Opening-up the Sustainable City

TOWARDS AN OPEN INNOVATION FRAMEWORK FOR FUTURE LOW CARBON CITIES

Majken K. Overgaard
Olli Voutilainen
Marcel Bogers
Thomas William Dale
Peter Normann Vangsbo

eit Climate-KIC

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Cities around the world are investing more in partnership development and expanding their search for sustainable solutions that can tackle phenomena such as climate change and other complex societal challenges. In doing this, these cities are functioning as platforms for Open Innovation processes and creating value for both participating stakeholders and the city itself. This white paper explores the current barriers and potential solutions across a number of selected Open Innovation initiatives in order to provide key learnings for cities that face similar challenges.

The broad, complex and systemic nature of climate change means that a multi-actor setup is required in order to adequately develop, test and implement new solutions. The characteristics of a city and its "innovation ecosystem" means that the city can increasingly function as an innovation platform in which different actors – universities, start-ups, SME's etc. – can be brought together through a framework entailing the principles of Open Innovation. In such an ecosystem, the shared goal between actors is to develop new products and services for use within the city that, amongst other things, create a positive climate impact. As part of the process, the city and its infrastructure is made available for the testing and implementation of solutions which, in itself, can lead to further co-benefits such as growth and job creation and thus implies an important value-adding interaction between the participants and growth creation.

The investigation presented here focuses on input sourced from a number of participants involved in past and present Open Innovation processes in order to document and describe their key learnings and observations. To analyse and simplify their experiences, we used a process model that is derived from the existing literature on Open Innovation as our framework. We adapted the process model framework proposed by West and Bogers (2014) to investigate a process of (1) obtaining, (2) integrating, and (3) implementing solutions on a city scale; as a research and innovation framework to guide our data collection and analysis. From this, we uncover barriers, potential solutions and best practices that will provide other cities with learnings. This white paper is designed to provide a snapshot of the ongoing development of the city's innovative ecosystem. Using a few selected cases, we outline how cities are emerging as Open Innovation platforms while they pursue new solutions for a sustainable future.

About Climate-KIC

Climate-KIC Nordic is the initiator of this white paper and is part of the world's leading public-private partnership addressing climate change mitigation and adaptation through innovation.

It is one of six Knowledge and Innovation Communities (KICs), supported by the European Institute of Innovation and Technology (EIT) that provides a unique model of innovation to address key societal challenges, benefit the economy, create new jobs and enhance the entrepreneurial culture of Europe. Climate-KIC's mission is to bring together, inspire and empower a dynamic community to build a zero-carbon economy and climate resilient society.

Climate-KIC is an innovation engine focused on bringing climate and sustainable innovation to market. It primarily focuses on the systems of and the systemic approaches to innovation.

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Thus, we not only need new technologies, but also new business models, legal frameworks, social practices and cross-sectoral thinking. Key to our systemic approach towards innovation is our partner network, which is a diverse set of

first-rate knowledge institutions, leading corporations, SMEs and ambitious actors from the public sector. Climate-KIC bring this community together to create a strong supply of new ideas and transform the way we tackle climate change.

Why Open Innovation is important?

Open Innovation has become a major phenomenon in facilitating innovations and accelerating and enhancing the innovation process. The use of external knowledge, user-driven innovations, networks and even entire ecosystems composed of different actors jointly contributing to new solutions is now a mainstreamed way of facilitating innovation (Adner, 2006; Bogers et al., 2016; West et al., 2014). This shift in innovation practices is underlined by the fact that an increasing share of innovations are presently created in a process in which using, doing and interacting is a fundamental approach. This approach, it appears, is replacing more traditional innovation processes driven by

the push of science and technology (Lundvall, 2007; Harmaakorpi & Melkas, 2012).

External information and knowledge is widely used among enterprises across the EU. According to the Community Innovation Survey (2015), the most common external sources of information for innovative enterprises were suppliers which 80% of enterprises utilized, and customers or clients from the private sector which 72% of enterprises utilized. In comparison, 38% used information from universities.

Open Innovation is not only important to the companies and their networks but equally valuable to the public sector, and cities in particular. Long-term observations show that there has been an increase in interaction and dialogue between the public sector and other stakeholders – including citizens, enterprises and knowledge institutions. Open Innovation represents a continuation of this trend, creating an opportunity for a city to innovate and design services as well

as carry out its economic development policy in a new way (e.g. Raunio et al., 2016).

When raising the level of analysis, cities are among the most important public actors in terms of Open Innovation, and many cities have begun to utilize external knowledge (cf. Chesbrough & Bogers, 2014; Almirall & al., 2014). Cities define the public demand for new solutions by identifying different societal challenges. Like consumers or companies, cities are also important users of innovation (Hautamäki & Oksanen, 2016) and therefore, they have significant sway in pushing for the development of certain types of innovations; whether they are green solutions, improved ways of producing welfare services or new technologies. Furthermore, the city represents a practical unit for working with Open Innovation as it is an environment that is bound to a specific place and contains concrete issues. Cities also, to large extent, have a need for external knowledge. It is often the case that the city hall and the city

offices do not capture the newest knowledge in their daily work and hence, collaborating openly with external partners represents a highly valuable activity for cities.

Cities and their Open Innovation ecosystems

Cities are often home to dynamic innovation ecosystems in which innovations emerge through collaboration between different actors. Innovation ecosystems typically consist of top-level universities, research institutions, sufficient financing, a sizeable local market, skilled labour, specialisation and co-operation among companies as well as connections to a global networks. In local ecosystems, people and their networks are usually the primary source of innovation whilst, the municipalities and cities play a significant role in development and facilitation of innovation activities (Hautamäki & Oksanen 2015).

Open Innovation practices infer that organisations should ascertain internal ideas, external ideas and spill-over knowledge by working with

– and not limited to – customers, users and citizens when creating or improving products and services. This collaboration is characterised by the cross-fertilisation of knowledge from stakeholders with different backgrounds (Leminen & Westerlund, 2016). Almirall & al. (2014) suggest that, when conducted in cities, Open Innovation should be centred around the ability to organize all relevant sources of innovation, which includes both players in the competitive market (i.e. companies) and collaborative communities (i.e. citizens and developers). This set-up, known as the integrated ecosystem approach to Open Innovation, aims to take into account the diversity of the actors involved and their differing motivations, skills and competencies.

Why do we need to implement sustainable solutions in the urban environment?

Despite their huge potential for prosperity, cities of all shapes and sizes harbour a variety of deeply engrained and often widespread societal problems. Issues with the urban environment can vary in terms of significance and complexity

however, those challenges that are particularly complex and multi-faceted have become known as "wicked problems". Wicked problems typically are not easily fixable and thus, require creative solutions to rectify. These issues occur across many areas of society but are particularly prevalent in the field of sustainable development.

Wicked problems call for solutions that account for the systemic cause of the issue. These solutions can be referred to as sustainable innovations (Hautamäki & Oksanen, 2015) and may vary in scale from small improvements in everyday life to large systemic interventions (Leminen & Westerlund, 2015). The demand for sustainable innovations further highlights the need for problems solvers to obtain new capabilities, which is often most efficiently done through participating in collective action. Moreover, it has been noted that the best solutions actually appear to be created within problem-solving networks; further emphasizing the benefits to using an inclusive approach to innovation (Hautamäki & Oksanen, 2015).

Climate change represents a typical example of a wicked problem (Hautamäki & Oksanen, 2015). The phenomenon is a systematic and complex problem with innumerable cause-impact relationships. Solving climate change will require an expansive multi-actor setup in order to adequately approach the challenges it presents. This setup however, needs to operate on a city scale as well as the more visible international level efforts. Establishing a multi-actor setup within a city requires one to take a step back and analyse the city on a systemic level (Hautamäki & Oksanen, 2015). In doing this, one will recognise that initiating climate action is neither the sole responsibility of the public sector, or the private sector.

Open Innovation as an enabler of sustainable cities

Cities represent key players in sustainable innovation developments which either mitigate or adapt to climate change. The urban environment provides a variety of possibilities to mitigate – and adapt to – climate change and thus the it represents a fruitful soil for exploring the potential of the climate innovations. The qualities of the urban environment's innovation ecosystem means that it favours sourcing and developing solutions in an open manner. Furthermore, doing so openly can create particular benefits

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for cities, whilst following the closed innovation model can bring critical constraints to the process and lead to unsatisfactory results.

A city's innovation system is affected by values of the host society in question. Globally, climate change is a burning issue which, in general, is of great interest to the public. In parallel, it is often suggested that all individuals should have the opportunity to participate in creative solutions to the challenges they see as important (Hautamäki & Oksanen 2015). In fact, citizens, as a group, display great willingness to bring forward their ideas for carbon friendly inventions and therefore can – and should – be seen as an underexploited potential in the collaborative creation of climate solutions. A city therefore, that utilizes the power of crowdsourcing ideas will stand to benefit.

Open Innovation inarguably has the potential to accelerate a city's transition to total sustainability. Due to the complex nature of the climate problem, climate solutions represent an area of

innovation in which there is remarkable value to be gained from establishing synergies and collaboration between stakeholders. If shared ideation is based on a real and persistent problem it is more likely lead to successful product (Hautamäki & Oksanen, 2015) and one can paint a more comprehensive and detailed picture of the problems and needs that require addressing through the establishment of links between city administrators, solution providers and academia. Furthermore, establishing links between the city and entrepreneurs, on top of the more typical solution providers i.e. established companies, can bring new viewpoints, experiences and competencies to the shared ideation process, creating potential to further improve the results. In summary, cities, companies and citizens all represent a critical part of the solution and thus, interaction between the players adds value by creating better innovation outcomes.

Benefits of Open Innovation identified from the city's – and the public sector's – perspective are cost-reduction, greater citizen involvement and improved services (Almirall & al., 2014). Furthermore, it can increase the speed at which solutions with a positive climate impact reach the market, access wider sections of the market and do so more efficiently than would otherwise be possible. Furthermore, cities and their networks showing the way as forerunners can start

... cities and their networks are showing the way as forerunners and this can start a snowball effect and lead to wider use of Open Innovation.

a snowball effect and lead to wider use of Open Innovation and create a more remarkable global impact in city sustainability.

The described trend and perceived potential value of Open Innovation can be seen in the appearance of many kinds of novel ways of

increasing and enhancing collaborative innovation in cities, particularly those focussing on creating and improving climate solutions. An increased number of front-runner innovation initiatives based on this thinking, such as those run by Climate-KIC, highlight this development.

Open Innovation as a framework

At its core, Open Innovation describes "a distributed innovation process based on purposively managed knowledge flows across organizational boundaries" (Chesbrough & Bogers, 2014: 17). These knowledge flows are governed through particular mechanisms, depending on the objectives and stakeholders, with the ultimate aim to create and capture value for those involved. While Open Innovation has emerged—since the term was coined by Chesbrough (2003)—as an organizational level concept, there is increasing recognition that it has important implications across various levels of analysis (Bogers et al., 2016).

Looked from a city perspective, Open Innovation is much about the interface between the city as an organisation and other stakeholders. Openness of innovation is closely linked to the interaction between these players. The way and pace in which cities have traditionally operated may remarkably differ from the one that innovation requires (e.g. Almirall & al., 2014). Transformed and more active relation of a city to its partners and increased participation of the residents in service development is a shift that has been called "new public governance" (e.g. Laitinen et al., 2013). Moreover, as mentioned earlier, citizens have the right and the opportunity to be creative and to contribute to improvements in services, products and the

structure of public organisations like municipalities (Hautamäki & Oksanen 2015).

Open Innovation and open ways of doing things are taking remarkable steps due to a few greater paradigm shifts. Digitalisation and business models enabled by the internet have built a new ground for the transaction of products and services but also new tools for co-creation on innovations. Digital technology is, however, not sufficient alone but it has been essentially supported by a parallel change in culture. Sharing economy and collaborative consumption point out the sustainable lifestyles and has increased the potential of using digital platforms. Another cultural change is start-up culture which is turning business models increasingly to community-based. This in all reinforces the open way of making innovation (see Raunio et al., 2016).

A city can be increasingly seen as an innovation platform. In this idea, instead of the starting point for innovation being business-led interests, it is actually the city and its demand for new kind of solutions the determines when and why innovation begins. Innovation platform can be physical or digital place. By definition, innovation platforms in a city context are "any kind of operating environment in the city in which content development or production has been systematically opened to external partners and value creation, with a focus on mutual benefits for the partners" (Raunio et al., 2016). In practice the platform can be a city district, a single public service or a group of actors.

The participants of the innovation platforms are small entrepreneurs and individuals rather than established companies. An innovation platform typically leaves room for experimentation and agile short-span projects rather than heavy research programmes led by major companies. The concept of innovation platform not only highlights Open Innovation but also illustrates the shift from triple-helix innovation model to quadruple-helix. Whereas triple-helix model consisted of city, businesses and knowledge institutions as main co-operators for innovation,

the quadruple-helix points out that equally important are the citizens and users as drivers for innovation (Arnkil et al., 2010).

As described, Open Innovation is to a great extent dependent on the purposeful interaction of the different parties. Stakeholders are diverse and can be grouped into seekers, solution providers and supporting actors (Almirall & al., 2014). There is a variety of ways to put innovation in action between these players. In many of these cases the key of innovating is collaborative ideation in different stages of innovation process.

