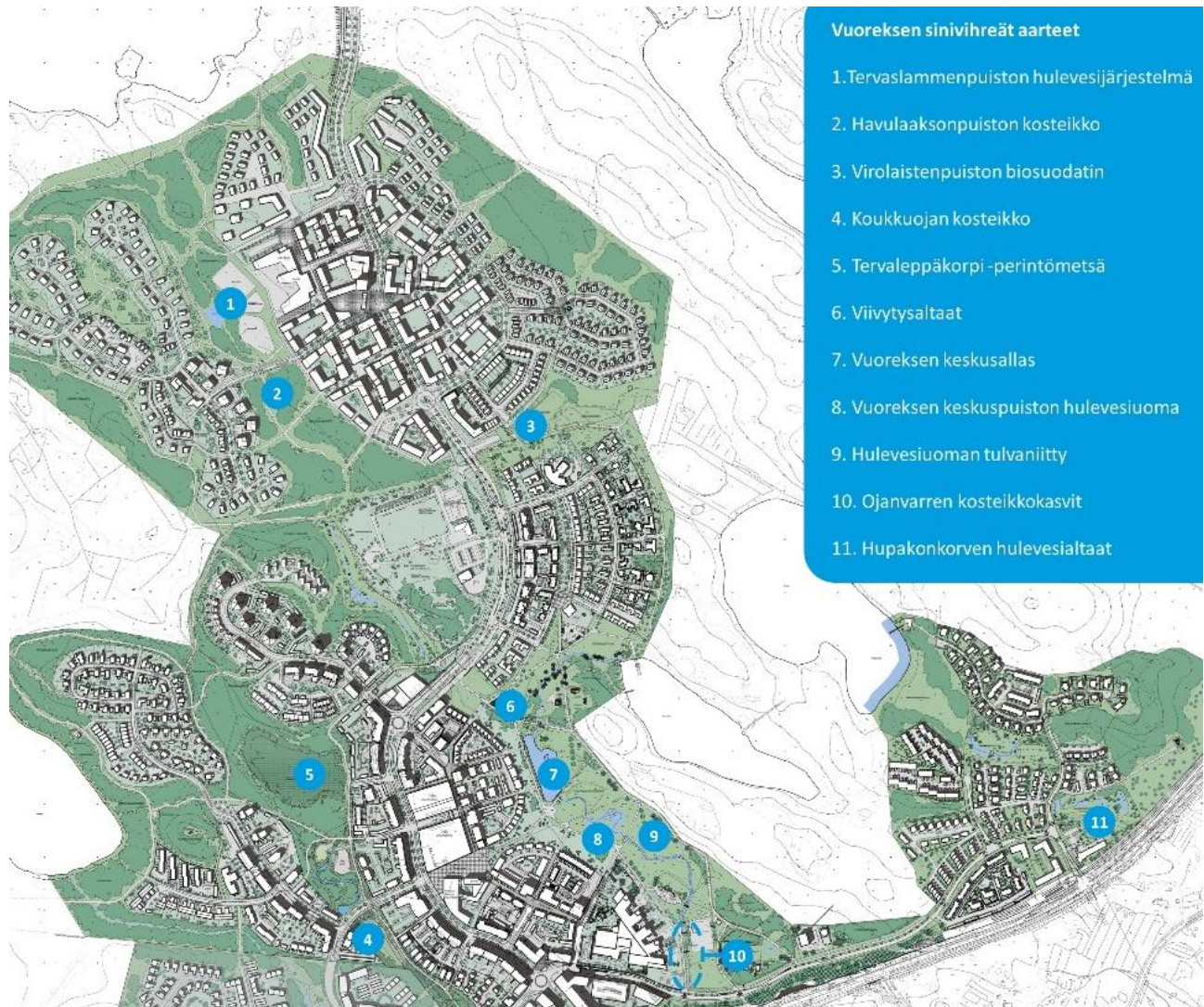


Figure 10: Vuores development plans and NBS solutions (blue marks) which together make up a system for local stormwater management. Some of the NBS solutions are constructed and in use, some are under construction and some are in the planning phase. (Rambøll, 2018).

Vuores current situation

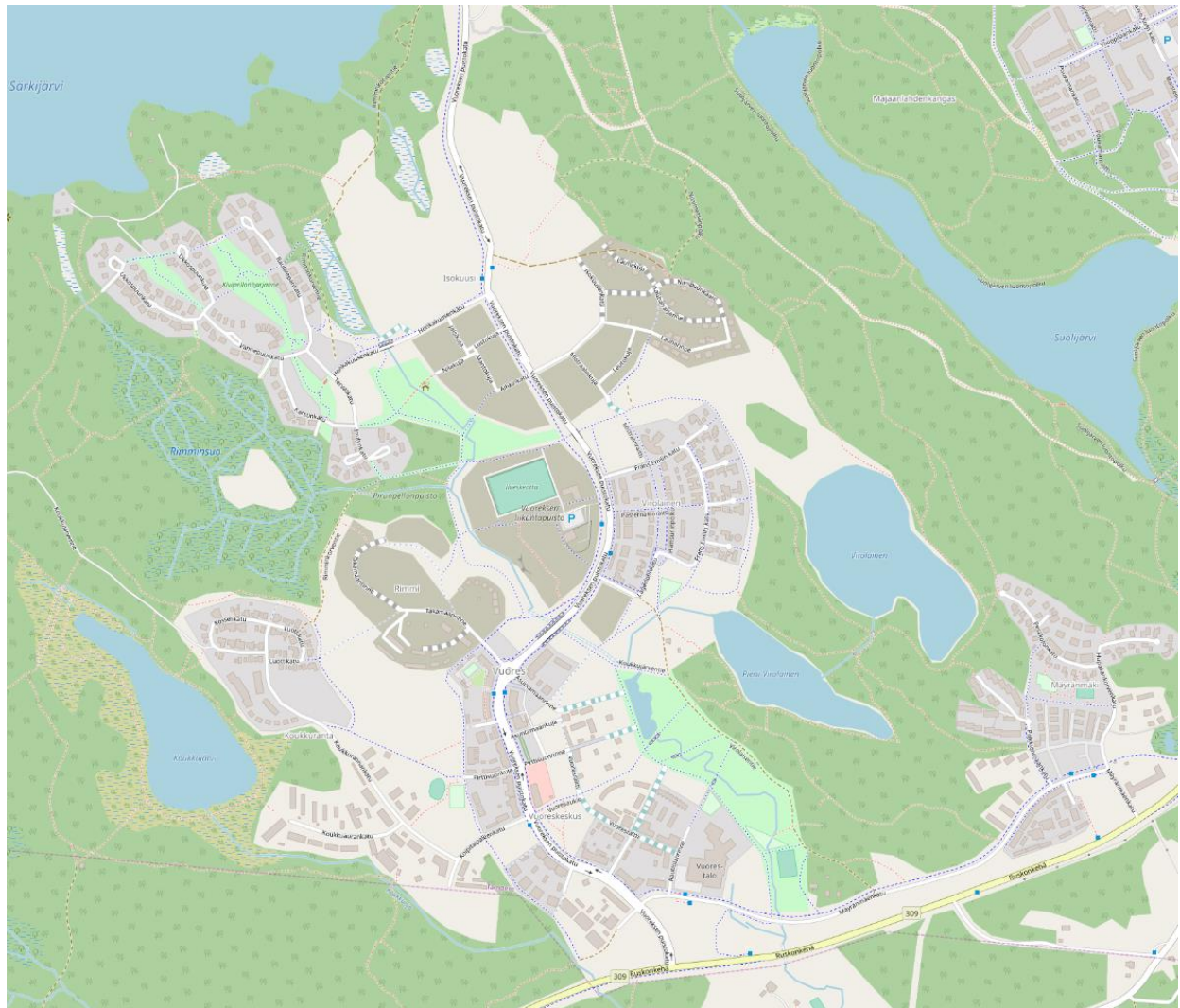


Figure 11: Status of the developments in Vuores according to Open Street Map (Open Street Map Contributors, 2018)



Figure 12: Aerial photo of Vuores district from the south (Vuores Portal, 2018b)



Figure 13: Aerial photo of Vuores center and the central park with the central dam. The photo is taken from the west. (Vuores Portal, 2018b)

Appendix B – Pictures

Pictures are taken by the author unless otherwise stated.

Hiedanranta



Figure 14: The covered landfill



Figure 15: An area with wetland upstream of the covered landfill

H1 Seminar Workshop



Figure 16: In the H1 Seminar Workshop, three workshop stations were prepared with the topics of water, biodiversity and recreation. The work stations included a map, a satellite photo and the structure plan of Hiedanranta, inspirational pictures and a printout of a powerpoint presentation, pens, post it notes, and a big paper to write and put post it notes on.

H2 Expert seminar

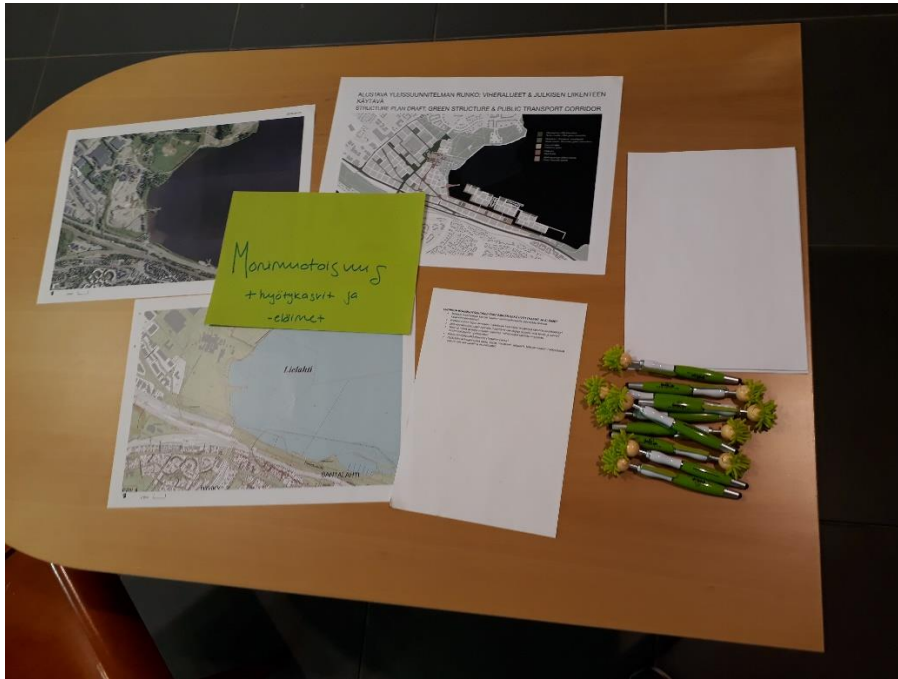


Figure 17: The six work stations in the co-creation workshop had different themes related to NBS, stormwater and green spaces, with pre-made questions and focus points based on the first H1 event.



Figure 18: At the end of the co-creation workshop, the note taker of each group presented the groups main findings in a plenary summary session (Foto: Maarit Särkilahti, 2018)

H3 Walk Tour



Figure 19: Participants and organizers noticed the bad smell one could smell next to the ditch conveying leakage water from the landfill to the lake (left in picture).



Figure 20: Various topics based on the H1 and H2 events were discussed in various stops along the walk tour.



Figure 21: The wetland upstream of the landfill was one of the topics generating debate.



Figure 22: UNaLab participated with a stand at a local information event in the day time before the walk tour, where citizens were invited to the walk tour, and some also came. The picture is taken when a presentation is ongoing in another room.

Vuores

Vuores central park



Figure 23: Vuores Central Park in the beginning of April 2018. Inhabitants commented that the park feels quite windy and unsheltered most of the year.



Figure 24: The Central Dam in Vuores Central Park in the end of May 2018. Inhabitants were happy and proud of the park in the flourishing summer months. Stormwater from the housing area are collected in grassed basins along the dam, and the stormwater filters into the dam.



Figure 25: The picture shows the area where Tervaslammenpuisto (the Tar burner park) will be developed, as a multifunctional stormwater and recreational park. In light runoff events, runoff conveys to the north (away in the picture), while in heavy runoff events, runoff will also convey to the south (towards in the picture) (H2PM1).



Figure 26: A high groundwater table gives muddy waters during construction. The water is treated in contemporary facilities by filtering through sand and fiber cloth, and pumped to the already constructed NBS for further treatment before release to the vulnerable small lake recipient (H2PM1).



Figure 27: Area collecting stormwater runoff from surrounding development plots. In extreme events, the area will also receive runoff from Tervaslammenpuisto from under the Tervaslammen bridge (H2PM1).



Figure 28: The stormwater area seen from the Tervaslammen bridge



Figure 29: Stormwater is conveyed partly daylighted and partly underground by filtering through crushed stone. Right before the wooden bridge, the water is led underground. In heavy runoff events, water will rise up of the crushed stone and also be conveyed on the surface. The municipality arranged a design competition and co-created a roofed picnic sitting area together with the winning design company (H2PM1).

VI Evening Workshop



Figure 30: The co-creation workshop was designed as a board game inspired by "The hidden diamond". Participants went through the stops, representing existing NBS and areas of potential new NBS, and discussed their experiences, ideas for improvements and suggestions for new NBS. Results were written down on numbered NBS cards for each stop, which contained pictures and information about each NBS/area, and also the comments made about the NBS/areas in the online questionnaire answered by some 40 residents before the workshop. Organizers reflected that this approach appeared to be a good way to collect relatively much input in relatively short time (OS4).



Figure 31: The discussions were lively, and people were involved. The big map on the table seemed to give good grounds for discussing.

V2 School Workshop



Figure 32: All the Vuores School pupils and ma number of the teachers participated to the introductory presentations about water issues, NBS, biodiversity and water animals in the V2 event.



Figure 33: After the introductory presentations, pupils went to their classrooms for group work. The 6th graders played the board game introduced in VI, while the younger pupils created «The NBS of their dreams» using LEGO, building bricks, drawing and writing.

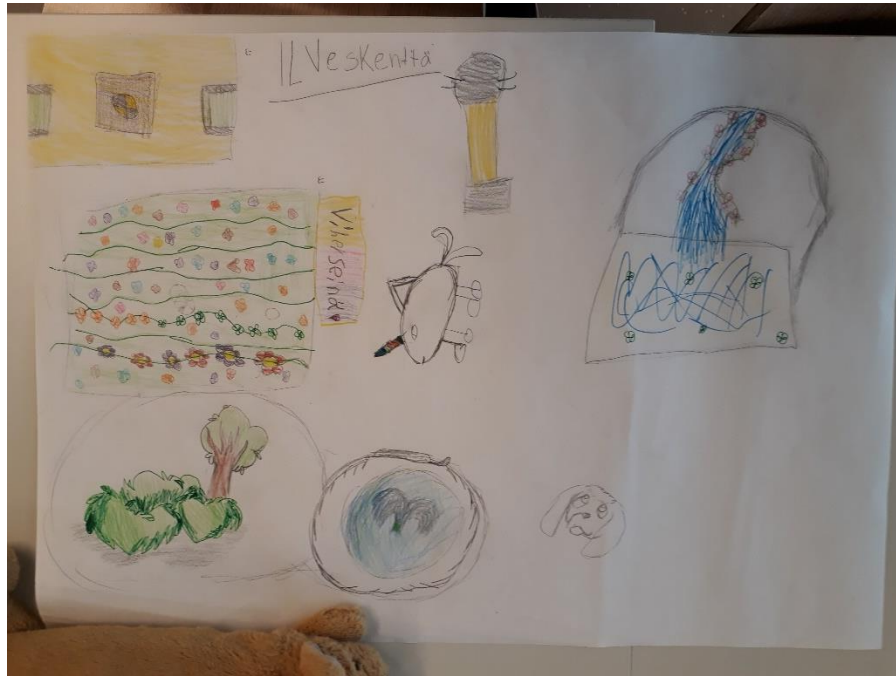


Figure 34: Many pupils innovated solutions involving running water and play with water.



Figure 35: The picture shows an NBS park with a bicycle parking area created by a group of two girls and two boys in 3rd grade. Teachers had made the groups beforehand, to account for social factors. A teacher reflected that this is essential for successful groupwork (V2PT). Organizers reflected that the collaborations with teachers were essential for the success of the co-creation process (O2, OS2).

V3 Nature Trail and Vuores Festival



Figure 36: UNALab stand at the local Vuores Day festival. The free buckets were popular.