The process of leveraging external sources of knowledge consists of several phases, such as 1) obtaining, 2) integrating and 3) commercializing, while there is also recognition of the interaction mechanisms that take place across these phases (West & Bogers, 2014). In the city context, such a framework implies a series of activities and capabilities that will allow relevant stakeholders to obtain, integrate and implement external knowledge as a basis for further interaction.

West and Bogers (2014) state that while obtaining could refer to a variety of mechanisms, like scouting, crowdsourcing, platforms, intermediaries (as supported by the literature), the next steps of actually integrating and implementing are at least as important as they will determine the ultimate success of the Open Innovation activity. However, many challenges have been identified in the literature, such as a lack of absorptive capacity[1] , a "Not-Invented-Here"

culture[2] , and a lack of the right commercialization capabilities or business model in general. At the same time, this process model is not purely a linear one but also entails recursive path and interactive processes more general.

Hautamäki and Oksanen (2015) find that sustainable innovation goes even beyond the implementation. Their division of the innovation process is comparable to the West and Bogers, when it identifies the stages of idea, invention and implementation. The additional fourth stage is called the impact of innovations. Impact of innovations is the stage in which innovation cre-

Open Innovation is to a great extent dependent on the purposeful interaction of the different parties.

ates new practices and leads to changes in the structures of organisations and in the actions of people.

Cities have a rich experience on ways of interaction in Open Innovation. Widely used examples of enhanced interaction are co-creation, living labs and crowdsourcing. In addition, Almirall & al. (2014) identifies embedded change agents, civic accelerators and use of open data as approaches for interaction.

Co-creation is in general about setting the problems and solving them together with the customer, company or other stakeholder. Value creation in co-creation is expected to increase thanks to the interaction between the city and

[1] Absorptive capacity has been defined as "a firm's ability to recognize the value of new information, assimilate it, and apply it to commercial ends". It has been said that in order to be innovative an organization should develop its absorptive capacity (Cohen and Levinthal, 1990).

[2] Not invented here is a stance adopted by social, corporate, or institutional cultures that avoid using or buying already existing products, research, standards, or knowledge because of their external origins and costs, such as royalties. The root causes are numerous, but often it is found that people don't trust or value what they don't create themselves. They either don't' understand it, feel threatened by it, or worse, simply view it as part of a knowledge turf war in which someone else's success detracts from theirs (Webb, 2010).

the other parties. In practice, co-creation takes place e.g. in demonstration factories which aim at solving the given problems in a co-creative manner. Co-creation takes also place in different kind of innovation contests, hackathons and innovation camps (Raunio et al., 2016).

Living labs are environments in which a product or a service can be tested – in quadruple-helix partnership – in a real-life context (Leminen and Westerlund, 2016). Users are closely engaged with the testing. Living labs are increasingly used in cities and they offer a way for a city, enterprises and citizens to work together in order to create not only new services but new business ideas and technologies. Example in practice is the new type of urban mobility services which are tested with limited and selected customers before launching the service.

Crowdsourcing is about asking the advice not only from small number of customers but gathering ideas from a large number of people. These participants may not be specialized to the problem to be solved but they might have a personal interest to the topic. Practical examples are digital forums for citizens which a city

can utilize e.g. in urban planning or a company can benefit in the commercialization of a given product (Almirall et al., 2014; Raunio et al., 2016).

Embedded change agents are operators who aim at close the gap between cities and citizens. The change agents work for a fixed period e.g. to develop applications (typically digital) and bring innovation to city government. Civic accelerators match cities with start-ups, private firms and non-profit organisations in order to change the way citizens interact with city hall (Almirall et. al., 2014).

To sum up, there is no single strategy or way of facilitating the interaction in Open Innovation – instead, there is a variety of methods for organizing the external actors (Almirall et. al., 2014). Means of making the Open Innovation happen are themselves under experimentation. On a positive note, this leaves room to innovate and tailor these methods further. However, it underlines the new and partly unknown character of Open Innovation and sometimes makes cities, companies or other players uncertain which approaches to choose.

Methodology

Since its founding, Climate-KIC as an organisation has worked to develop Open Innovation initiatives across Europe. This paper presents current findings from its activities across its expansive European network.

The chosen approach is a combination of observations and interviews. The purpose is to be able to both study and produce a theoretical framework by observing the existing practice regarding the current development of Open Innovation initiatives, while being able

Our methodology is focused on retrieving data from multiple partners with the intention of understanding the interplay between these actors.

to transform this practice, pinpoint potential barriers and design new future solutions and frameworks based on the ongoing learning and engagement of the participants.

Building the data collection and analysis on general case study methodology (Yin, 2014), we conducted semi-structured qualitative interviews with actors from the quadruple helix, made up of representatives from government, industry and academia and citizens. We interviewed representatives from local communities; the local ecosystem, from start-ups to SMEs to larger companies; academia; municipalities; and

other representatives from the public sector. Our methodology is focused on retrieving data from multiple partners with the intention of understanding the interplay between these actors. This is also done to highlight the importance of working with multiple stakeholders when working with Open Innovation. We aim to understand both what has been performed, what type of tools and methodologies are been applied and more importantly what the key learnings from the various stakeholders have been. As a framework, we used a process model that we derived from the existing literature on Open Innovation. That is, following and adapting the process model framework as proposed by West and Bogers (2014), we used a process of (1) obtaining, (2) integrating, and (3) implementing solutions on a city scale as a research framework to guide our data collection and analysis.
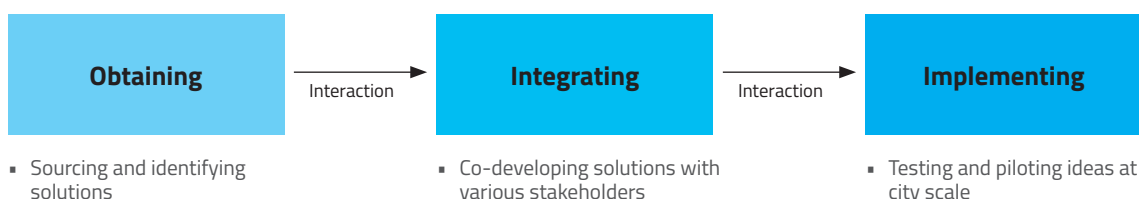
By using observations and interviews as data sources, we were able to follow dynamic situations and social relations between actors.

We observed existing practice and applied a participatory research design to provide participants with the possibility to interpret, react to and elaborate upon the ideas as they emerge. We believe that by providing observations, qualitative interviews and analysis it is possible to provide a transformative tool for continuing to use Open Innovation in cities working to provide new climate solutions.

The focus in the interviews was to analyse different Open Innovation processes that have taken place within recent years. We had a focus on covering the innovation processes from which ideas were obtained, integrated and finally to implemented into the infrastructure of a city. Thus, the cases described in the following section were chosen to cover these different parts of the Open Innovation process and analysed in the light of what value it provides for the participants. Furthermore, the cases are analysed in the light of what successes, barriers and possibilities they provide.

Obtaining	Interaction →	**Integrating**	Interaction →	**Implementing**
▪ Sourcing and identifying solutions		▪ Co-developing solutions with various stakeholders		▪ Testing and piloting ideas at city scale

Open Innovation framework, adapted from West and Bogers (2014)

THE COMPLEXITY OF A MULTIFACETED CHALLENGE

Cases

The case descriptions are an analysis of the interviews and observations performed in this study. They are intended to provide a thorough understanding of how the Open Innovation process is being used in cities across Europe and how it is able to provide value to its stakeholders.

The definition of value is not necessarily the same between actors and their perception of such is very much dependent on the nature of the stakeholder. We intend to use the cases to outline how a city can capture value from Open Innovation events, how such events are organised in order to attract the desired partners and participants, and how an organisational set-up is created through which it is possible to implement the outcomes of the Open Innovation process. Answering these questions requires in depth knowledge of greater picture – namely the solutions required, the potential partners and the city itself. In addition to the event level analysis, we take a step back to investigate whether changes to the "business model" of the city can facilitate a greater utilization of the Open Innovation concept.

When viewing the cases it is also important to consider what the prerequisites are which qualify an Open Innovation process as a success. Is it the procurement of a finished product? An inspiring event has been conducted? Is it when a municipality has engaged in dialogue with its citizens? Or when a company has been created. The expectations and understanding on what constitutes a success can come in many forms. In this same vein, the idea of potential failures and barriers can also differ depending on the viewpoint. In many cases the understanding and alignment of the many potential interests present is the key to an Open Innovation process. Therefore, in the following cases we will provide an overview of experiences and key learnings from a number of case studies.

Climate solutions for Copenhagen

Crowdsourcing solutions across borders

START DATE	2015
LOCATION	Copenhagen, Denmark
THEME	Urban Transitions
LEAD CONTACT	Per Boesgaard, Coordinator of Partnerships and Innovation, City of Copenhagen
STAKEHOLDERS	Private & Public

Case Study Overview

In 2015, Climate-KIC Nordic and the City of Copenhagen initiated an Open Innovation Call, 'Climate Solutions for Copenhagen' with the intention of providing the city with new sustainable solutions to tackle environmental problems such as flood prevention, encouraging energy efficient buildings, smart city solutions and the mitigating the urban heat island effect[1]. At the Open Innovation Call the best proposals were selected, and participants asked to pitch to City Officials who then shortlisted the proposals they wanted to support. Climate-KIC played a key role in the process, by drawing on its large European network to identify relevant solutions from across the continent and connecting them to stakeholders who could either utilise or develop them (e.g., cities or businesses). The 'Climate Solutions for Copenhagen' call was

deemed a success and the experiences gained from the event are now being used to implement a similar process in the Swedish cities of Gothenburg and Malmo.

This case study highlights how 'Climate Solutions for Copenhagen' enabled stakeholders to source and co-develop sustainable solutions for the city. Building on this, the case study then elaborates further the benefits of the Open Innovation process for city officials looking for new ideas, as well as for SMEs, who can gain access to decision makers and communicate their sustainability solutions for the city.

Obtaining: Using the European Network to crowdsource solutions

The impetus for the Open Innovation Call in Copenhagen was the publication of the municipality's new climate strategy, the 'Copenhagen

[1] Open Innovation Call for the City of Copenhagen, Climate-KIC website: www.climate-kic.org/events/open-innovation-call-for-the-city-of-copenhagen/ – Accessed 2nd Dec 2017

Climate Plan 2025' which announced that the city would be carbon neutral by 2025. Beyond this headline policy, the plan focused on: developing smart city design; energy optimisation of buildings; flood protection, and, storm water management as key areas of concern. Based on these focus areas, Climate-KIC Nordic and the City of Copenhagen produced a list of the sustainability challenges to be targeted through 'Climate Solutions for Copenhagen'. Once refined, these challenges developed into an open call for suitable solutions, sent out across Climate-KIC's European-wide network. The objective was to find the best and most suitable solutions for Copenhagen readily available at a planning and project level. Thus, in order to facilitate the right type of solutions, Climate-KIC and the City of Copenhagen put a lot of effort into specifying the challenges in as much detail as possible, in order to ensure relevance for both the city and the solution providers.

Through the open call, 'Climate Solutions for Copenhagen' received 57 applications originating from 12 different countries. Of the 57 solution providers, approximately 50% were businesses (e.g., SMEs), 25% were larger companies and the remaining 25% were researchers. From the initial 57, 15 of the strongest proposals were shortlisted and proposers invited to Copenhagen on 2nd October 2015 to pitch their ideas. Upon arrival, each 'finalist' received pitch training. The judging panel consisted of a politician, a municipal decision-maker, a business developer and a project manager from Climate-KIC Nordic. The audience consisted of approximately 100 invited guests from investment companies, the municipality and local organisations that work within sustainable solution development.

Unlike standard pitch competitions, 'Climate Solutions for Copenhagen' was not designed to announce winners or give out awards. The participants pitched to be part of a continuing collaboration with the City of Copenhagen, as well as investors who were interested in the

Ultimately, the Open Innovation event was designed to provide all parties with a meaningful match, the solution providers with a new customer and the city with a solution

solutions. The Open Innovation pitching event provided all parties with a meaningful match: Solution providers matched with customers and the municipality matched with solutions.

Integrating: Adapting the innovative solutions

Specifying the challenges was pivotal for the next stage of the Open Innovation Call and was evident in the fact that 14 out of the original 15 'finalists' who pitched in October 2015, were given the green light to continue collaborating with the municipality. Following the selection of the finalists, the next step was to integrate the solutions into the municipality's plan. Due to the municipality's complex technical systems and infrastructure developments, integration took longer than anticipated. Initial technical due diligence discovered that three of the participant's presented technologies which were incompatible with Copenhagen's pre-existing technical infrastructure and these could not continue beyond this stage.

Preliminary studies discovered that some of the technical solutions proposed could potentially work together – the solution providers decided to merge both of their ideas into one product,

the 'Green Energy Package'. Both solution providers now run a join venture selling this package which is currently being developed in collaboration with the City of Copenhagen and Climate-KIC Nordic who are offering support to refine the package, identify suitable test sites and assist in linking the SME with investors.