Figure 37: The aquarium with water animals that were collected from the stream running past the school was a magnet for children at the Festival area, and also attracted their parents to the UNALab stand (OSP8).



Figure 38: A variety of inhabitants, with ages ranging from the early 30s to the 60s, participated in the Nature Trail. Ad-hoc participation seemed prevalent especially among the younger participants.

Local Park



Figure 39: A steep ditch (snowcovered in the right side of the picture) runs through the local park.



Figure 40: A brief introduction to water issues, NBS and biodiversity were given before doing experiments to purify the muddy waters in the ditch with filters made of milk cartons and any available filter material that the pupils could find. The filtering experiments were popular and the pupils wanted to do it many times to improve the filters (O1).



Figure 41: Participants emphasised the importance to keep the popular climbing trees during the renovation.

Appendix C – Case Study Propositions

As part of developing the research design (Yin, 2014) in the initiatory phase of the study, case study propositions were developed. The propositions guided the development of the surveys and initial interview topics and questions.

Proposed outcomes

It is assumed that the co-creation process may affect knowledge, competence, attitudes and networks of the participants and the organizers/project owner.

Building competence

- Increased idea on what solutions may give good NBS and green spaces.
- Increased idea on the design of solutions and the spaces, what design details may optimize outcome for all stakeholders - including project owner .
- Increased idea on how to implement solutions in a way that stakeholders are satisfied, its efficient, practical, nice, etc.
- Increased idea on how to operate and maintain solutions in a way that stakeholders are satisfied, its efficient, practical, nice, technical and user function is sustained, etc.
- What compromises may we face related to NBS? Eg. area use and maintenance.
- How may applying NBS in my work or projects be useful to me?
- What is the vision for our municipality regarding urban development?
- Increased knowledge of how NBS may be beneficial for the society, environment, inhabitants, real estate developers, municipality, etc.

Competence and knowledge specifically for project owner

- Increased knowledge on stakeholders' desires and needs, their situation, opportunities, etc.

Competence and knowledge specifically for participants

- “I learned more about the project and what it may mean for me and my job/daily life.”
- “I learned more about my own role and how I may be part of the project onwards, - in the implementation, evaluation and maintenance phases.”
- “I learned more about the other stakeholders and their views of the project and what is important to them.”

- “I know more about NBS, - the concept and the potential benefits, and the practical implications for this project and for my job/neighborhood/life.”

Attitude changes in participants

- Increased friendliness to project.
- Increased feeling of ownership of the project and its vision.
- Interest in having a role and contribution to the project, for example in the implementation, evaluation and use & maintenance phases.
- Reduced criticism, skepticism and worries of NBS.
- Increased inspiration to consider and to use NBS in projects in work.
- Increased positiveness to NBS being implemented in neighborhood.
- Higher willingness to do compromises, such as for area use and maintenance needs.
- “My attitude went from curious/skeptical/nervous to eager, secure and involved - I want to be part of this cool project/urban development and use my job/neighborhood-role to participate in making a difference for the better.”

Positive effects on participant attitudes are proposed to lead to

- Less resistance to NBS, project and urban development.
- More friendliness, help and support of project and urban development.
- More participation; more, more diverse and better input; results, NBS and Urban Living Lab that is optimized and has high outcome, is widely used, well-functioning, reasonable to execute and maintain, etc.

Other outcomes

- Positive effects on network - strengthened and expanded network.
- Having true influence in the project and urban development.

Proposed success factors

- Good experience of the workshop and of contact with other people. For example:
 - “My concerns and ideas were received and listened to in the workshop.”
 - “I felt I could contribute and that it was room to share what I wanted, and I had a good experience of participating in co-creating visions/ideas/plans together.”
 - “I met many new interesting people and old contacts, and it was nice to talk and to establish and strengthen relationships.”

- Feeling of contributions being included in the further process, and of having a true influence and impact.
- Good information and communication between organizers and participants before and after events.

Appendix D – Interview topics and questions

Below is a list of topics and questions in interviews. The interviews were semi-structured, which means there was flexibility to follow up topics that arose, asking further questions and trying to understand more of the underlying backgrounds of the answers and thoughts that interviewees brought up.

Due to time frames of the interviews and variations between interviewees and between the events regarding the relevance of different questions, not all the questions/topics were asked to all the interviewees. Also, some questions were added and sharpened during the field work period as experiences of doing interviews and deeper understandings were gained. However, the main line and main topics were kept the same. Also for organizers, all questions were not asked to all interviewees due to time frames and varying relevance. Often interviewees would also cover the topics when talking and there was not a need to ask all the questions. Multiple interviews were held with main organizers to have time to cover everything, and also to collect insights at different times during the TUC. The topics were not necessarily asked about in the order given below, as the order sometimes was adapted to build further when the interviewee brought up the topics. Questions in parenthesis were only asked if interviewees didn't bring it up themselves.

Mini-Interviews with Participants During Events

Main focus: Motivation, expectations, experiences of event and outcomes of event

Short and In-Depth Interviews

For everybody

Motivations, experience, outcomes and evaluation of event

Motivations, expectations for event

Experience of event

Experience of discussion, flow, focus, if everyone got to talk

Did you get to share your point of views? Felt you could have impact?

Outcomes of event? (personally, for work, for neighborhood, for City)

(Did you learn, about what?)

(Co-created visions/ideas/solutions?)

Networking, social cohesion

(Other bonuses?)

Important for such events to go well?

How may improve event?

Communication, understandings, attitudes, evaluation of process and further involvement

Experience of process overall this far (if applicable)

Experience of information and communication before and after event

Understanding of overall goal of event, project and process? (For City, neighborhood, participants?)

How may you benefit from it, how may be your role in it?

Original hopes, motivations, attitudes towards process/project? Changed?

Do you feel you/event/project has an impact?

Want to keep being involved? In what ways? Do you see yourself being involved in co-creation of NBS and green spaces (or other topics) in the future? How may you benefit from it?

How may improve process?

Challenges, solutions and impacts

Challenges to implementing (including everything from deciding on and planning) multi-beneficial NBS in new projects? (Why is it like that?)

Suggestion for solution?

What impact may the solution have?

What do you think of the idea of establishing a community of practice around NBS, stormwater management and green spaces?

Challenges of co-creating multi-beneficial NBS and green spaces? (with inhabitants, experts, builders, municipality, etc) (Why is it like that?)

Suggestion for solutions?

What impact may the solutions have?

Factors for success?

Success factors and hopes further

Overall, for participation and co-creation of NBS to go well, what is that to you?

What do you hope from UNaLab project onwards?

Additional for teachers

The Children's expectations and experiences of the workshop?

Communication with parents? Their attitudes and interests?

Additional for H2

Was there something that caught your attention in the seminar? And in the seminar discussions?

Additional for inhabitants in Vuores

Challenges/problems/issues in Vuores as inhabitant? Vandalism? Social cohesion?

Suggestion for solution?

What impact may the solution have?

Additional for organizers

What is your background?

What is important to you in your work and life in general? (motivation/purpose)

About each event

Beforehand: What are the plans?

Expectations, hopes?

Purpose?

Worries?

Clarifications about what was said and done in the events if needed

Experience of event?

Outcomes of event? (For Tampere UNaLab, in general, for the various participating stakeholders, for your work, personally)

(For people: Learn (about what)? Share opinions, influence? Co-create?)

How was communication before and after event?

Important factors for event to go well?

Success factors for such events to be useful for the various NBS-related professions and other stakeholders?

Was there something that went not as expected?

Improve to next time? Something more wished for?

About the co-creation process overall

Purposes, success criteria and expectations

What is goal for UNaLab in H/V? What want to do there overall? (How changed?)

What are main goals with co-creation? What will be co-created?

For TUC to go well, what is that to you? What would be successful results? (Success criteria)

What did you expect from the TUC beforehand?

What did you expect would be the outcome of the process beforehand, and what do you expect by now?

Experiences, outcomes, challenges and evaluation

How have you experienced the process?

What has been as expected, and what has not?

What has been good?

Is there something you wish was different?

What were things in the co-creation process that were important for it to go well? (Success factors)

What do you see as main outcomes of the process this far? (effects on awareness, understanding others' points of views,...)

How may people's feelings towards the project/urban development have changed as a result of the events? (ownership, cooperation, trust, ...)

Social bonds within project and partners

Challenges in relation to the co-creation process?

Suggestions for solutions?

What impact may the solutions have?

What do you think is important factors to make co-creation processes good in general cases like H, V, LP?

How maybe has your expectations or view of co-creation and the outcomes changed?

Stakeholders and resources

Who do you see as main stakeholders (SH) for Tampere UNaLab in H/V? Why?

(Who had been important to involve, and involved?)

What and how has communication with SH been so far?

Are there some type of SH you wished had been more? How can it be solved?

What is needed from the SH to make the ULL successful?

What and how has the communication been in the project and city (internally/with partners)?

How has the cooperation and the support been in the TUC and project so far?

What has been important support and resources for you?

Some resources you wish you had more of?

Usefulness, uptake, forwarding and influence

What's important in order to make the outputs of the TUC useful?

For the inputs from TUC that is forwarded, who are the people important to forward the inputs to? How has the forwarding been so far?

What is your impressions of what kind of and how much influence the TUC will have on the final results, and the plans for stormwater and green spaces in H/V? How is the influence achieved? Barriers? How may they be overcome?

Context

The context of Tampere, H, V and LP (what intentions does the municipality have, how are things done, regulations, circumstances, practices, existing and planned stormwater management systems, important stakeholders)

How is UNaLab's role in relation to the larger development projects of H and V?

Plans and hopes further

What will be done onwards now after the TUC? How? With what purpose? How will the ULLs in H/V be?

What do you wish for the rest of the process, what is important to you? How to make that happen?

Additional for organizers that were internal or external partners

Purpose for you of cooperation with Tampere UNaLab? What do you wish as outcome?

Internal: What is your role and responsibilities in the project?

External: What does it consist of, the cooperation between you and Tampere UNaLab?

Plans for cooperation further? Your role onwards?

How experienced cooperation so far?

Personal/work outcome for you from the cooperation so far?

What may be important for you for the cooperation to go well further? Success factors

Additional for facilitators

What are the purposes behind what you are preparing and doing in the events?

Comparisons, experiences, typical outcomes, learnings from other workshops

Context; how does the cooperation with Tampere UNaLab work, what is the scope

Examples of adaptations as a result of realizations and deeper understandings during the research

Issues of vandalism in Vuores arose in event. Vuores interviewees and city officials were asked about the situation and experiences.

Issues of social cohesion and lack of community feeling in Vuores arose in an interview. The remaining Vuores interviewee was asked about the situation and experiences.

Uncertainty of how TUC results would be taken up in the Hiedanranta urban development project arose. Organizers and city officials were asked about the situation, experiences and how they were hoping to strengthen the uptake.

Appendix E – Documents

The following documents were coded in NVivo. If the document had a Finnish title, the google translation is given, or the topic is described in parenthesis.

Table 7: Documents

Abbreviation	Title (topic)	Author
H1d1	Post-Workshop Reporting Hiedanranta WS1	Oh
H1d2	Pre-Workshop Planning Hiedanranta WS1	Oh
H2d1	Post-Workshop Reporting Hiedanranta WS2	Oh
H2d2	Pre-Workshop Planning Hiedanranta WS2	Oh
H3d1	Post-Workshop Reporting Hiedanranta WS3	Oh
H3d2	Pre-Workshop Planning Hiedanranta WS3	Oh
Hd1	Workshops Summary Hiedanranta (PPT)	Oh
	Results of the workshop (internal report listing inputs and wishes)	Om
TUCd1	Co-creation workshops in Tampere Finland (summary of TUC) (PPT)	Op and Om
TUCd2	Co-creation process, activities and inputs to the next phases (plan for content of H and V WSs)	Op
TUCd3	Co-Creation workshops in Tampere Spring 2018 (preliminary plan and responsible persons for workshops)	Om
TUCd4	(Updated plans after co-creation)	Om
TUCd5	UNaLab grant sheet - details of plans before co-creation	UNaLab consortium
V1d1	Post-Workshop Reporting Vuores WS1	Op
V1d2	Pre-Workshop Planning Vuores WS1	Op
V2d1	Post-Workshop Reporting Vuores WS2	Op
V2d2	Pre-Workshop Planning Vuores WS2	Op
V2d3	Meeting Minutes (from planning meeting held with teachers)	Op
V3d1	Post-Workshop Reporting Vuores WS3	Op
V3d2	Pre-Workshop Planning Vuores WS3	Op
V3d3	UNaLab-project WS3 (Short summary and notes of inputs)	Op
Vd1	Co-creation Workshops in Vuores, Tampere Finland (PPT)	Om and Op
Vd2	Vuores workshops (internal report listing results)	Om

The following pages present the templates of the pre-workshop planning and post-workshop reporting sheets developed by Ines Vaittinen, Spela Zalokar and Clara Mafe on behalf of the European Network of Living Labs (ENoLL, <https://enoll.org/>) for internal use in UNaLab.

Workshop Planning

To complete BEFORE the workshop by the organiser

NAME OF THE EVENT

LOCATION

DATE

AIM	Description
What is the background of the workshop? Theme? Why are you running the workshop?	
What is the objective of the workshop? What is the objective in relation to the project overall?	
What is the stage of the process we are developing? Vision creation, experimentation or prototyping & testing, implementation?	
At what stage of the overall process are we in?	

<p>Is this the first or last of a series, what has preceded the workshop and what will follow?</p>	
<p>What are the expected outcomes?</p> <p>What do we walk away with?</p> <ul style="list-style-type: none"> - Intangible outcomes - Tangible outcomes 	
<p>What practical requirements do we have?</p> <p>In order to reach these outcomes? What do we need to have prepared?</p>	
PARTICIPANTS	Description
<p>Who are the target audience?</p> <p>What is the background of participants?</p>	
<p>How many participants?</p> <p>Should they be split in working groups?</p>	
<p>Have they met before?</p> <p>What is the relationship between the participants?</p> <p>Should there be an element of networking?</p>	
<p>Are there any required participants?</p> <p>Do we need any experts?</p>	

<p>What are their expectations from the workshop?</p> <p>What do you think they are expecting? If possible, ASK!</p>	
<p>What are the benefits of participating in this workshop?</p> <p>What do participants take home?</p>	
<p>What is the impact of participating?</p> <p>Long-term benefit, change in the know-how</p>	
ORGANISATION	Description
<p>Is this workshop part of a series?</p> <p>How is it connected to other workshops?</p>	
<p>Can we link the workshop to other events?</p> <p>What would be the connection?</p>	
<p>How much time do we have?</p> <p>Will there be breaks/lunch?</p>	
<p>Are we leading or supporting?</p> <p>Is someone there to support us?</p>	

What is the location like?

What do we need to organise ourselves?

Workshop Reporting

to complete AFTER the workshop by facilitator

WORKPACKAGE(S)

WORKSHOP TITRE

DATE OF WORKSHOP

TIME OF WORKSHOP

VENUE OF WORKSHOP

WORKSHOP ORGANISER

WORKSHOP

PARTICIPANTS

RAPPORTEUR

WORKSHOP CONTENT

What was the workshop Agenda?

Provide Agenda

1

What was the goal of the workshop?

How was the information presented?

Did participants have the chance to interact and express their ideas?

Did you miss any information?	

WORKSHOP METHODS & TECHNIQUES

What method did you use? T2.1 (EASW or Design Thinking) T2.4 Which Urban Living Lab Training methods	
Why was this method chosen? How did it suit your needs?	
What were your expectations of this methodology before the workshop? How have they changed after the workshop?	
What tools or techniques were used? e.g. Customer journey, personas, Lego Serious play etc. What did these tools aim to achieve?	

PARTICIPATION

Number of participants	
Was everyone present involved in the discussion? Were there any dominant/passive participants?	
What type of participants attended the workshop? From which stakeholder groups?	

Were the participating stakeholder groups the same as in previous workshops (if any)?
 What was the difference? Was this intentional?

Do you have any tips for follower cities on how to involve participants?

Was a list of participants & signatures provided?

IDEAS AND OPINIONS

Was there an strength of opinions?
 What different streams of opinion could you identify?

How many ideas were transferred?
 How many of these were *new* ideas?
 What were the best ones?

What was the most controversial topic?
 That one topic generating more debate

WORKSHOP OUTCOMES

Did you reach the goal?
 How was this done?