Implementing: Bridging the gap between cities and ideas

To date, none of the solutions have been fully implemented. This represents a key learning point in the open innovation process: the implementation of sustainability solutions into a city takes time – it is a long-term objective, regardless of whether parties are working towards the same goal. This reality can be challenging for participants, such as start-ups, who are frequently dependent on generating cash flow in the short term. Furthermore, it is evident from

the call 'Climate Solutions for Copenhagen' that within large groups of stakeholders (each with their inherent organisational interests) good project management and continued follow-up is essential for the Open Innovation process to work effectively. Often this requires facilitators who can manage the process and maintain interest in the challenge.

Gaining political support, and the provision of adequate resources, are also necessities for bridging the gap between the integration and implementation stages of the Open Innovation Call. Copenhagen offered a unique learning experience and as a result, Climate-KIC Nordic is now working with the City of Gothenburg to ensure that the municipality's complex technical systems, and infrastructure developments, are prepared to incorporate the selected solutions. This is to enable solutions providers to implement their ideas in the short term, with the necessary financial and political commitment required.

Case Study Summary

The Open Innovation Call, 'Climate Solutions for Copenhagen' enabled the municipality to engage with international stakeholders (businesses, large corporates, researchers, etc.) to design and implement sustainability solutions in the city region. Although the process is still ongoing, they are key learning points to take away, that could potentially enhance Open Innovation Calls in other cities across Europe.
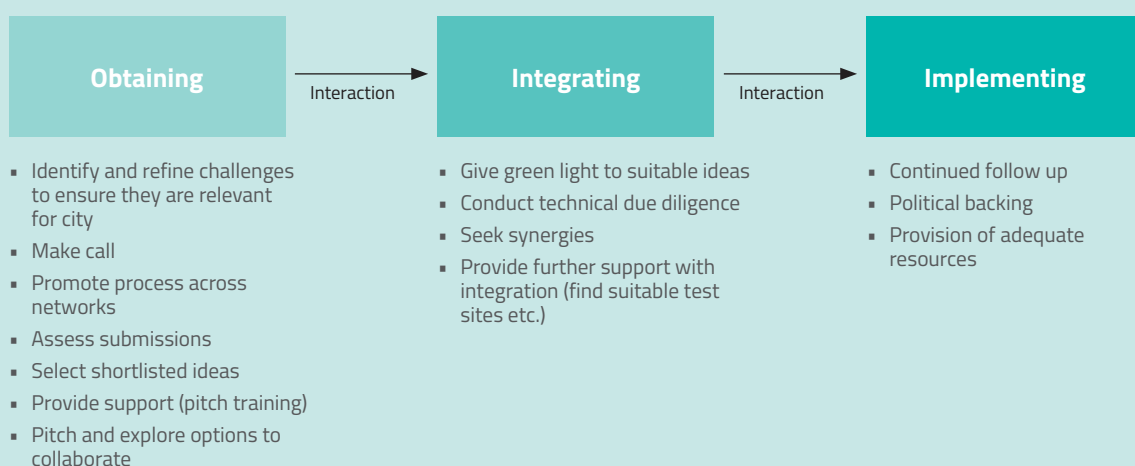
Challenges:

A number of key challenges (as well as opportunities) were identified. These are: to work with the municipality and ensure that both technical systems and infrastructure developments are compatible with sustainability solutions; to ensure the challenge has a clear vision and specification; that facilitators are required to match make and stimulate interest in the project; and, that good project management is essential for the Open Innovation Process to work effectively.

Results:

Although none of the solutions has been implemented, the process resulted in:

- Over 57 applications originating from 12 different countries

- 14 out of the original 15 'finalists' who pitched on 2nd October 2015, were given the green light to continue collaborating with the municipality.

- A joint venture has been established offering a 'Green Energy Package.'

- The municipality identified the need to update technical systems and infrastructure developments

- Climate-KIC Nordic learnt from the process, changing the Open Innovation Call in other European cities.

Obtaining		Integrating		Implementing
	Interaction		Interaction	

Obtaining
- Identify and refine challenges to ensure they are relevant for city
- Make call
- Promote process across networks
- Assess submissions
- Select shortlisted ideas
- Provide support (pitch training)
- Pitch and explore options to collaborate

Integrating
- Give green light to suitable ideas
- Conduct technical due diligence
- Seek synergies
- Provide further support with integration (find suitable test sites etc.)

Implementing
- Continued follow up
- Political backing
- Provision of adequate resources

A System is Changing:
From Administrators to Facilitators

By elaborating on the City of Copenhagen's experience of the Open Innovation Call, it is possible to highlight the municipality's key learning points as a result of hosting the event, as well as exploring the challenges faced by the organisers, Climate-KIC Nordic, during the process. This has been achieved by drawing on the municipality's experience first-hand, in particular the experiences of Per Boesgaard, Coordinator of Partnerships & Innovations, Climate Unit, City of Copenhagen.

Obtaining the Concept – include your colleagues, all of your colleagues

When asked why the City of Copenhagen joined the project Per Boesgaard explained: *"Being part of Open Innovation processes is important and inevitable for cities today. The technical development is moving very fast and as a municipality we have the possibility and responsibility to actually create real change and co-develop green solutions in close collaboration with start-ups and universities and our citizens. This is recognised and prioritised in Copenhagen. The challenge from inside the municipality has been to identify all the right people in the various departments and get them involved. When you are working to develop and implement new infrastructure solutions it usually doesn't only affect one person in one department, it will interfere with many different departments across the structure in the organisation. This was a rather big challenge and next time we are going to do this, which we are, we need to get everybody on board and make sure they have time to help the projects become a reality, before we even start the development!*

We need to be able to create an ownership to the ideas, before they are presented".

Per continues, *"When we initiated this ambitious collaboration, it was a challenge to make people understand the process, because everything was so new, I was also lacking a set-up and a way to describe how we could work together and how this could help our development as a city."*

In other words, it is necessary to encourage buy-in from all departments within the municipality to ensure that solution providers are given appropriate support to develop their idea into a product or service.

Integrating the Concept – create a sense of ownership

Per reflects on the timescales for the Open Innovation Call and the need to shorten these if they are to encourage start-ups and SMEs to develop sustainability solutions for Copenhagen.

"In order to get the municipality to move in the same direction we need to have everyone on board. All employees must have ownership of the project, if we are going to be able to implement the solutions. And even though Copenhagen is a large city there is a restriction as to how many solutions we're actually able to work with. In this project, we went from 57 to 15 to 14 solutions. In the future, when we were considering the solutions we need to be even more focused on what is realisable and when can it be realised …

In the current project, we managed to create a flow from obtaining the solutions to the development of

various integration scenarios. It did however take almost a year, which can be a difficult timeframe for especially smaller companies and start-ups. This is however, a very typical timeframe for a municipality. And most importantly we have to make sure that we have the facilities and resources to actually be able to implement the solutions."

Going forward the City of Copenhagen aims to be 'solutions ready' by developing facilities and resources.

Implementing the concept – Changing the system

At present, the City of Copenhagen is working to implement sustainability solutions. Following the pitching event, the successful proposals were partnered with relevant departments in the municipality. Reflecting on this, Per offered his advice to others planning an Open Innovation Call:

"It is very important to be aware of in this part of the process, to keep assisting the companies in the dialogue in order for them to understand how a municipality work and how decisions are made. This is after all a political organisation. I'm really proud that we are actually able to carry it out and involve not only the many external partners with potential solutions for us, but also the many, many internal employees in the municipality, who have worked hard to make this a reality. However, in order to work in an Open Innovation framework in the future we need to change the system. We need to be able to work more openly. The system is not developed to fit with these types of processes and we are slowly in a process where we are moving towards being a platform, where the city's problems are put on display and everyone can come up with potential solutions. We are becoming facilitators now, before we were administrators."

The Open Innovation Call highlights how the role of municipalities has changed in recent years, from administrators (top-down decision-making), towards open facilitators (those sharing problems and co-developing solutions with stakeholders).

Co-Development for Mutual Benefits:
Wattelse's (an SME's) experience of participating in 'Climate Solutions for Copenhagen'

This section explores the benefits Small to medium sized companies (SMEs) can gain by participating in the Open Innovation process. SMEs frequently find it difficult to gain access to city officials, event when they have developed innovative sustainability solutions that could be of value to the city. More often than not, when SMEs do have access to city officials, it doesn't guarantee that their idea will be implemented within their city or scaled up within other municipalities.

By elaborating on Wattelse's experience of the Open Innovation Call, it is possible to highlight the challenges an SME can face when collaborating with municipalities. Wattelse are a Swiss-based company have developed a product, the MONALYSE that aims to increase

the energy and resource efficiency of buildings by identifying physical deficiencies and optimisation measures[2]. In 2015, Wattelse had already established themselves domestically and had developed a product that was both inexpensive and easy to implement, however, they had experienced difficulties opening dialogues with city officials. Elaborating on these challenges, Martin Hofer CEO of Wattelse contextualised the need for his product in Copenhagen and provided further insights regarding the benefits of Open Innovation process from an SME perspective:

'We want to work with Copenhagen. The lack of comfort and energy effectivity in buildings is a global topic

[2] Climate-KIC, Start ups, Wattelse website: www.climate-kic.org/start-ups/wattelse/ Accessed 2nd December 2017

and Copenhagen is one of the leading cities in driving sustainability. Therefore, the city was very relevant for us and to be chosen to apply the Wattelse-method in Copenhagen was a great pleasure.'

Getting obtained: Getting access to decision makers

Access to city officials represents a significant challenge for SMEs who wish to scale up and replicate their sustainability solutions. The lack of collaboration between these stakeholders to date, has hindered the development and implementation of sustainability ideas in cities, slowing down the growth of many SMEs.

Waltese experienced this challenge first hand in 2015, when they tried to approach the City of Copenhagen to raise awareness of their new service. After several attempts to engage with the municipality Waltelse sought guidance and support from Climate-KIC Nordic, who were able to link up the SME with contacts at the City of Copenhagen. Following initial discussions, the municipality were interested in the services Wattelse proposed and after a month-long process, both stakeholders agreed to develop a joint Open Innovation Call to explore collaboration further.

Getting integrated: Testing the solution with the city

Wattelse's service proved to be of interest to the City of Copenhagen and both stakeholders are currently in the process of evaluating how to implement the solution within the city. In the first quarter of 2017, Wattelse concluded a scoping study with the City of Copenhagen, across selected municipal buildings that evaluated the potential integration of the service, assessed the budget and expected return on investment linked to the specific buildings. This

process ensures that the building infrastructure in Copenhagen is suitable for automated, big data analysis. The scoping study also enabled both stakeholders to understand any challenges associated with implementing the service. Martin Hofer explains how the Open Innovation process enabled the SME to collaborate with the City of Copenhagen:

'Being part of an Open Innovation process is a great chance for all of us. For the partners involved to get new opportunities and inspiration, for the start-ups to gain potential customers and visibility.'

Becoming Implemented: What is the actual value for a start-up/SME?

The main objective for any business is to foster collaborations that could ultimately lead to economic value (e.g. generating an income). From Wattelse's perspective, the Open Innovation process played a key role in integrating their service into the City of Copenhagen's building portfolio and thus could potentially lead to economic value for the SME in the future. However, not all value accrued from collaborating with the municipality will be strictly economic; working with the municipality can improve the credibility of Wattelse's service – a useful acquisition for business development in the future. Martin Hofer concludes:

'Having a local success story can open up the Danish market to further business opportunities. Our goal is to export our technology and skills to corporate partners to scale the environmental impact.'

The Open Innovation Call enabled the Swiss-based SME to apply their service within Copenhagen and paves the way for other businesses and start-ups to approach the City of Copenhagen with sustainability solutions.

Case #2

The City of Modena

Understanding the Ecosystem

START DATE	2015
LOCATION	Modena, Italy
THEME	Urban Transitions
LEAD CONTACT	Claudia Carani, Project Manager, AESS
STAKEHOLDERS	Private, Public & Third Sector

Case Study Overview

The 'Open Innovation Process' can be explained through the development of multi-actor clusters involved in the Climate-KIC flagship project 'Transition Cities' , initiated by the Sustainable Development Agency (AESS) in Modena, Italy, in 2015.

The Transition Cities project was created in partnership together with seven other cities and aiming to stimulate pilot studies and experiments in relation to three main areas of activity: buildings, energy and mobility. These three areas of activity were identified as they have the potential to significantly reduce carbon emissions within cities. The Transition Cities project aimed to: promote new start-ups; leverage EU funds; enable cities to explore new institutional and business models in order to maximise carbon reduction; and, disseminate its findings widely across major European networks[1]. . Through the multi-actor clusters, the project supported cities in articulating their needs and identifying their sustainability challenges.

Within the City of Modena , the calls for proposals focused on identifying innovative services for sustainable mobility and the funding was allocated to the following[2]:

- The activation and management of the experimental electric car-sharing service that can be used by the City and the private citizens in the Municipality of Modena (€ 50,000), and;

- Installation of automatic traffic detection devices, for the purpose of obtaining data on flows and modal shift differentials on some urban axes in the municipality of Modena (€ 15,000);

- Developing a "SEO – Smart Energy Oracle" online platform to monitor energy investments in public assets (€ 15,000).

The proposal call was intentionally open to all stakeholders within Modena, to boost a 'climate

[1] Climate-KIC, Transition Cities, Project, www.climate-kic.org/projects/transition-cities/ – Accessed December 2017

[2] AESS Modena website, Climate-KIC, www.aess-modena.it/en/projects/climate-kic.html – Accessed December 2017

innovation' approach in European cities and stimulate all stakeholders to contribute towards the transition to a sustainable society. Each proposal was appraised and the best ideas were selected by AESS and the City of Modena. Claudia Carani, the Project Manager at AESS explained the benefits of the 'Open Innovation Process' for Modena:

' … Gaining insight into the different methodologies used to facilitate the process and acquiring knowledge about the city's ecosystem were the two important key learnings …
so even though we acquired new solutions, it was not only about that.'