How is the goal going to contribute to the overall framework of the project?

Did the workshop meet your expectations?
 How? And if not, why?

Did the workshop meet the participant's expectations?
 What key messages and ideas did they take home with them?

What tips would you give to follower cities on how to reach the goal?

FOLLOW-UP

Were any specific actions formulated?
List of actions (including due date)

What was the level of commitment to follow up?
(Estimate/prediction)

Will there be an evaluation of actions?
Method of evaluation

FEEDBACK

How did you ask for feedback about the workshops?

What were the main feedback outcomes?

Appendix F – Archival records

Table 8: Archival records

Abbreviation	Title (topic) [format if relevant]
Hr1	Results and follow-up of the UNaLab workshops in Hiedanranta [Blog]
H2d3	Nature-based stormwater systems - Seminar and workshop for construction and restoration (seminar program ahead of event)
Hr2	Hiedanranta structural plan used as material in Hiedanranta events
LPr1	[Name of park] is refurbished to be fun and enjoyable
LPr2	Map of preliminary park plans
TUCr1	First results of Co-creating Nature-based Solutions in Tampere [Blog]
V2r1	Children's Urban Nature Lab in Vuores [Blog]
Vr1	Results and follow-up of UNaLab workshops in Vuores [Blog]
VQ	UNaLab questionnaire before the first workshop in Vuores

(Accessed 11.08.2018)

Table 9: Links to archival records

Abbreviation	Links:
Hr1	https://www.tampere.fi/tampereen-kaupunki/ajankohtaista/blogit/FIlecJhyH.html
H2d3	https://www.eventbrite.com/e/luontoperustaiset-hulevesijarjestelmat-seminaari-rakentamisen-kiertotalous-tyopaja-tickets-44274565417?utm_term=eventurl_text
Hr2	https://www.tampere.fi/tiedostot/h/Pq7B5MCph/20171207_Hiedanranta_Structural_Plan_Booklet_Updated_30Mt.pdf
TUCr1	https://www.unalab.eu/news/first-results-co-creating-nature-based-solutions-tampere
V2r1	https://www.unalab.eu/news/children%E2%80%99s-urban-nature-lab-vuores
Vr1	https://www.tampere.fi/tampereen-kaupunki/ajankohtaista/blogit/1vtriXzK9.html
VQ	https://query.eharava.fi/2351#

In addition, Facebook websites, Facebook events and the Vuores portal website (Vuores Portal, 2018a) also constituted sources of information.

Main event-related websites visited:

<https://vuores.fi/vuores-paiva>

<https://www.facebook.com/vuores/>

<https://valiakainenhiedanranta.fi/>

<https://www.facebook.com/hiedanranta/>

Appendix G – Surveys

The following pages show the feedback surveys used in H2, H3 and V3 respectively.

In both H3 and V3 some participants didn't speak English, or spoke English poorly. In H3 this was solved by the participants getting help with translating the survey orally by organizers, and writing answers in Finnish. In V3, the survey was translated to Finnish. This turned out to be important for the study, as half of the respondents didn't speak or spoke poorly English, and the situation was not suitable for taking time for oral translation.



Event Survey 11th of April

- I agree that my written comments may be used anonymously for reporting and research purposes by the European Urban Nature Labs (UNaLab) project

Please tell us a bit about you...	
Gender: <input type="radio"/> Female <input type="radio"/> Male	Background: <input type="radio"/> Real estate company/owner and developer <input type="radio"/> Architect, urban planner <input type="radio"/> Technical consultant <input type="radio"/> Construction company <input type="radio"/> Maintenance <input type="radio"/> Tampere municipality <input type="radio"/> Non-governmental organization (NGO) <input type="radio"/> Student (please specify field) <input type="radio"/> University staff (please specify field) <input type="radio"/> Applied research company <input type="radio"/> Other (please specify)
Age group: <input type="radio"/> <25 <input type="radio"/> 26-35 <input type="radio"/> 36-45 <input type="radio"/> 46-55 <input type="radio"/> 56-65 <input type="radio"/> >65	
Attended workshop 13.03.? <input type="radio"/> Yes <input type="radio"/> No	Specification: _____

What was your motivation(s) to attend today's event?
<input type="radio"/> To learn from the presentations
<input type="radio"/> To network
<input type="radio"/> To learn about the Hiedanranta project
<input type="radio"/> To share my views in relation to Hiedanranta
<input type="radio"/> I gave a presentation
<input type="radio"/> I organized the event
Other motivations if any:

Do you think a community of different stakeholders who meets regularly to discuss needs, plans, challenges and other issues concerning the Hiedanranta project would improve any of the following?	No	Yes		
		a little	moderately	a lot
Implementation efficiency in Hiedanranta	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Site planning workflow	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Building permit application workflow	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Construction workflow	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trust between stakeholders	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cooperation and communication among project partakers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Personal stress levels from work related to Hiedanranta development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maintenance experiences in the use phase	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inhabitant experiences in the use phase	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Is there anything else that regular meetings of stakeholders could affect?

Would you like to be part of such a community of practice?
 Yes No

If so, how often would you prefer to meet?
 Weekly Monthly Quarterly Twice a year Yearly Less than yearly

Comments if any:

Evaluation

1	<p>How did you experience the walk tour?</p> <p>What was good?</p> <p>How can it be better another time?</p>
2	<p>How did you experience the group discussion in the end?</p> <p>What was good?</p> <p>How can it be better another time?</p>
3	<p>How did you experience the organizing of the overall event and process this far?</p> <p>What was good?</p> <p>How can it be better?</p>

Hopes

4	<p>What do you hope for from the overall participatory process around Hiedanranta?</p>
5	<p>What do you hope for from communication from/with Tampere UNaLab onwards?</p>
6	<p>Would you like to be part of a community of practice with different stakeholders who meets regularly to discuss needs, plans, challenges and other issues concerning the Hiedanranta project?</p> <p><input type="radio"/> Yes <input type="radio"/> No</p> <p>If so, how often would you prefer to meet?</p> <p><input type="radio"/> Weekly <input type="radio"/> Monthly <input type="radio"/> Quarterly <input type="radio"/> Twice a year <input type="radio"/> Yearly <input type="radio"/> Less than yearly</p>

Additional comments if any

Mikä oli parasta Vuoreksen sinivihreisiin aarteisiin tutustumisessa?

(Voit valita useita valintoja)

- Luonnosta oppiminen
 - Hulevesijärjestelmistä oppiminen
 - Ideoiden ja mielipiteiden jakamisen avulla vaikuttaminen
 - Uusiin ihmisiin tutustuminen
 - Ajan viettäminen tuttavien kanssa
 - UNaLab-hankkeen Vuoresta koskeviin suunnitelmiin tutustuminen
 - Inspiraation saaminen Vuoreksen hulevesijärjestelmien suunnitteluun osallistumiseen
 - Ulkoilu ja hauskanpito
 - Muu:
-

Mikä voisi olla paremmin ensi kerralla?

- Enemmän ohjeistusta, taustatietoja ja tutustumista
 - Enemmän tietoa UNaLab-hankkeen toteutuksesta Vuoreksessa
 - Jotain muuta, mitä?
-

Mikä on taustasi?

- Asun Vuoreksessa
- Asun muualla

Kiitos! 😊

English original text:

What was your main outcome(s) of the nature trail-event?

- Learning about nature
- Learning about the stormwater solutions
- Contributing with ideas and opinions
- Getting to know new people
- Catching up with acquaintances
- Learning about UNaLabs activities in Vuores
- Getting inspiration to involve in Vuores' stormwater solutions

Walking outside and having fun

Other: _____

What can be better next time?

More introduction and getting to know each other

More information about UNaLab plans in Vuores

Other: _____

What is your background(s)?

I live in Vuores

I live outside Vuores

Appendix H – Interview consent sheet and GDPR attachment

The following pages show the information and consent sheet for interviewees that were interviewed outside of events, and the GDPR information attached. The GDPR sheet was also attached to signature lists with disclaimer and consent in the co-creation events. The GDPR attachment was made in collaboration with Tampere UNaLab and UNaLab Headquarters. Both the interview sheet and the GDPR attachment was approved by the UNaLab data manager.



Invitation to Participate in a Research Project at Tampere UNaLab

Processes for Co-Creating Nature Based Solutions and Urban Space in Tampere

Purpose of study

There is a lack of experience and knowledge about co-creation processes in urban development projects where stormwater is to be managed sustainably using Nature Based Solutions (NBS). The goal of this study is to contribute to knowledge in this field.

Participants

Relevant participants are persons involved in or related to the participatory processes of Tampere UNaLab in 2018.

What does it involve to participate in this study?

By participating in this study you agree to one or more interviews with Anine Drageset. You may revise the interview transcriptions afterwards and may stay anonymous if desired.

What happens with the information about you?

All personal data will be treated confidentially. Data is registered with help of voice recording, which will later be deleted.

Voluntary participation

It is voluntary to participate in the study, and you may at any time withdraw your consent without giving a reason. If you withdraw, all information about you will be deleted.

Background and results

The study is performed by Anine Drageset for UNaLab Tampere. Results of the study will be used within Tampere and the UNaLab project, and will be presented in the form of a master thesis submitted at the Norwegian University of Science and Technology. For questions about the study, please contact

Anine Drageset

+358 40 1852498

ext-anine.drageset@vtt.fi

Please find a more detailed description of the register and information concerning the rights of the data subject attached.

Consent to participation in the study

I confirm to have received information about the study and to have read the description of the register and information concerning the rights of the data subject, and I am willing to participate in the study.

Signature of the participant

Date

Name in capital letters

Description of the register and information concerning the rights of the data subject

In accordance with EU General Data Protection Regulation (2016/679) and Finnish Personal Data Act (523/1999).

1. Name of the register

The co-creation process of the European UNaLab project in Tampere 2018

Working title of study: *Co-Creation in Nordic Urban Development Projects Applying Nature-Based Solutions: Experiences from Tampere*

2. Controller, data protection officer and contact person

Controller:

Name: City of Tampere

Address: Aleksis Kiven katu 14-16C, 33101 Tampere, Finland

Data protection officer:

Name: [REDACTED], Data protection officer, City of Tampere

Address: Aleksis Kiven katu 14-16C, 33101 Tampere, Finland

E-mail: [REDACTED]@tampere.fi

Contact person concerning the register:

Name: [REDACTED], Project Manager, Unalab, City of Tampere

Address: Aleksis Kiven katu 14-16C, 33101 Tampere, Finland

E-mail: [REDACTED]@tampere.fi

3. Categories of the personal data

The categories of the personal data that are contained in the register are name, mail, phone number, employer/organization, work address, photos, produced workshop results, voice recordings, comments made in event(s) and/or comments in interviews in relation to event(s).

4. Purposes of the processing and the legal basis for the processing

The personal data is processed for purposes of research and reporting for the European UNaLab project. The research is about co-creation processes in urban development projects where stormwater is to be managed sustainably using nature-based solutions (NBS).

The data is being processed on the basis of the consent of the data subject.

5. Regular sources of information

The information is collected from the data subject and from public sources of information

6. Recipients or categories of recipients of the personal data

The following recipients have access to the personal data: Participant organisations in the UNaLab project, The European Commission, and professionals responsible for reviewing research in relation to publications.

7. Transfer of data outside the European Union or the European Economic Area

The personal data may be transferred outside the European Union and European Economic Area if this is necessary for processing of the personal data due to technical reasons. In such cases, the transfer shall be made in accordance with requirements of the EU General Data Protection Regulation.

8. The existence of automated decision-making, including profiling

NO

9. The period for which the personal data is stored or the criteria used to determine that period

The data is being stored for a period of 5 years, or otherwise the lifetime of the European UNALab project and its disseminations.

10. Principles of protection of the register

Access is limited to employees of the European Commission and relevant employees of the participant organisations of the UNALab project. Other professionals are granted access as necessary only in relation to publication of research.

11. Rights of the data subject

The data subjects have the following rights (as the data is being processed on the basis of the data subject's consent):

Right to withdraw consent

The data subjects have the right to at any time withdraw their consent on which the processing is based on. This shall not affect the lawfulness of processing based on consent before its withdrawal.

Right of access (GDPR Article 15)

The data subjects have the right to obtain from the controller confirmation as to whether or not personal data concerning him or her is being processed and access to his or her personal data and information concerning the processing of his or her personal data (such as purposes of the processing, the categories of the personal data concerned, the recipients or categories of recipient to whom the personal data have been or will be disclosed, envisaged period for which the personal data will be stored or the criteria used to determine that period).

Right to rectification (GDPR Article 16)

The data subjects have the right to obtain from the controller rectification of inaccurate personal data concerning him or her. The data subjects have the right to have incomplete personal data completed.

Right to erasure (GDPR Article 17)

The data subjects have the right to obtain from the controller the erasure of personal data concerning him or her if (i) the personal data is no longer necessary in relation to the purposes for which they were collected or otherwise processed; (ii) the data subject withdraws consent on which the processing is based and where there is no other legal ground for processing; (iii) the personal data have been unlawfully processed; (iv) the personal data have to be erased for compliance with a legal obligation in Union or Finnish law.

Right to restriction of processing (GDPR Article 18)

The data subjects have the right to obtain from the controller restriction of processing where one of the following applies: (i) the accuracy of the personal data is contested by the data subject, for a period enabling the controller to verify the accuracy of the personal data; (ii) the processing is unlawful and the data subject opposes the erasure of the personal data and requests the restriction of the use instead; (iii) the controller no longer needs the personal data for the purposes of the processing but they are required by the data subject for establishment, exercise or defence of legal claims.

Right to data portability (GDPR Article 20)

Where the processing is based on the data subject's consent and carried out by automated means, the data subjects have the right to receive the personal data concerning him or her, which he or she has provided to the controller, in a structured, commonly used and machine-readable format and have the right to transmit those data to another controller without hindrance from the controller to which the personal data have been provided.

Right to lodge a complaint with a supervisory authority

The data subjects have a right to lodge a complaint with a supervisory authority if the data subject considers that the processing of personal data breaches the data subject's rights pursuant to EU General Data Protection Regulation.

Appendix I – Overview of the overall plans before and after the co-creation process in spring 2018

Some changes in the plans may also be result of project management and planning going forward in general alongside the actual co-creation events. The plans beforehand are adapted from the original UNaLab project description in the grant agreement. The plans after are adapted from an Excel table update in an internal mail dated June 21st 2018.

Hiedanranta

Table 10: Tampere UNaLab plans for Hiedanranta before and after the co-creation process in spring 2018

Before	After
Co-created bio-filtration NBS for stormwater management in a park	Co-created biofilter for leakage from contaminated site (area of biofilter 50-100 m ²)
Pilot-scale algae-based system for sustainable water purification and nutrient recovery, in partnership with local university	Pilot-scale algae-based system for sustainable water purification and nutrient recovery, in partnership with local university
Innovation vouchers to enable existing housing companies to work with stakeholders to co-design and co-implement small-scale stormwater management landscaping systems and complementary infrastructure (eg green roofs and walls, rain gardens, rainwater collection systems for non-potable irrigation etc) and/or urban garden areas. (As a part of up-scaling activities)	*(Exchanged with Vuores action:) Implementation of ca 800 m ² green roof to manage water flows (storage) and quality, with particular focus on their performance during cold seasons, suitable growth media, plants (biodiversity) and maintenance needs. Aim is to develop replicable solutions for construction companies.
	Monitoring of NBS performance to treat storm waters (urban runoff, construction phase and polluted waters, emissions to natural water bodies) in Nordic conditions. Six monitoring stations (movable, to be used in both Vuores and Hiedanranta). Water flow, pH, turbidity, temperature, conductivity, nitrate and DOC will be monitored online. Additionally, parameters like micro-plastic litter, medicine

	residues and organic pollutants will be analysed from water samples.
	<p>Additionally:</p> <p>Supporting citizen society role in NBS implementation by organizing workshops for building insect hotels, frames for urban gardening and decks.</p>
	<p>Additionally:</p> <p>Possibly collection of topsoil and/or plant seeds from valuable biodiversity locations before construction phase (bank for later use in the area).</p>