By adopting an open approach, Modena ensured greater public involvement, widened its economic base through the cultivation of entrepreneurs, start-ups and SMEs, and captured the most up-to-date knowledge, thinking, and competencies. Thus, the open innovation process, when managed well, can be used to provide solutions to problems that both the city and society deem important.

Obtaining: Local stakeholders co-develop mobility solutions

Within the Transition Cities project, AESS utilised an open innovation approach and engaged the local community in the development of innovative solutions that responded to the needs of sustainable mobility for Modena. In early 2016, AESS facilitated a two-hour workshop and invited local stakeholders, from both the public and private sectors with experience in the field of mobility as well as local residents. All stakeholders were asked to identify the main sustainable mobility priorities for Modena in order to create both the context and opportunity for anyone to source, co-develop and scale-up city solutions.

The discussions and brainstorming with local experts provided valuable insight and knowledgable feedback that the city would otherwise not have had access to had they not utilised this approach.

The outputs from the workshop were of particular value to Modena, as it enabled the city to select priority thematic areas for sustainable mobility that were locally relevant, namely: electric vehicles; smart mobility through traffic detection devices, and cycling. The best ideas from the workshop then contextualised the

The stakeholders were asked to identify the main priorities for Modena with regards to sustainable mobility and the feedback provided the city with valuable input

'calls for contributions' for the development of innovative projects for the city. Stakeholders could then collaborate in multi-actor clusters, to source, co-develop and test innovative products or services within the priority thematic areas and thereafter apply for funding to test ideas.

The 'Open Innovation Process' requires multi-actor clusters to collaborate to reduce the likelihood of single stakeholders developing isolated initiatives that lack strategic coherence and do not have an agreed perspective on where to focus investment and scale up. Carani reflected on the open approach, and suggested that it is necessary to:

'[Firstly] Engage a good mix of stakeholders with different backgrounds and positions in the community that could bring different perspectives in the working group, and [secondly] To provide an effective facilitation in order to achieve results in maximum of two hours.'

AESS effectively facilitated the workshop by planning, guiding and managing the discussions

between stakeholders in order to define clear objectives, actively participate in discussions, contribute new ideas and agree on solutions (e.g., getting 'buy-in' from each actor).

Integrating: Insights for Modena

In August 2016, AESS contextualised all the innovative ideas that arose from the facilitated workshop, summarising and published the findings as a consultation document for a public call for sustainable mobility solutions. The City of Modena received a number of multi-actor cluster proposals that not only provided further insight into local stakeholders' specific expertise and knowledge, detailed experiments and potential pilot studies but also provided a comprehensive list of stakeholders interested in being part of the 'Open Innovation' process, thus paving way for potential future collaboration.

Implementing: Catalysing sustainable mobility solutions

Following the facilitated workshop and the calls for contributions for the development of innovative projects for the city in August 2016, the winning proposals were selected and the results published on the City of Modena website the following September 2016.

The City of Modena selected four proposals, each of them presented new, innovative pathways for the city to meet its aims and objectives for sustainable mobility as set out in the municipalities own mobility strategy, as Carani explains:

'The bottom-up approach ensured the suggestions presented were aligned with the City's Sustainable Mobility Vision and Strategy and even if the City of Modena didn't co-finance the selected projects, the engagement was very high.'

The following proposals were successful[3]:

- Electric Vehicles: The creation of a car-sharing scheme using electric vehicles in the city.

- Smart mobility: The development of sensors and apps that survey and analyse traffic modes and routes for the city, which reduce congestion and air pollution and freight systems.

- Cycling initiatives:

- WeCity 2.0: the integration of an existing bicycle app that is combined with crowd data coming from the bikers using the road network of the city (cycle ways and safety cycle ways)

- eGoBike: the development of a new bike rental service for tourists, bike delivery to hotels and tourist point, and bike tour in the province of Modena

- Mobile Bike Repair shop: the creation of a mobile shop that provide assistance to repair bicycles and provide information

Both Climate-KIC and the City of Modena supported the successful proposals by: guiding the new entrepreneurs; exploring new business models for carbon reduction; disseminating information and findings across major European networks; providing expertise; leveraging European funding and in some instances part-financing projects; providing spaces within the city for pilot testing, and, linking up and synergising with other projects in the region (e.g., Bologna, Italy).

[3] Climate-KIC Italy, www.climatekicemiliaromagna.it/innovation -pathfinder/projects/transition-cities – Accessed December 2017

Case Study Summary

The Transition Cities project utilised an open approach that promoted experimentation and pilot studies to enable cities to address gaps in provision; deepen their understanding and enabled maximisation of their potential, both in terms of learning from individual projects and then sharing that knowledge and experience with similar cities. The process is explained below:
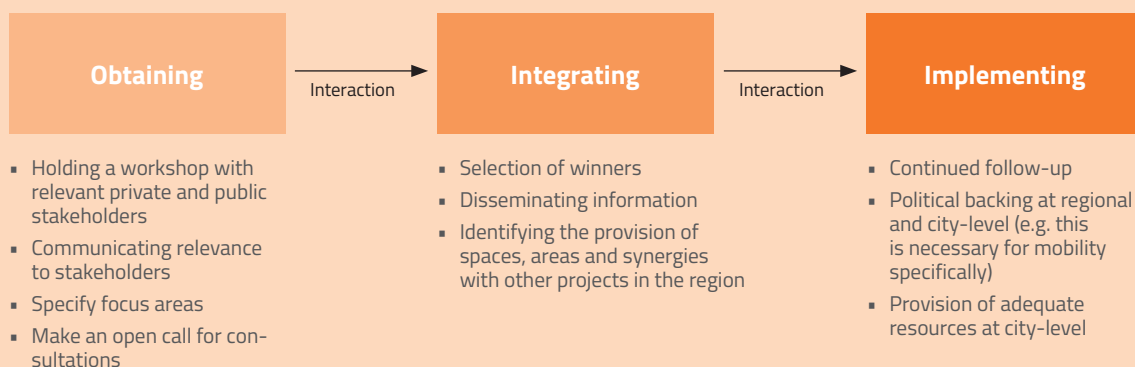
Challenges:

The Open Innovation process isn't without its challenges, especially when working with a large consortium: it can be difficult to manage all stakeholders involved as they are all driven by a desire to create different forms of value. AESS identified this and acted as 'match makers' as well as engaging local stakeholders in both the priority theme selection and the consultation call. AESS supported the process by acting as brokers between stakeholders involved in the collaboration. Multi-actor clusters ensured that the open approach was inclusive to all local stakeholders from start to finish and AESS played a key role in keeping the overall process in motion.

Results:

The project lead, AESS, collaborated with the City of Modena and Climate-KIC to seed fund the successful proposals in order to boost wider investments. This has resulted in:

- The launch of an Electric Vehicle (EV) sharing scheme in Modena that was funded using a public-private investment model. The project provided 56 EVs for the City of Modena, saving an estimated 158,600 tonnes CO_2 emissions every year.

- The Smart Mobility app enabled data analysis of different traffic modes and routes in Modena City Centre using innovative means (sensors and applications) – this data has fed into the local sustainable mobility plan.

- The cycling initiatives improved access to bikes to encourage locals and tourists to use sustainable modes of transport.

For Modena, the process of Open Innovation represented a new approach where the city could work with local stakeholders to identify key transport priorities for the area and then source and co-develop solutions to sustainability challenges.

Obtaining	Interaction →	**Integrating**	Interaction →	**Implementing**
• Holding a workshop with relevant private and public stakeholders • Communicating relevance to stakeholders • Specify focus areas • Make an open call for consultations		• Selection of winners • Disseminating information • Identifying the provision of spaces, areas and synergies with other projects in the region		• Continued follow-up • Political backing at regional and city-level (e.g. this is necessary for mobility specifically) • Provision of adequate resources at city-level

Case #3

Sunmapper

Big data ideas creating transformative change within cities

START DATE	2014
LOCATION	Lyngby-Taarbæk Municipality, Denmark
THEME	Urban Transitions
LEAD CONTACT	Lars Hotels Bonde, CEO, Picodat
STAKEHOLDERS	Civil Society & Public

Case Study Overview

A Hackathon is a 48-hour brainstorm and discussion where multi-disciplinary teams aim to develop innovative sustainable solutions. In 2014, a Hackathon was facilitated by IBM and developed by DTU Compute in collaboration with DTU Skylab, Lyngby-Taarbæk Vidensby and Lyngby-Taarbæk Municipality. Danske Bank was the main sponsor of the Hackathon; it distributed a total prize of DKK 45,000 for the three best solutions. Climate KIC Nordic also sponsored a special award of DKK 10,000 for a project with a particular focus on climate solutions[1]. The Hackathon was initiated to bring students together in order to source and co-develop technological solutions that could address the municipality's sustainability challenges and help them meet their climate targets.

At the event, a panel of industry experts and decision-makers judged the best ideas – a team of students who developed a product called 'Sunmapper' were the winners. 'Sunmapper' is an online platform for residents interested in purchasing solar power. The platform enables

The partners wanted to use the hakathon as an Open Innovation format in order to bring people with different backgrounds together and initiate a joint development process

residents to take control of their own domestic solar energy needs; it presents all relevant information needed to determine whether making an investment in solar panels is a sound

option for their particular property. The web platform also supports the municipality with its own climate targets – to increase the uptake of solar power within the city. Following the Hackathon, the student team decided to develop their business called Picodat, as a way to sell the 'Sunmapper' product and apply the skills and training from the Hackathon. Within a short period of time, the team of students had transitioned from Hackathon participants to lead the development of an innovative tech start-up.

Obtaining: 48-hour brainstorm for Big Data solutions

The Hakathon focus on 'Big Data' challenges stakeholders to provide innovative technical solutions for decision-makers that have to manage and store vast quantities of complex data within the city. In partnership with corporates and utility companies, the Lyngby-Taarbæk Municipality utilised the Open Innovation process facilitating an event that brought together talented stakeholders from different disciplines to source and co-develop sustainable solutions.

One of the teams at the Hackathon compromised of students with computing, mathematics and business skills who co-developed the 'Sunmapper' platform. The team used the heat-release maps of municipal buildings and data regarding energy consumption and roof pitches provided by the Hackathon partners. The solution stood out from other ideas at the event as it enabled users to identify whether their building was suitable for solar PV. Following the co-development

[1] Vidensby website, translate.google.co.uk/translate?hl=en&sl=da&u=vidensby.dk/arrangement/big-data-hackathon-2/&prev=search – Accessed December 2017

stage, the judges assessed the teams product on its user-friendliness, ability to scale up and commercial potential. They awarded Sunmapper the top prize at the event.

Integrating: Transitioning from idea to Big Data business start-up

The winners at the Hackathon event received support from event partners in assessing whether the technology could be developed yet further. Support included collaboration opportunities with Lyngby-Taarbæk Municipality and the opportunity to pitch the solution to local decision-makers and a wide selection of Danish businesses willing to potentially fund the solution; hands-on experience with IBM Bluemix, the latest Big Data tools; financial support (1st prize DKK 25,000, 2nd prize 15,000 DKK and 3rd prize 5,000 DKK as well as a special prize from Climate-KIC Nordic for products that focus on climate solutions); and, a potential place on the Climate-KIC Accelerator programme[2].

A few years later, following this support and after researching the idea further, the Sunmapper team decided to formally create a start-up company, called Picodat. The new start-up could enable them to access other business support available and develop their ideas. When refining their business model, the Picodat team identified that the 'Sunmapper' platform was best suited for municipalities who could offer the service to local residents who, in turn, could explore the potential of installation of solar PV on their homes. The platform was seen to bridge the gap between local residents and municipal climate targets ,as the technology encouraged residents to consider renewable energy installation. Picodat CEO Lars Holtse Bonde elaborates:

'With Sunmapper we're trying to show the potential of solar panels in the easiest way possible, in order to encourage homeowners to reduce CO2 emissions as well as benefitting economically. By providing Sunmapper, municipalities can offer an extra service to their citizens and come closer to realising their climate targets'.

The uptake of renewable energy is key if Lyngby-Taarbæk Municipality is to meet their climate targets. On average, every household that installs a solar PV can save the equivalent of 300 pine trees of CO2 emissions – thus 'Sunmapper' could significantly help the municipality.

Implementing: Upscaling and replicating solutions

Picodat was registered in 2016 and was accepted into the Climate-KIC Nordic Accelerator (Stage 1) Programme. The Accelerator Programme is a six month training programme that offers: equity-free grant funding (e.g., for prototyping and Research & Development); one-to-one meetings with mentors; monthly workshops, and, networking opportunities. The Climate-KIC Nordic programme provided support so that 'Sunmapper' could make their idea commercially viable. The team continued to work with Lyngby-Taarbæk Municipality and other Hakathon partners during the development and launch of the product. In the weeks following 'Sunmapper's' launch, the platform attracted over 200 unique visitors (roughly 0.5% of the entire population of Lyngby-Taarbæk)[3]. This was encouraging for Picodat; it now has long-term plans to roll out the 'Sunmapper' platform across Denmark.