Vuores

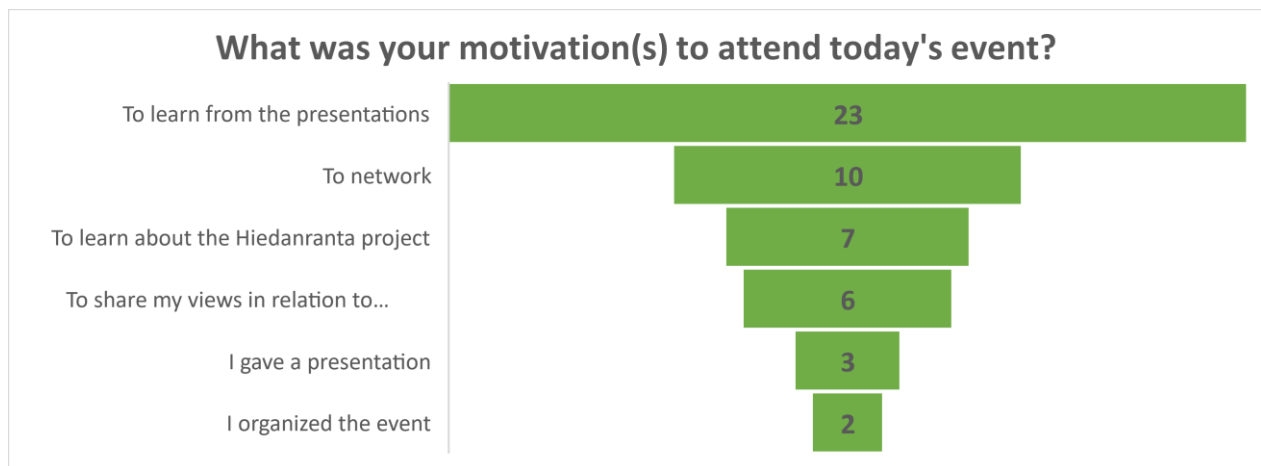
Table 11: Tampere UNaLab plans for Vuores before and after the co-creation process in spring 2018

Before	After
<p>Installation of co-created NBS for stormwater management in Tervaslammen park for control of water flows and water collection in both existing and developing areas (complementary to existing stormwater ponds, swales and retention areas).</p>	<p>*Co-created retention/infiltration basin with alluvial meadows for urban runoff in Tervaslammen Park (area of retention basin and alluvial meadows ca. 700 m²) Biochar and Leca®-gravel will be tested as a part of filtration structures.</p>
<p>Co-created bio-filtration NBS for stormwater management in Virolaisten park</p>	<p>*Virolaisten park co-created biofilter (area of biofilter ca 650 m²). Biochar and Leca®-gravel will be tested as a part of filtration structures.</p>
<p>Implementation of green roofs and/or walls to manage water flows (storage) and quality, with focus on performance during cold seasons.</p>	<p>*(Exchanged with Hiedanranta action:) Innovation vouchers to enable existing housing companies and other communities (ca. 3 sites) to co-design and co-implement small-scale NBS and complementary infrastructure (e.g. green roofs or walls, rain gardens, rainwater collection systems for non-potable irrigation, etc.) and/or urban garden areas. Aim is to enhance social connectivity, biodiversity and stormwater management.</p>
<p>Performance management: development and implementation of maintenance measures, and review and optimization of integrated blue-green-grey stormwater management infrastructure performance.</p>	<p>Monitoring of NBS performance to treat storm waters (urban runoff, construction phase and polluted waters, emissions to natural water bodies) in Nordic conditions. Six monitoring stations (movable, to be used in both Vuores and Hiedanranta). Water flow, pH, turbidity, temperature, conductivity, nitrate and DOC will be monitored online. Additionally, parameters like micro-plastic litter, medicine residues and organic pollutants will be analysed from water samples.</p>
<p>Biofilters and water permeable surfaces (pavements, infiltration swales, raingardens etc) to improve both the connectivity of the urban hydrological regime as well as water quality</p>	<p>[There won't be more biofilters and water permeable surfaces in UNaLab in addition to what has been mentioned above. Instead:] * Floating wetlands to e.g. increase biodiversity and recreational values, provide nesting space for birds and improve water quality. Testing of mycorrhizas as a part of the wetland structure.</p>

<p>Accessible urban spaces for combined recreation, stormwater management, food production and/or biodiversity preservation to enhance urban amenity values and social connectivity.</p>	<p>Improvement of accessibility: Duckboards ca. 600 m to improve citizens accessibility to conservation area.</p> <p>Supporting citizen society role in NBS implementation by organizing workshops for building insect hotels, frames for urban gardening and decks.</p>
	<p>Additionally:</p> <p>Awareness raising and education of citizens including school children about NBS, water quality and biodiversity of NBS. Ca. 25 information signs will be installed to Vuores' NBS. Educating school children to monitor water quality and water insects.</p>

Appendix J – Survey Results H2 Expert Seminar

A paper survey was distributed when participants were returning after lunch for the co-creation workshop. Responses were collected mostly after the workshop, and some at the end of the seminar day. Oral feedback was that the seminar presentations after the workshop were especially interesting and (lærerike), something which is not reflected in the survey due to the timing. However, the results may in addition to the co-creation workshop also reflect experiences of the seminar presentations and seminar discussion that happened before lunch.



Benefits of the event

Open question: What primary benefit(s) did you gain from attending today's event?

Written answers:

Knowledge of NBS

New information on green roofs

Contacts

Networking, influence

Information and discussion about NBS + roof/deck-gardens

Heard about the projects and different points of view

Good ideas for projects (in Turku) which we are developing

Familiarity with topics, engagement and sharing

A multiple-choice section had the following questions with chance to rate from 1 (Not at all) to 7 (Very familiar / Very engaged / As much as I wanted). 19 respondents answered the section.

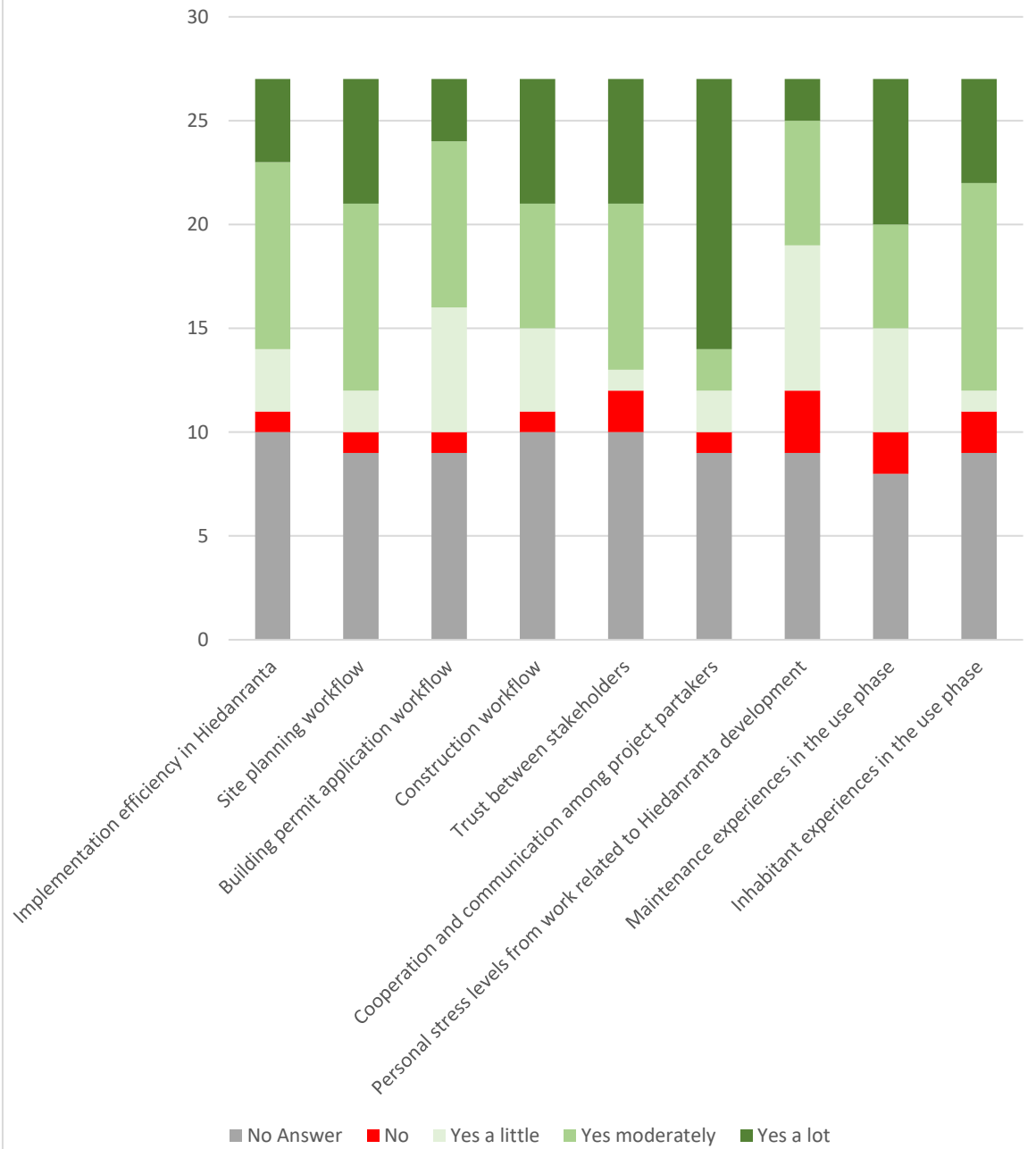
- Prior to today's event, how familiar were you with the topics presented and discussed?
- After today's event, how familiar do you feel with the topics presented and discussed?
- How engaged were you to participate in, contribute to or influence the Hiedanranta project, before you attended today's event?
- How engaged are you to participate in, contribute to, or influence the Hiedanranta project, after today's event?
- To what extent were you able to share your thoughts and opinions during today's workshop session(s)?