[2] DTU Hackaton, translate.google.co.uk/translate?hl=en&sl=da&u=www.compute.dtu.dk/forside_historier/hackathon&prev=search – Accessed December 2017

[3] Organicity EU, organicity.eu/inspiration-from-hackathon-to-data-driven-start-up/ – Accessed December 2017

Case Study Summary

Picodat is now a fully-fledged start-up offering a free web platform that enables homeowners to enter their address and see the potential for rooftop solar PV. Support from Lyngby-Taarbæk Municipality and Climate-KIC Nordic has enabled Picodat to refine their product, 'Sunmapper' calculates the pitch, orientation, shadows, recommended placement and size of potential panels. The technology enables local residents to get a breakdown of the potential costs and savings associated with solar PV, as well as an option to receive quotes from relevant solar PV installers in their area.

Even though Picodat has established that there is a market for 'Sunmapper', the team continue to research the right business model and market for their product and are scoping all options. The web platform has been revised many times and the team have identified that there is no 'one size fits all' solution for 'Sunmapper' – it has to be tailored for each municipality due to differences in cities climate targets and strategies.

Challenges

During the development of the 'Sunmapper' platform, Picodat faced several challenges. To begin with, none of the student team initially intended to develop a start-up as they had no experience of running a business (e.g., turning a technical solution into a commercially viable product). Although winning the Hackathon was a confidence boost for the student team, it quickly became apparent that they did not have

all the skills necessary to develop their product. Support from Lyngby-Taarbæk Municipality and Climate-KIC Nordic through the Accelerator (Stage 1) programme was vital in the team's decision to develop the 'Sunmapper' product further and actually start a business.
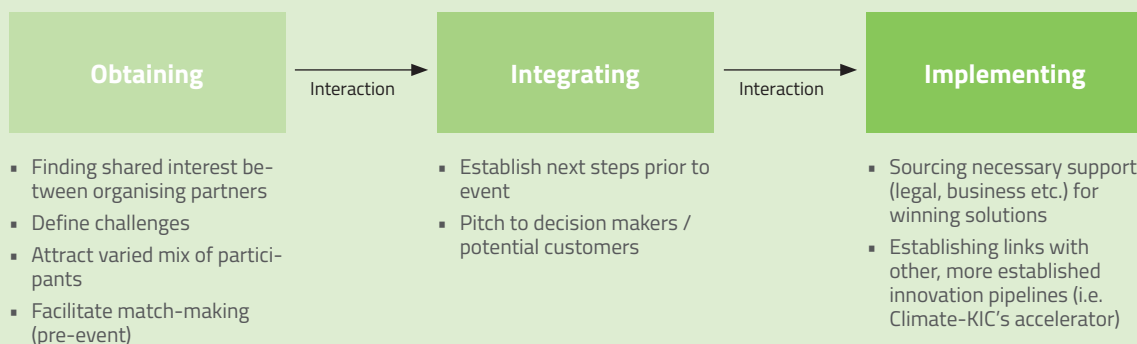
Climate-KIC Nordic played a pivotal role in bringing together the start-up business and the Lyngby-Taarbæk Municipality – both at the Hackathon event and during the Accelerator programme. However, facilitating partnerships and collaborations takes a long time for the Open Innovation process to be effective. This can be challenging for start-up businesses like Picodat who often work on shorter timescales as they need to generate income quickly in order to develop the business further.

Crucially, start-up businesses often require much more time to develop their products and services than initially thought. The Picodat team acknowledged that when they started out, they neither understood how to progress appropriately with a successful idea, nor how much work was required to see the full potential of the product realised. By providing appropriate support, start-ups can be helped to speed up the development of their business.

Results

- Student team won the 'Big Data' Hackathon in 2014

- The launch of the 'Sunmapper' platform attracted over 200 unique visitors (roughly 0.5% of the entire population of Lyngby-Taarbæk)

- Registered the start-up as Picodat in 2016

- Start-up successfully admitted on to Climate-KIC's Accelerator (Stage 1) programme

Obtaining	Interaction →	**Integrating**	Interaction →	**Implementing**
▪ Finding shared interest between organising partners ▪ Define challenges ▪ Attract varied mix of participants ▪ Facilitate match-making (pre-event)		▪ Establish next steps prior to event ▪ Pitch to decision makers / potential customers		▪ Sourcing necessary support (legal, business etc.) for winning solutions ▪ Establishing links with other, more established innovation pipelines (i.e. Climate-KIC's accelerator)

Acceleration of OfficeVitae

Universities as Open Innovation breeding grounds

START DATE	2016
LOCATION	Delft, The Netherlands
THEME	Urban Transitions
LEAD CONTACT	Sybren Steensma, Business Developer, Climate-KIC Netherlands
STAKEHOLDERS	Private & Third Sector

Case Study Overview

This case study explores the start-up 'OfficeVitae' which was conceived by a research team led by Professor David Keystone, based at Delft University of Technology (DUT), the Netherlands. The Faculty of Industrial Design developed sensor technology and development hardware (as part of a 'Green Comfort' project), that could measure indoor air quality in homes and office spaces. The DUT team thought that the technology could potentially be brought to market and be profitable, however, the product required an appropriate business model. The team in the Faculty of Industrial Design decided to research potential business models, and realised that they needed a team member with the business expertise and aimed to source a full-time external entrepreneur.

... universities across Europe are opening up their doors and making their research available This movement towards free access to research and data is very important in the creation of eco-systems capable of hosting Open Innovation

The research team participated in Climate-KIC's flagship, 'Building Technologies Accelerator' (BTA), a business support programme that provided: access to Climate-KIC's Living Labs where the new product could be tested; business skills to support start-ups, and, opportunities to meet skilled entrepreneurs that they could potentially take the technology from the university and turn it into a commercial product available on the market[1]. They achieved the latter by

participating in a matching process that enabled the research team to work with an entrepreneur, the process was developed by Climate-KIC Netherlands Business Developer, Sybren Steensma. Following the event, the research team identified an experienced entrepreneur who helped them develop a business in order to market the product.

Obtaining: From research data to innovative technical solution

The DUT research team approached Climate-KIC Netherlands in 2016 with their business idea – they quickly realised the potential of the product and offered co-funding for further post-laboratory development. The funding enabled OfficeVitae to investigate the product's commercial potential and enabled the development of the sensor technology and the raw data that had been collated from the 'Green Comfort' research project to assess the product-market fit.

Sybren Steensma, a Business Developer at Climate-KIC Netherlands saw the potential in the research data and identified that the team needed a mix of expertise and skills to turn a research project into a commercial business with great market potential.

'Prof. Dr. David Keyson had developed a very interesting system and many ideas on how to commercialise [the product] ... but having a research background he didn't have the exact insight in

[1] Construction 21, www.construction21.org/articles/h/officevitae-put-employees-at-the-center-of-health-and-comfort-in-offices.html – Accessed December 2017

where the biggest commercial potential was and how to bring it from laboratory to product to market. His job is to develop the best integrated solution for the reduction of energy usage in buildings, which he did. Now we needed to identify someone, who might have the right set of competences to develop the commercial strategy and bring the system to market.'

Following the funding to develop the product, Steensma encouraged the DUT research team to apply for the 'Building Technologies Accelerator' (BTA) programme, to open up the commercialisation process and match the project with an entrepreneur with the required skills.

Integrating: Match-matching the right skills for a start-up business

Later that year, Climate-KIC Netherlands, as part of the 'Building Technologies Accelerator' (BTA) programme, organised a 'Business Lounge,' a pitching event where ventures originating from university research projects, were pitched to a panel of entrepreneurs and experienced business owners. The event was designed to

facilitate the transition from university research to marketable product by opening-up university work to external parties with the necessary expertise to assist in the commercialisation process. In the build-up to the event, Sybren Steensma, supported the 'Green Comfort' lead Prof. David Keyson in identifying what the right team for the business would look like (e.g., what skills were required). The pitch-based event enabled the Professor and his research team to identify a suitable entrepreneur with whom they would like to work. Through Climate-KIC Netherland's matching process, the entrepreneur and the university professor entered into a partnership to lead the company forward: Tako Werts became the CEO, Professor David Keyson became the CTO and DUT remains a major stakeholder of the venture.

Implementing: Creating partnerships in the Open Innovation process

For the 'Open Innovation' process to be effective it requires the development of a dynamic, functional team. Central to a team's functionality is

trust between partners. The 'Business Lounge' provided a safe space for the research team to meet with skilled entrepreneurs in order to get to know each other and to recognise each member's different modes of working. Steensma explains how Climate-KIC Netherlands facilitated and supported the match making between the research team and entrepreneur:

'We held a lot of meetings, we talked a lot. More and more, they started working as a team and I could take a step back. Instead of being the primary point of contact I just got CC'd in and after a while I wasn't even part of the email correspondence. This was an important step.'

Following Climate-KIC's matching effort, there were a few months of negotiations between Prof. David Keyson and the entrepreneur before agreeing on a partnership that could successfully take the business forward. Following the matching, in 2016 the 'Green Comfort' research project re-branded to become 'OfficeVitae' and became a registered spinout that started as a project by the DUT. The process took time,

however, as the three parties needed to agree on how to create the right foundations and vision for the future company. Steensma reflects upon the most important factor for the 'Open Innovation Process':

'Open Innovation is always about human interaction and the most important thing is to get the right people together.'

Successful Open Innovation requires supporting stakeholders who connect and match stakeholders together, build bridges between them and act as brokers between the different sub-divisions of the collaboration. These match-making stakeholders are essentially acting as civic accelerators building bridges between players and are pivotal in keeping the overall process in motion. However, to get the right people together takes time and requires a key point of contact (in this case, Climate-KIC Netherlands) that can initiate the relationships and provide enough support to ensure the team works together.

Case Study Summary

The successful collaboration between the research team, entrepreneur and DUT resulted in the development of a commercial business, OfficeVitae. The team created the 'OfficeVitae Health Platform' that used the data sets and smart technology from the DUT research project to measure key parameters in the office environment and visualises the data on its interface[2]. Through the provision of this data, OfficeVitae is able to facilitate more efficient building management. Steensma identified the commercial value in the health platform, stating that:

'In the economy of the future, more and more employers are competing over talent. To invest in their wellbeing and productivity is becoming a necessity, which is why I see great opportunity for OfficeVitae.'

However, without the 'Building Technologies Accelerator' (BTA) it is possible that the research team would not have found a suitable entrepreneur to collaborate with.
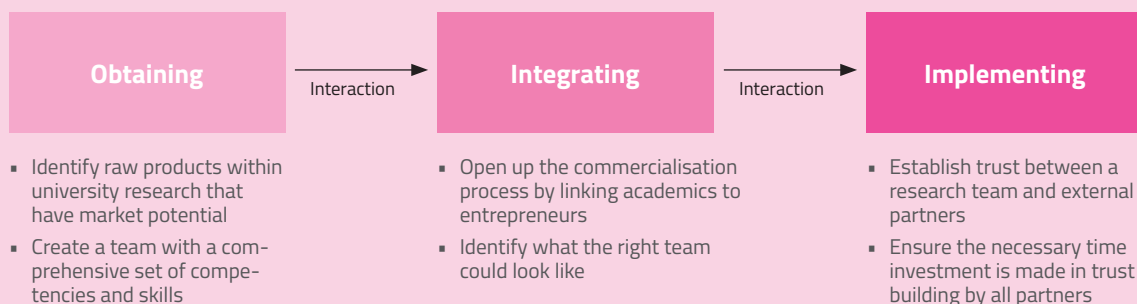
Challenges:

The open innovation process enables pioneering university spin-off companies that think outside the traditional limits of cities and municipalities to collaborate with a range of stakeholders that otherwise may not be available to them before. Often, though, innovation can be challenging as it requires a diverse mix of knowledge and different approaches to turn a research project into a commercial business. For OfficeVitae, it was necessary to identify someone with the right skills and once part of the team, create establish an efficient internal structure. The internal structure was paramount to the research team as they needed an outsider with commercial experience to supply a stream of effective ideas for product development to ensure it was market ready.

Results:

- The collaboration led to the first 'Building Technologies Accelerator' (BTA) start-up being developed in December 2016.

- The results from pilot studies with Accenture and Knight Frank have been promising: with energy savings, more productive employees, less sickness, higher retention rates and better company performance.

- The team has expanded with five researchers employed by the business and are currently exploring other products and projects.

[2] Climate-KIC, OfficeVitae www.climate-kic.org/start-ups/officevitae/ – Accessed December 2017

Obtaining	Interaction →	**Integrating**	Interaction →	**Implementing**
▪ Identify raw products within university research that have market potential ▪ Create a team with a comprehensive set of competencies and skills		▪ Open up the commercialisation process by linking academics to entrepreneurs ▪ Identify what the right team could look like		▪ Establish trust between a research team and external partners ▪ Ensure the necessary time investment is made in trust building by all partners

Case #5

ReGen Villages

Re-inventing the City: Building new sustainable cities from the ground

START DATE	2015
LOCATION	Almere, Netherlands
THEME	Urban Transitions
LEAD CONTACT	James Ehrlich, President, ReGen
STAKEHOLDERS	Private, Public & Third Sector

Case Study Overview

At the Centre for Design Research (CDR) at Stanford University, James Ehrlich, a Senior technologist, has worked with a scholars on new stream of research focused on the built environment – specifically, sustainable cities. The research eventually transitioned into the ReGen project which sought to develop strong, resilient communities, one neighbourhood at a time. Following years of research, in 2015 James Ehrlich decided to develop a commercial business, ReGen Villages, to provide model blueprint for businesses, government and academic action[1]. The partnership aimed to accelerate the proliferation of affordable, integrated village designs, providing off-grid, integrated and resilient

... it is possible to rapidly deploy complete neighbourhoods at the nexus of food, water, energy and waste

villages that could power and feed self-reliant families around the world.

The ReGen Village concept provided a holistic approach by combining a variety of innovative technologies, such as energy positive homes, renewable energy, energy storage, door-step high-yield organic food production, vertical farming aquaponics, aeroponics, water management, and waste-to-resource systems.

The new business aimed to tackle challenges expected from climate change and over-population from the economic, social and environmental perspective. However, the model blueprint requires challenging the status quo, shifting

[1] Business Insider www.businessinsider.com/self-sufficient-village-regen-2016-9?r=US&IR=T&IR=T – Accessed December 2017

from the traditional 'top down' development of housing as they propose a model intervention into prevailing modes of residential living, as James Ehrlich, President of ReGen Villages states:

'This is an experiment ... normally, government has a [development] plan for an area, but we've turned that upside down.' – (Quoted in the Guardian, 12th July 2016, article available here.)

ReGen Villages have drawn on the open innovation process in order to make the business a commercial success. The business still have to work with existing decision-making processes and land regulations when proposing new city concepts to municipalities. In this, they have worked very closely with the Dutch Government, the Almere Municipality and Danish design firm, EFFEKT, to get their buy-in for the development, ensuring the venture was commercially viable and that it met compliance requirements.

Obtaining: Using research data to build sustainable cities

Following years of researching organic family farms and communities around the world, in 2013 Ehrlich discovered research data that signified future populations could be put at risk due to food shortages and intense resource consumption. Given the data identified that the natural resource systems were under increasing strain, the proposition of a residential village that considers its own food production, energy generation, waste re-use, and water conservation could drastically reduced the reliance on municipal systems. With this in mind, Ehrlich decided

to volunteer at an open innovation competition at Stanford University, where 20 universities competed to who can design and build the most energy positive homes. He became the 'organic food coach and lecturer' for the cohort and was inspired by the different approaches proposed at the competition. Following further research in France in 2014, he identified that it was possible to rapidly deploy complete neighbourhoods at the nexus of food, water, energy and waste, thus Ehrlich developed the ReGen Village project as a commercial business.

Integrating: Getting the idea off the ground

Once the university spin-out had been registered in 2015, James Ehrlich soon realised that there was a high demand for his blueprint model: millions of people around the world desperately wanted to live in ReGen Villages. Realising that local government buy-in was a crucial component for the new development, Ehrlich approached various municipalities around the world to encourage legislation that would fast track permitting and exception zones for

regenerative community development. Ehrlich elaborated:

'We require governments to think completely differently about how whole neighbourhoods and communities are grown rather than merely built – and this means re-thinking zoning, permitting, environmental, health and economic obstacles lifted or removed.'

ReGen Village represents a shift from the status-quo, 'top down' approach to housing developments and requires the political support to introduce incentives for low carbon developments and industry support, where real profitability is about having healthy, thriving communities of inhabitants.

Implementing: University and Government partnerships for sustainability

A year later, following countless meetings with national governments, municipalities and refining the blueprint model, Ehrlich was approached by the Dutch Government to develop the ReGen

Villages concept in an area of The Netherlands called Almere – a town renowned for being forward thinking. Following the offer from the Dutch Government, it soon became apparent that Ehrlich had the technological knowledge, but not necessarily the design skills, to turn his vision into a reality; he decided to collaborate with other stakeholders. ReGen Vilages thus collaborated with a EFFEKT (an architectural firm) as well as municipality (primarily in Almere and in Oosterwold) and the national Dutch Government, in order to develop comprehensive plans of the development and reach a signed land agreement in 2016[2].

Overtime, the relationship between the Stanford University spin-out and the Dutch government has been proved effective – the government has created preferential regulations for sustainable developments, for example: suitable land grants without down payment, where both parties

realise that there's a shared success in the eventual sale, lease and management of these communities (and where municipalities receive increased tax benefits). Additionally, the local government in Almere has agreed to fast-track all permits when working with ReGen Villages in the creation of exclusion zones for 'prototyping' pilot neighbourhoods. This is openly communicated across the region and nationally, to enable anyone in the country to access information regarding the project and showcase the benefits of the Village. Ehrlich is hopeful that other governments will be just as supportive:

'We require interested cities to join with us in presenting to national/parliamentary levels of government for removing obstacles, and/or to legislate a new way forward for regenerative community developments to flourish.'

It is hoped that the ReGen Village concept will be upscaled and replicated in other countries, in partnership with national and local government, business and universities.

[2] ReGen Villages www.regenvillages.com – Accessed December 2017

Case Study Summary

ReGen Villages has a global vision to bring science-to-action research to implement thousands of regenerative, villages within the next decade. The ReGen Villages initiative will act as conduit for bringing design challenges and endowment funding to partner universities around the world, in addition to providing safe, secure and self-reliant communities to life.

Building on an open-source ideology and partnering with national and municipal governments, major universities, industry partners, regional and local stakeholders at every level, ReGen Villages aims to dissolve barriers to rapid deployment and proliferation. Drawing on the Open Innovation process to bring stakeholders together to develop a sustainable neighbourhood blueprint model requires an integrated focus on the human and technical issues – this is ReGen Village's recipe for success.

Challenges:

Often policies and the ways of working between cities and municipalities are often too different to allow smooth cooperation. For solution providers such as ReGen Village, this requires navigating their way through an incoherent working environment and can present a sizeable barrier to scaling up solutions to new cities. This barrier was exemplified by the experiences of ReGen Village, as they spent the first year or so developing relationships with both national and local government, in order to identify ways of working that would align. This research was crucial to the business, as without it, ReGen Village may not have been able to scale up they first pilot community in The Netherlands.

Results:

- First pilot community in Almere, Netherlands where they are designing, integrating and facilitating first 25 pilot homes, as well as agreements in the pipeline to develop ReGen across Northern Europe in Sweden, Denmark, Norway, Germany and Belgium.

- Significant interest in ReGen Villages: since June, 2016 they have received over 20 million page views and 10 thousand emails from all around the world.

- On August 25th, 2016, ReGen Villages was presented at the White House for the Office of Science and Technology Policy (OSTP) as part of a round table on the nexus of food, water, energy and waste.

- Nominated for a Global Solutions Award from Singularity University.

Obtaining	Interaction	Integrating	Interaction	Implementing

- Recognition of stakeholder needs and desires
- Identifying value in research data
- Refining innovative ideas

- Facilitating engagement through meetings and workshops
- Identifying challenges that must be overcome

- Collaborating with other stakeholders that have expertise

Smart Kalasatama

Joint Development of a New Smart and Sustainable City District

START DATE	2013
LOCATION	Helsinki, Finland
THEME	Urban Transitions
LEAD CONTACT	Veera Mustonen, the Head of the Smart Kalasatama Project
STAKEHOLDERS	Private, Civil Society, Public & Third Sector

Case Study Overview

In 2013, the City Council of Helsinki launched the Smart Kalasatama Project which aimed to develop Helsinki's very own new, smart and sustainable city district. As part of the project, the Kalasatama Developers Club (KDC) was initiated as a collaboration network that encouraged local stakeholders to get involved in developing the Kalasatama City district[1]. The KDC is one of the first of its kind in Europe and aims to ease the process of finding partners to

Open Innovation requires a lot of presence, a lot of engagement and a lot of time. People come with different backgrounds and it takes time for them to get to know each other

collaborate and develop projects with, fostering a new kind of district-based co-operation. Although the project aims to develop sustainable urban districts that are energy efficiency and reduce waste, the key aim is to give people back one hour of their time each day (e.g., by enhancing transport, improving the efficiency of energy generation, etc.).

The district is developed in close co-operation with public sector, academia, NGO's, businesses and residents who are all integrated into the Open Innovation process as a way to experiment and implement new smart ideas.

The Smart Kalasatama Project will house up to 20,000 residents and provide jobs for around 8,000 people. Although the district is not yet completed, currently over 3,000 inhabitants live

in the area and it is expected a further 1,000 are expected to move in each year[2].

Obtaining: Local residents share insights for sustainable city district

The KDC, which meets up four times a year, enables local stakeholders and planners involved in the 'Smart Kalasatama Project to discuss ideas, build networks and contribute towards future plans (it is also known as The Innovators' Club). Veera Mustonen, the Head of the Smart Kalasatama Project, shares insights about why KDC has been so successful in facilitating the sharing of expertise and knowledge between stakeholders:

'We have to recognise all interests simultaneously. If you are doing something, that isn't in everyone's interest, then you're doing it wrong. It is possible to co-create … initiatives that benefit all stakeholders.'

Thanks to the KDC's activities, stakeholders can regularly share news and gather information about upcoming events and future projects. There are more than 300 people from industry, universities and civil society involved in KDC's activities overall. KDC's meetings are held at different locations in the district to enable everyone to participate in the decision-making process and provide insight and expertise on the local area.

[1] Smart Kalasatama Programme, fiksukalasatama.fi/en/co-creating-services-for-smart-cities/ – Accessed December 2017

[2] Forum Virium Helsinki, forumvirium.fi/en/smart-agile-piloting-in-kalasatama/ – Accessed December 2017

Integrating: Sourcing and co-developing smart solutions

To date, stakeholders are working together with the KDC, to design and implement innovative sustainability ideas within the district. The KDC has acted as the initial focal point and meeting place for project related activity, from brainstorming and co-creating ideas, to networking and designing projects. The 'Smart Kalasatama Programme for Agile Piloting' accelerated innovation within the city by procuring prototypes to real city environments that have be co-created in meetings and hakathons. Stakeholders are motivated to work with different types of organisations as there is support available to turn the idea into a reality. Although the KDC facilitate networking, any subsequent activity, such as implementing the project and developing

project plans, takes place between stakeholders outside of the KDC facilitated events. Mustonen explains:

'We have a lot of constructive involvement and interesting players [involved in projects]. People want to come back and they want to be involved because they want to meet each other and work together. Now people know each other and they have their own network, which we don't facilitate.'

Although there are clear benefits in bringing stakeholders together, there are still inherent challenges that are brought to light throughout the Open Innovation process. For example, political processes and bureaucracy can often slow down the development of a project, there is often strict regulation on infrastructure projects and larger stakeholders can be difficult

to engage in the process as they may have whole departments delivering similar projects. Mustonen reiterates this point:

'Some companies [larger stakeholders] can, in a sense, create a whole ecosystem within their own organisations. The incentive to participate in these Open Innovation processes is therefore not that strong for them. They keep coming to our activities, though. To meet the start-ups and experience the future possibilities through the network.'

Implementing: Creating 'test beds' within the city

In the Kalasatama district, there are currently around 20 active projects owned and run by the different stakeholders involved with the KDC. These projects often vary in size, with larger infrastructure projects driven by companies or organisations and smaller projects run by the residents (e.g., community-led initiatives). Today more than 78 businesses, 4 universities and over 20 local residents are actively involved

in sustainability projects in the Kalasatama district, not to mention the many hundreds of residents, who actively participate in projects more generally by providing feedback to the KDC regarding projects in their district.

Mustonen reflects on the successes of the KDC in facilitating the Open Innovation process in the Smart Kalasatama project:

'Open Innovations requires a lot of presence, a lot of engagement and a lot of time. People come with different backgrounds and it takes time for them to get to know each other. You have to create the space and atmosphere for people to meet. Facilitate in the beginning, then let go. And give it time!'

Effective facilitation is paramount for the Open Innovation process to be successful in engaging stakeholders and stimulating interest in projects, as is the provision of the right amount of time for stakeholders to work together as they try to counteract the inherent challenges they each face individually.

Case Study Summary

The Smart Kalasatama Project is an experimental innovation platform where anyone can co-create smart urban infrastructure and services. The City Council of Helsinki utilised the Open Innovation process in this project; it enabled them to obtain the best knowledge available in their local ecosystem, (e.g., from universities, businesses or residents). By facilitating events and creating the right environment for networking, the KDC encouraged stakeholders to participate in the design and development of the Kalasatama City District. The KDC effectively encouraged the development of innovative solutions from large and small consortiums as well as keeping stakeholders motivated by offering support for the best ideas.

Challenges:

Managing large consortiums can be challenging within the Open Innovation process as they frequently consist of different stakeholders, each with their own way of working. These differences can be overcome, but this requires keeping the stakeholders motivated and driven to implement their solution. This can be achieved by helping them to develop a vision with buy-in from each stakeholder involved.

Results:

- Helsinki qualifies as an EU 'Innovation Capital' for its innovation platforms such as Smart Kalasatama and intelligent transport pilots.

- The Smart Kalasatama Programme for Agile Piloting has launched three calls under three themes, and received over 130 offers. The programme has engaged over 500 citizens, 10 city departments and 30 companies in co-creation activities.

- In 2015, Frost & Sullivan ranked it Helsinki number one 'Real-Time City' in Europe for its data-based services, open source utilisation and collaboration. The Smart

- Kalasatama Project runs quarterly 'Innovators' Clubs' what attract more than 200 stakeholders who come together to co-create smart infrastructure and services[3].