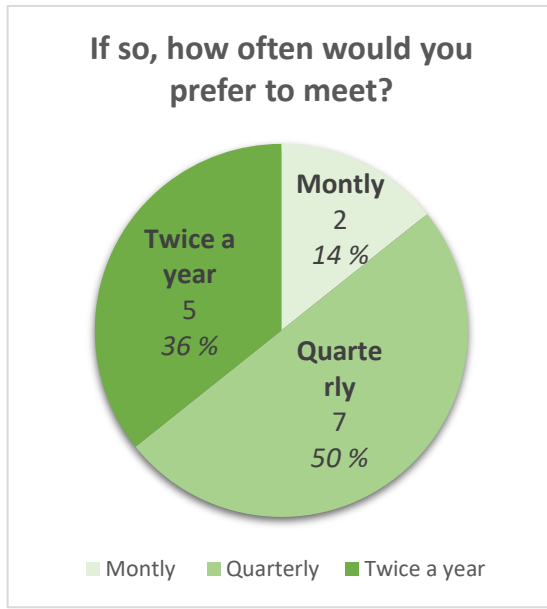
Of the 19 respondents that answered the section, seven (37%) marked familiarity at level 7 prior to the event and after the event. Four respondents (21%) were 6/7 familiar before the event. While two remained at 6/7 after the workshop, one increased to 7 afterwards, while one decreased to 5. This may indicate that all the new knowledge can make one feel less familiar with the topics than one felt before, or it can be a fill out mistake. Of the remaining eight (42%) respondents having prior familiarity of 5 or below, six (75%) reported an increase in familiarity (of 1 level). The familiarity was on average 4 prior to the event, and 4,8 after the workshop.

Regarding engagement in the Hiedanranta project, the response was an average of 3,6 engagement before the event, and 4,1 engagement after the workshop. 5 of the 19 respondents (26%) reported an increase in engagement.

Regarding being able to share thoughts and opinions during the workshop, respondents replied in average 5.2/7 (74%).

Do you think a community of different stakeholders who meets regularly to discuss needs, plans, challenges and other issues concerning the Hiedanranta project would improve any of the following?





*as described in the question above

(one person answered both monthly and quarterly)

Background of the people who answered Yes:

Architect, urban planner, landscape architect/ - designer	4
Technical consultant	2
Tampere municipality	2
Construction company	1
Maintenance	1
University Staff	1
Gardener	1
Nature Surveyor	1
Biochar producer	1

(one person crossed out two backgrounds)

Appendix K – Survey Results H3 Walk Tour

Survey respondents' motivation, background, outcomes and hopes

A paper survey was distributed after the walk tour. Of the 11 respondents 3 were supporting the organizers by representing their work organization, and the remaining eight were participants. In text answers, answers from organizing support are marked with (OS) in the end of the sentence. The order of the text answers are different for each table to support confidentiality.

Table 12: Respondents' topics of interest and motivation to come

Main topics of interest	What was your motivation to come?
Milieu and old buildings	To get a possibility to have an impact and be a part of the development process
Urban nature/outdoor activities	Interest towards old cultural and industrial area
Nature values and objects	New city culture is interesting
Parks	I live close and I'm interested in how the area is developing
Future plan of area	Interesting to see what is the plan for near future
Urban nature	To hear how (wild) nature will be included in the area
Stormwater, nature	Research, activism
	I'm at work (internship)
	I'm interested in all that happens in Hiedanranta :) (OS)
Ecology; Nature x Land use	As an expert to give advice on Ecology (OS)
Stormwater	Occupational, stormwater management, public opinion gathering (OS)

Use of Hiedanranta area

One free time, once per month

Walking, coffee shop

Walking, events in Kuivaamo ("drying house), skateboarding

Son does skateboarding

Music and art happenings in the summertime

Once (midsummer 2017)

Visit, tourism, research

How were you invited?

Hiedanranta Fb

Facebook

Tampereläinen magazine

Ad in a newspaper

[In the information event in Lielähtikeskus today]

In the event in Lielähtikeskus today

[Through work]

By a friend

Answers to multiple choice questions with rate from 1 to 7

Among the 8 participants, two reported to have a high familiarity with the topics presented and discussed already before the event (6/7), which they marked as unchanged (6/7) after the event. The remaining six participants saw an increase in familiarity with the topics, from an average of 4/7 before the event to 5.7/7 after the event, (tilsvarende) an average reported increase in familiarity of 42%. For all the eight participants, the average reported increase in familiarity was 28%.

The eight participants' engagement to participate in, contribute to or influence the Hiedanranta project was on average 4.3 before the event and 4.9 after the event, an increase of 14.7 %

When asked to what extent they were able to share their thoughts and opinions during the event, there was one clear outlier. Among the remaining seven participant respondents the average was 6.3 of 7, corresponding to 90%. The outlier replied 1 of 7. An explanation may be that the participant came late and missed the thorough introduction round where everybody said their name, background, motivations and wishes for the event. Thereby the participant missed the initial social establishment of the group, which in combination with personality might have led to a lack of feeling welcome to share thoughts and opinions. However this is hard to know.

Answers to text questions

A various number of the respondents left various of the text questions blank.

How did you experience the walk tour?

Quite fine. Interesting discussions.

Very good and interesting

Interesting and informal

It was OK

interesting!

What was good?

The experts

Questions and answers

Explanation in different places

It was nice to see the places and hear the plans

New information of the plans

New things for me like wetlands

Overall a good idea

Good to network (OS)

People shared opinions (OS)

How did you experience the organizing of the overall event and process this far?

The joint introduction of the group was good

It's ok

Good

What was good?

Easy to come, and an experience that you are listened

Informative

It was a good idea to walk around together (OS)

Participants were open and involved (OS)

What do you hope for from the overall participatory process around Hiedanranta?

More events like this :)

New walking tours while the area develops

Maybe a new walking tour later

Events, garden experiences and outdoor activities

That the input of non professionals will truly influence the design of the area

That citizens' opinions are taken seriously

Better information before. Today I got information in Lielahikeskus

Already quite good ideas have been in the project

* To get experience myself

* To improve the role of Ecology and multifunctionality of UNBS (OS)

Active citizens, who dare to share their opinions (OS)

What do you hope for from communication from/with Tampere UNaLab onwards?

Web-page, fb-group [gives personal mail adress]

It is good to be shown in the typical media

Similar activities like today yearly

To be present in important city venues [two unreadable words] (OS)

Appendix L – Survey Results V3 Nature Trail

A brief multiple-choice feedback survey was answered by 8 of the 11 participants. The respondents replied that their main outcome(s) of the nature-trail event was i) Learning about nature (7 respondents, 88%), ii) Learning about the stormwater solutions (5 respondents, 63%) and iii) walking outside and having fun (5 respondents, 63%). Six of the respondents (75%) were from Vuores and two (25%) were from outside of Vuores.