[3] Smart Kalasatama Programme, fiksukalasatama.fi/en/building-blocks/innovators-club/ – Accessed December 2017

Obtaining		Integrating		Implementing
	Interaction →		Interaction →	
• Recognition of stakeholder interests • Provision of space and a platform for sharing ideas • Accessible space for all stakeholders to engage		• Facilitating engagement through events • Allowing for further engagement outside of facilitated events		• Allowing the process to run outside the KDC and providing ad hoc support when necessary

Case #7

Residual Heat to Urban Food

The More the Merrier: Accelerating change through large partnerships

START DATE	2016
LOCATION	Malmö, Bjuv, Lund and Oskarshamn in Sweden
THEME	Sustainable Production Systems
LEAD CONTACT	Bengt Persson, External Collaboration Specialist, The Swedish University of Agricultural Sciences
STAKEHOLDERS	Private, Civil Society, Public & Third Sector

Case Study Overview

In 2016, Climate-KIC Nordic, together with four Swedish municipalities (Malmo, Lund, Oskarshamn and Bjuv) and large corporate companies (e.g., E.ON, ICA Fastigheter and Veolia) created a consortium and announced a joint 'Open Innovation Competition' to identify solutions to overcome a wide range of the technical challenges associated with residual heat reuse[1]. The competition explored how residual heat, low temperature heated water, could be used in the production of food or other biological products within the urban environment. Residual heat is often emitted as clean warm water is currently regarded as a waste of both energy and resources and is ultimately detrimental to the environment. Waste residual heat can be used to create environmental benefits for cities but this requires changes in supply chains, patterns of use, consumption of energy and regulatory frameworks.

urban gentrification). The consortium were looking for solutions that incorporated concepts of sustainability, the circular economy and a zero waste ethos. The Open Innovation Competition was a means for the consortium to identify solutions that could be integrated into a regional Residual Heat project.

Obtaining: Technical solutions for Residual Heat challenges

The Open Innovation Competition invited businesses, academics and local residents to propose ideas and technical solutions that could be assessed, tested and implemented in each respective city region. The winning solutions from the Challenge would then be incorporated into a regional Residual Heat project. Bengt Persson, an External Collaboration Specialist at The Swedish University of Agricultural Sciences, who coordinated the Open Innovation Competition, explained how the project was created:

The Open Innovation process will provide technical solutions for urban food production units located in a highly developed urban environment and create a number of societal co-benefits for the community

'The four municipalities identified residual warm water as an opportunity to combine waste reduction and sustainability with enterprise, job creation and social function … [By] establishing a number of real life applications in small scale showing how to combine loops of residual goods. Many of the different parts of the solution is known but no one has put them together in a real life.'

The consortium sought to address these challenges and use residual heat to produce fish, vegetables and other biological goods in production units located in their respective urban areas. By addressing these challenges, it was hoped that the competition would identify positive socio-economic benefits within each respective city, (e.g., employment, education and

The solutions for urban food production units would be located in highly developed urban environments, offering residents various societal benefits. Persson elaborated:

[1] Climate-KIC, Events, www.climate-kic.org/events/open-innovation-urban-food-from-residual-heat/ – Accessed December 2017

'With interest in sustainability and the circular economy increasing worldwide, our partners are hopeful that success in these projects can lay out a template for future projects worldwide, thereby inspiring a lasting positive effect on the environment whilst further motivating the citizens to reflect on their own behaviour and waste.'

In response to the Open Innovation Competition, proposals were submitted by businesses, academics and local residents and were assessed by a panel of industry experts. All proposals focused on three challenges that were deemed necessary to address:

1. The technical challenges – identification and capture of waste heat; maintaining temperature between source and site; overcoming supply fluctuations, and, storing the heat for future use.

2. The biological production challenges – identification of optimal temperature, lighting, ventilation, soil and PH values; obtaining optimal mix of cultivated plants, and identifying appropriate and sustainable agriculture.

3. The business challenges – the production volume of price elasticity for consumers; with potential for job creation, and, social benefits.

Integrating: Supporting the transition to a sustainable city

The 'Open Innovation Competition' enabled stakeholders within the consortium to support and guide the participants as they developed their ideas for market. Support included: professional advice and assistance on how best to progress with turning their idea into a reality and the opportunity to collaborate with world leading companies and prize money (approx up to EUR 210,000) funded by Vinnova, Sweden's Innovation Agency[2]. Awards were made to those participating at each stage of the competition from the second round onwards – though a significant amount was reserved for the winner. The winner would also have the opportunity to develop their idea and be involved in the

[2] SLU, www.slu.se/en/ew-news/2017/3/open-innovation--urban-food-from-residual-heat/ – Accessed December 2017

final regional Residual Heat project. The Open Innovation Competition was structured in three distinct stages, each of which would shortlist participants. It was intentionally designed to be more than a traditional competition, by incorporating the principles of Open Innovation into the DNA of the process; it acted as a platform for innovative participants to collaborate and co-develop their ideas within a community of driven, like-minded people. Bengt commented on the usefulness of the Open Innovation process when selecting the best ideas for the project:

'With our wide-range consortium stretching from municipalities to energy companies, grocery stores and researchers and together with Climate-KIC Nordic we expect a big impact from the Open Innovation process leading to widespread solutions. The real-life applications in our municipalities will be important starting points for the dissemination.'

Implementing: Innovative solutions bringing benefits for all

The main objective of the Open Innovation Competition was to demonstrate how food production can be increased in urban areas where arable land is currently being used for development. The Competition aimed to showcase how new production facilities can enhance economic growth in the region by providing jobs and fostering knowledge exchange – enabling the replication of the technology across Europe. Utilising the residual heat from industrial waste as a way to supply vegetable and fish farming in closed land based systems is an effective solution for ensuring the sustainable supply of food within urban regions. Persson explained that the Open Innovation process will be used again to identify innovation solutions to low carbon challenges within cities:

'We look forward to develop, experiment and build in the coming years.'

The Competition is still in progress, with the successful proposals from the first stage having pitched their ideas at a Pitch Event and Workshop on 2nd October 2017 in Alnarp, Sweden. The best ideas will progress to Stage 2 and receive support and aim to refine their solution and pitch for Stage 3 in September 2018[3].

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[3] Pitching Eventbrite, www.eventbrite.com/e/urban-food-from-residual-heat-open-innovation-pitch-event-tickets-37839161952# – Accessed December 2017

Case #7 – Residual Heat to Urban Food
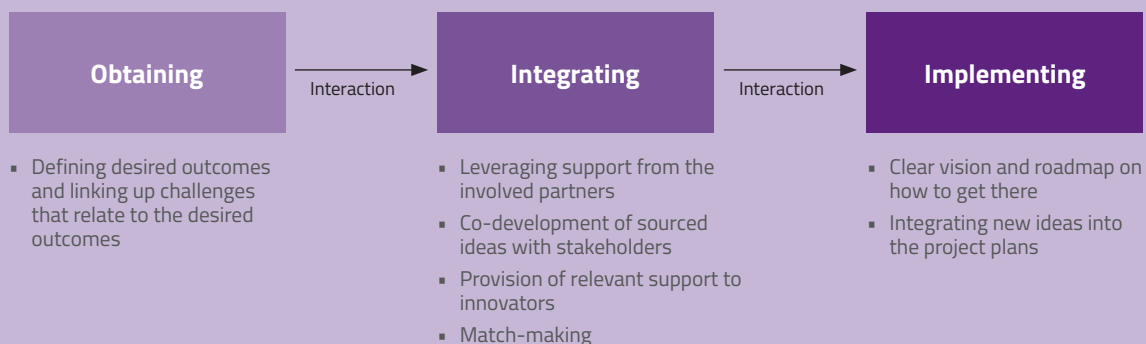
Case Study Summary

The shift from a traditional competition towards an Open Innovation Competition afforded the opportunity for municipalities to engage, not only with world leading companies, but also students, professionals, local residents and SMEs. Instead of the municipality solely designing and implementing a Residual Heat project, it was provided insight into alternative approaches as well as the buy-in from the local Swedish community to develop solutions that cater for everybody.

Challenges:

The shift from traditional competitions can bring challenges – the traditional stakeholder roles can become blurred, as the municipalities collaborate with stakeholders on challenges and are thus more engaged in the solution co-development than previously. This can create challenges as each stakeholder has a different way of working and it is often not clear who is leading the project as there are various stakeholders involved.

Results:

- Over 13 diverse stakeholders joined the Open Innovation Competition consortium from municipalities to world leading companies.

- In the first round for proposals in March 2017, there were 46 submissions from 21 different countries. From this, the competition narrowed down the pool to 28 proposals whose representatives then attended a pitch and workshop event in Alnarp, Sweden.

- Over EUR 210,000 worth of prize money was funded by Vinnova, Sweden's Innovation Agency.

Obtaining	Interaction →	**Integrating**	Interaction →	**Implementing**
• Defining desired outcomes and linking up challenges that relate to the desired outcomes		• Leveraging support from the involved partners • Co-development of sourced ideas with stakeholders • Provision of relevant support to innovators • Match-making		• Clear vision and roadmap on how to get there • Integrating new ideas into the project plans

Findings

Open Innovation in cities can be executed in many ways and thus entails various types of collaboration. The cases illustrate this and paint a detailed account as to the barriers, opportunities and best practices involved in the process of openly developing climate solutions.

Despite certain pluralities, it is possible to identify a number of common issues that run across the cases. In the following section, these barriers and opportunities are highlighted.

Barriers

Breaks in the innovation process
Transforming an idea into a product through Open Innovation processes can often take a long time. In part, this is due to the greater number of collaborators that naturally makes the process more demanding than traditional innovation processes. However, it is also due to the need to develop the required levels of trust and inter-party support needed to keep the process running smoothly. The process of building trust often takes time, especially when the process involves personal ideas, money and a desire to do things the right way.

The discontinuity between the beginnings of integration and actual implementation in many cases represents a serious challenge. The consequences of this challenge can be seen in the Wattelse case in which despite enlisting the help of Climate-KIC and acquiring the right contacts within the City of Copenhagen, they still had to wait over a year before beginning to integrating their product the city's systems. These breaks in the process emerge for many reasons. A significant one is that climate solutions often represent new territory and thus, have not been tried before. Unfortunately, collaborative R&D

... city actors are often the initiators and organizers of Open Innovation processes. Their ability to open up their development challenges to a wider audience represents the main driver of collaborative problem solving

takes time and often the last step of implementation is the most demanding. Although piloting, often the last stage of R&D, is crucial in product

development, it is important that innovators plan beyond this and therefore prevent projects stalling before full implementation.

Discontinuity can cause serious problems for some projects and collaborations. The time spans of different stakeholder groups can vary drastically from each other. For example, a start-up often hopes and expects to achieve results very quickly whereas a municipality is typically more rigid in terms of ways of working and making decisions. This may lead to temporal incompatibility, a phenomenon which is illustrated well in the case of Climate Solutions for Copenhagen.

Cities as facilitators of Open Innovation
At present, it is the city actors who are often the initiators and organizers of Open Innovation processes. Their ability to open up their development challenges to a wider audience represents the main driver of collaborative problem solving. When making a call for solutions it is crucial that the organizing city possesses both

competence and intelligence, often however, many cities and municipalities have little experience of this and their ability to effectively deal with non-traditional partners can be somewhat limited. Yet there are a number of exceptions to this, often found amongst cities with a history of opening up their R&D activities – i.e. Copenhagen – and learning from them is valuable.

**Incoherence of public demand
for new solutions**
Policies and ways of working between cities and municipalities are often too different to allow smooth cooperation. In particular, their climate strategies and sustainability objectives vary a lot. For solution providers wishing to expand beyond their present location this means navigating their way through an incoherent working environment and presents a sizeable barrier to scaling up solutions to new cities. This barrier was exemplified by the experiences of the case of Lyngby-Taarbæk Hackathon and seems to be a commonly faced challenge. In addition,

the willingness of municipal administrations to experiment and take-on risk presents a similar barrier which can reduce the scope of the innovation processes outcomes. Although more related to a municipality's leadership and ambition than its political persuasion, this factor can vary dramatically between administrations. Furthermore, both barriers can make it difficult for companies to establish projects shared between municipalities and can be further exacerbated by varying technology standards between cities.

New and unknown methods of working
Despite its recent growth, Open Innovation is still a relatively new phenomenon, particularly within the city context. When applied to sustainable and climate-smart solutions we are often working with emerging concepts which may or may not even be named yet. Cities and their partners are quite often dealing with "ideas tried without a specific recipe" and in order to progress further, more conceptualizing and continuous creation of vocabulary is needed; this is apparent in the case of the City of Copenhagen.

Methods of interaction between actors within Open Innovation processes are relatively new,

quite numerous and in many cases actors are still unsure as to which is the best way to engage new actors in new circumstances. It can be confusing for cities and companies to identify the most appropriate way of working with each other and systematic tools supporting the collaborative development are needed to overcome this. Furthermore, in Open Innovation there are no defined business models and often they vary a lot from one case to another and are sometimes blurred. For many processes, the business logic is not always visible from the outset and commonly evolves later in the process. Open Innovation – and the utilization of external knowledge – also represents a new business model for cities, the benefits of which need to be articulated.

Pre-requisites for success: What to bear in mind

Traditional stakeholder roles can become blurred
The white paper cases show, that in one form or another, all members of the "quadruple helix" – cities, businesses, knowledge institutions and citizens – are involved in the Open Innovation

Open Innovation White Paper

process. Moreover, some of the cases also exhibit how, through the opening-up of the innovation process, the traditional roles of these stakeholder groups can become "blurred". In the Modena case for example, we can see that through intense engagement during the workshop activities companies – or solution providers – began to constructively influence the city's policy with regards to sustainable mobility. In turn, the city had a more active part

Successful Open Innovation requires supporting actors who connect and match stakeholders together, build bridges between them and act as brokers between the different sub-divisions of the collaboration

in solution development, a process which traditionally the city would be uninvolved in. Looking beyond this, we can also see that through Open Innovation processes, citizens – who traditionally play a "end-users" role – are more engaged in solution co-development. This is particularly visible in the Smart Kalasatama where piloting of solutions takes place in the public domain leaving space for feedback and other forms of follow-up to take place.

Keeping stakeholders motivated and reating the right environment for constructive innovation
Open Innovation, by definition, involves large numbers of actors, stakeholders and collaborators. Large consortia can and often are difficult to manage. Lack of, or loss of, motivation can be problematic in large consortia, especially in projects which have many different – and sometimes conflicting – objectives. Stakeholder or partner motivation is driven through value creation, however, value creation doesn't necessarily refer solely to profit generation. We can see this in the Modena case study, where

the consortia members view value differently – i.e. some, generally SMEs and big businesses – will view value as largely economic, whilst others – i.e. universities and certain start-ups – may also value the idealistic achievements of creating societal and environmental impact. The different ambitions of the stakeholders need to be appreciated by those overseeing the innovation process. This is vital to the overall success of the innovation process as without a tangible end-result that is satisfactory to all parties, members of a consortia may be reluctant to continue.

Furthermore, we can see that establishing the right conditions for the collaboration is also important. Academic literature and observations in our case studies have identified three essential qualities that an Open Innovation ecosystem must possess. These are 1) a platform of equal stakeholders, i.e. there is no structured hierarchy 2) an informal setting and 3) an inbuilt inter-disciplinary nature, the consortia draws upon a comprehensive range of skills and competencies.

The importance of match-makers
Successful Open Innovation requires supporting actors who connect and match stakeholders together, build bridges between them and act as brokers between the different sub-divisions of the collaboration. These match-making actors are essentially acting as civic accelerators building bridges between players and are key in keeping the overall process in motion. Bespoke match-making events are one form of bridge building activity used to enable Open Innovation and they are being increasingly used by supporting actors to do so. Match-makers are crucial in not only bringing different cultures together but also in developing and establishing the models through which collaboration

will take place. The role of match-makers can vary between the different approaches to Open Innovation. In events such as hackathons, they are very "hands on" where as in different – longer and less intense settings – often they can operate more subtly. Typically, match-makers are typically found to be business developers and intermediate organizations however, they have also been known to be progressive

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municipality offices, forward thinking officials and business mentors. Another successful form of match-makers are those based in city districts who are responsible for encouraging bottom-up innovation from the city's start-up and entrepreneurial sector. In Kalasatama we see that the local match-makers do just that, providing a physical space for Open Innovation complete with attractive community arrangements, professional support and access to resources for experimentation.

Opportunities and benefits

New knowledge brings new opportunities
As we have discussed, Open Innovation makes it possible for cities to obtain the best knowledge available in their local ecosystem; i.e. from local universities, companies or user-citizens. Open Innovation processes however, also expand the scope of the municipalities traditional search and reach out to new territory. Through the open process pioneering university spin-off companies that think outside the traditional limits of cities and municipalities, such as ReGen, are suddenly on the radar of local decision makers and thus the range of knowledge

available to them is greater and more comprehensive than before. It is often the diverse mix of knowledge and ways of thinking that makes innovation happen. The example cases in this white paper show that creative combinations of different actors and different areas of society obtained and integrated through Open Innovation processes may lead to entirely new solutions and systems capable of incorporating sustainable concepts, i.e. the circular economy, where previously they were absent.

Open Innovation in cities entails economic, green and societal value
As previously mentioned, Open Innovation can be designed to develop products and services which are sustainable, competitive and increase well-being. Tailoring the Open Innovation process to do so most obviously takes place in the initial obtaining phase – for example, early on a city may announce that it is seeking solutions that perform function X and do so with minimal carbon emissions. However, less obviously, this can also be done in the latter stages of the process. Establishing a strong multi-actor set-up can promote the interests of involved stakeholders throughout. For example, a set-up which heavily involves end-user/customer base – usually citizens in the case of City-led Open Innovation – will often find that their interests are better reflected in the process's outcome. These findings suggest that the strength of Open Innovation's multi-actor set-up is that it allows further value to be achieved beyond the process in question's primary objective.

Such value typically comes across as: economic value for companies, through marketing new products, and for cities, by achieving cost-savings via low-energy solutions; environmental value for cities and the society, e.g. by low-carbon innovations; social value for companies, e.g.

meaningful business; and societal value for the city and the citizens, e.g. job creation.

An innovation`s scalability, both within a city and between cities, is one determinate of its economic value. Scaling up proven solutions however, increases its potential to achieve green and societal value as well. Furthermore, economic value, or profit isn´t always forthcoming immediately. Some cases, such as ReGen, suggest that long-term profit can be potentially achieved by utilizing Open Innovation processes whilst value in the short term is gained in alternative forms, green and societal for example. In fact, cases such as Urban Food from Residual Heat and ReGen are very much geared up to tap into the societal value first and foremost.

Transforming distinctive potential into systemic changes
The size and impact potential of solutions produced through Open Innovation processes can vary from the small-scale to those which qualify as large systemic changes. Certain

types of innovation processes – such as the Hackathon – in the beginning, result in solutions which are small-scale and are limited to specifically solving a targeted problem. Yet, through post-event follow up acts, such as clustering several interrelated solutions at a city level, there is potential to make a more significant impact across the entire city. This can be seen in the case of Kalasatama, where such clustering takes place in the 'Kalasatama Developers Club'. Furthermore, the Kalasatama district is acting as a pilot or 'front-runner' district, in which clustered solutions or otherwise can be put on trial, with those that produce successful results becoming earmarked for implementation in the rest of Helsinki.

When looking beyond city districts or cities themselves, Open Innovation can lead to systemic change or more radical leaps in the whole societies. Systemic change means that sustainable innovation has achieved a broader impact in society. This way, innovation provides a gate to look beyond the obvious.

Summarizing conclusions

Open Innovation can clearly be used as a tool to accelerate the development and increase the quality of climate solutions in the city environment.

The form in which Open Innovation processes can take place however, are varied and plentiful. Through the incorporation of many different types of actors, Open Innovation can create more context-savvy solutions which remain – or are possibly more – competitive on the market. Thus, through adopting Open Innovation into their approach to sourcing solutions, city administrators can create added value across many sectors of the city that would be largely unattainable through traditional means. Typically, the value mentioned here would refer to non-economic benefits such as climate change mitigation, more localised environmental benefits and different forms of societal value. However, Open Innovation can also encourage longer-term economic growth through increased engagement between the municipality and sectors of its innovation ecosystem it traditionally neglects. For example, practising Open Innovation can "nurture" the city's innovation ecosystems that are often ignored through closed processes, in particular this refers to start-ups and entrepreneurs who often struggle to gain access to administrators and decision makers. Furthermore, through increasing the scope of their search and engaging with new types of actors, cities can uncover "new knowledge", elsewise known as knowledge and up-to-date thinking which a city administration would be unlikely to come across otherwise.

The Open Innovation process itself can be divided into three distinct stages – described in the cases as: Obtaining, integrating and implementing – and although transitions between the stages will be improved significantly with

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careful planning, the overall duration of the process or an individual stage can be long regardless. Through studying the aforementioned cases in this white paper, we have been able to

identify a number of barriers which may either prevent city-led Open Innovation events becoming a success or reduce the overall net-benefit a city will receive from utilizing Open Innovation. These barriers however, can to a certain extent be avoided or overcome through a number of actions often based around careful and case specific prior planning.

This white paper has aimed to scrutinize the process of Open Innovation from the perspective of city administrations who wish to make the transition towards being sustainable and zero-carbon. It shows the richness of the tools and methods applicable to the process of Open Innovation and tools such as: Co-creation, living labs, crowd sourcing and many other forms of Open Innovation are in active use and often well-tailored to a city's needs.

Although the "opening up" of city still represents relatively new approach, there is a considerable amount of knowledge behind it. This knowledge is distributed across many cities and other stakeholders, although more it is more prominently found in "more advanced" cities. Given that the knowledge is scattered across many municipal geographies and organisation, continuous learning among cities and their collaborators is needed in order to secure its dissemination and practical uptake.

Open Innovation – trumpeted in some areas as the "new normal" – is very much based on the idea that today's solutions are created in problem-solving networks. In the light of the White Paper, this seems to very well fit in cities' search for solutions for a sustainable future. New ways of doing things in order to open up the city are firmly taking their place.

References

Adner, R. 2006. Match your innovation strategy to your innovation ecosystem. *Harvard Business Review*, 84(4): 98-107.

Almirall, E., Lee, M. & Majchrzak A. 2014. Open Innovation requires integrated competition-community ecosystems: Lessons learned from civic Open Innovation. *Business Horizons* 2014 (57). 391-400.

Arnkil, R., Järvensivu, A., Koski, P. & Piirainen, T. 2010. *Exploring Quadruple Helix. Outlining user-oriented innovation models.* Working Papers 5/2010, Työelämän tutkimuskeskus. University of Tampere.

Bogers, M., Zobel, A.-K., Afuah, A., Almirall, E., Brunswicker, S., Dahlander, L., Frederiksen, L., Gawer, A., Gruber, M., Haefliger, S., Hagedoorn, J., Hilgers, D., Laursen, K., Magnusson, M. G., Majchrzak, A., McCarthy, I. P., Moeslein, K. M., Nambisan, S., Piller, F. T., Radziwon, A., Rossi-Lamastra, C., Sims, J., & Ter Wal, A. L. J. 2017. *The open innovation research landscape: Established perspectives and emerging themes across different levels of analysis.* Industry and Innovation, 24(1): 8-40

Chesbrough, H., & Bogers, M. 2014. Explicating Open Innovation: Clarifying an emerging paradigm for understanding innovation. In H. Chesbrough, W. Vanhaverbeke, & J. West (Eds.), *New Frontiers in Open Innovation:* 3-28. Oxford: Oxford University Press.

Chesbrough, H. 2003. *Open Innovation: The New Imperative for Creating and Profiting from Technology.* Boston, MA: Harvard Business School Press.

Community Innovation Survey 2015. ec.europa. eu/eurostat/statistics-explained/index.php/ Innovation_statistics

Cohen, W. and Levinthal, D. 1990. *Absorptive capacity: A new perspective on learning and innovation*, Administrative Science Quarterly, 35(1):128-152.

Harmaakorpi, Vesa & Melkas, Helinä 2012: Introduction. In Harmaakorpi, V. & Melkas, H. (Eds). *Practice-Based Innovation: Insights, Applications and Policy Implications.* 1-16. Berlin-Heidelberg, Springer.

Hautamäki, Antti & Oksanen, Kaisa 2015. Sustainable Innovation: Competitive Advantage for Knowledge Hubs. In P. Lappalainen, M. Markkula & H. Kune (Eds): *Orchestrating Regional Innovation Ecosystems, Espoo Innovation Garden.* 87-102. Finland, Otava.

Hautamäki, Antti & Oksanen, Kaisa 2016. Sustainable Innovation: Solving Wicked Problems Through Innovation. In Anne-Laure Mention & Marko Torkkeli (Eds): *Open Innovation: A Multifaceted Perspective.* 87-110. Singapore, World Scientific Publishing.

Laitinen, I., Harisalo R., Stenvall, J. 2013. Palvelutiede julkisten palveluiden uudistajana: kansainvälinen vertailu. Tampere University Press.

Leminen, S. & Westerlund, M. 2015. Cities as Labs: Towards Collaborative Innovation in Cities. In P. Lappalainen, M. Markkula & H. Kune (Eds): *Orchestrating Regional Innovation Ecosystems, Espoo Innovation Garden.* 167-176. Finland, Otava.

Lundvall, Bengt-Åke 2007: Innovation System Research: Where It Came from and Where It Might go. Globelics working paper series No 2007-01. The Global Network for Economics of Learning, Innovation and Competence Building System.

Raunio, M., Nordling, N., Ketola, T., Saarinen, J., Heinikangas, A. 2016. *Open Innovation Platforms, an approach to city development. Handbook for developers.* Helsinki, 6Cities Strategy.

West, J., Salter, A., Vanhaverbeke, W., & Chesbrough, H. 2014. Open Innovation: The next decade. *Research Policy*, 43(5): 805-811.

Webb, N. 2010. *The Innovation Playbook.* John Wiley & Sons, Inc. 1st ed: 83

Webb, N. and Thoen, C. (2011). The innovation playbook. 1st ed. Hoboken, N.J.: J. Wiley & Sons, Inc.

West, J., & Bogers, M. 2014. Leveraging external sources of innovation: A review of research on Open Innovation. *Journal of Product Innovation Management*, 31(4): 814-831.