



SUSTAINABLE URBAN TRANSITIONS

A model for understanding the
emergence of innovation in
sustainable urban development

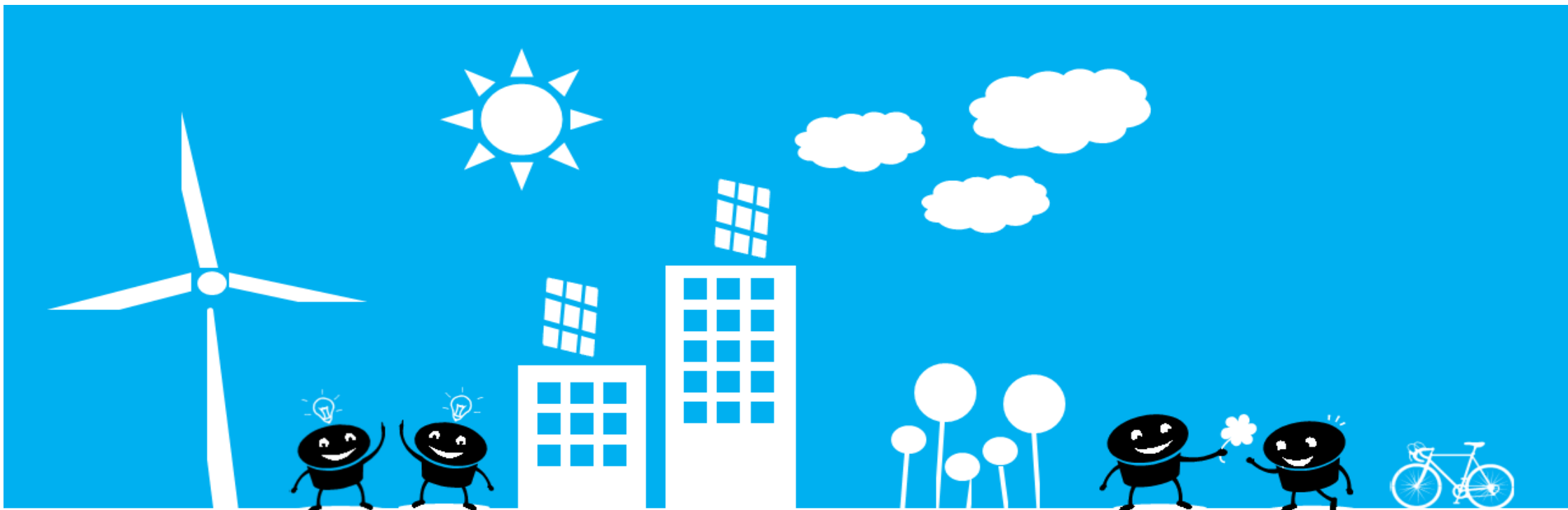


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INTRODUCTION

Cities today are facing major challenges, such as climate change and growing populations. With increasing urbanisation and expanding cities, the optimisation and allocation of resources in cities becomes more important. At the same time, urban systems need to be adapted and developed in a long-term and an environmentally responsive way in order to create sustainable conditions for inhabitants. Segregation is yet another challenge that must be taken into account in order to create sustainable cities.

The term ‘sustainable urban development’ is based on the concept of sustainable development, and includes taking economic, environmental and social sustainability aspects into account in urban development. A sustainable city can be defined as an urban area that enables its inhabitants to enjoy a good economic and social life without using the earth's resources in an unsustainable way.

Achieving sustainability in a city involves transitioning from a current system to a future sustainable system. This transition creates a challenge for public organisation, but also for incumbent actors controlling resources that are embedded in today's cities.

Innovation has been pointed out as an important aspect in meeting urban challenges. Mistra Urban Futures, a Swedish collaborative centre for sustainable urban development, assigns innovation a significant role in enabling sustainable societal transitions, and explores the link between sustainable urban development and innovation. Vinnova, the Swedish Governmental Agency for Innovation Systems, has funded a program for developing innovation platforms for sustainable and attractive cities.

Gothenburg is one of four cities receiving grants, with Mistra Urban Futures as one of the project partners. The purpose of the project is to develop a platform to facilitate the emergence of innovations that may contribute to handling urban challenges.

Currently, the understanding of innovation in sustainable urban development is weak. The concepts of innovation and sustainable urban development have not been thoroughly combined and a clear systemic framework for understanding the emergence of innovation in sustainable urban development is lacking. This hinders cities in their work with sustainable urban development and Gothenburg is no exception. Thus, there is a need to understand how to induce and support the emergence of innovations for sustainable transitions of cities, to recognise the actors that must be involved, and identify prerequisites for a successful realisation. This report addresses this need by presenting a model for understanding the emergence of innovation in sustainable urban development. This work is commissioned by Mistra Urban Futures within the Gothenburg innovation platform, and carried out by SP, the Technical Research Institute of Sweden.



INNOVATION IN URBAN DEVELOPMENT



Creating a sustainable city through innovation includes taking all sustainability dimensions into account – that is economic, environmental and social sustainability. Often, technological innovations focus on improving economic and environmental features in buildings, transport systems and energy systems by introducing new products, services or processes of commercial value.

Meeting the social dimension of sustainability requires creating innovations with a societal value. Social innovations explicitly aim at this requirement since they target social needs by means of generating and diffusing innovations with a high societal value through social processes of innovation that include open and inclusive relationships and collaborations. An example of a social innovation can be a second hand store that supports a sustainable lifestyle through the reuse of clothing. Social innovations may include technical solutions with a commercial value but primarily aim at creating a societal value. Social innovations are considered essential in sustainable urban development and to the sustainable growth of cities by creating acceptance for change. This acceptance is important in urban development since cities need to continuously change and adjust in order to persist. Change and innovation is indeed required in order to shift from today's urban environment to a future sustainable one. In other words, this requires that a sustainable societal transition takes place.

This report defines an innovation in sustainable urban development as **"a social innovation that contributes to a sustainable transition in an urban environment"**. This, thus, includes all innovations with a purpose of creating societal value and contributing to a transition towards a sustainable city.

For innovation in sustainable urban development to emerge, a variety of actors need to interact. This includes citizens who have an important role in fostering creativity and acceptance for change.

POINT OF DEPARTURE

Two frameworks - *Transition Management* and *Technological Innovation Systems* – are the point of departure for the model presented in this report. They underpin the understanding of the emergence, development and diffusion of innovation in sustainable urban development through providing a holistic approach to innovations and transitions.

TRANSITION MANAGEMENT

Transition Management (TM) is a guidance framework that seeks to create a systemic change, i.e. a transition, in a societal system, such as the energy or transport system, by focusing on solving problems in a long-term perspective. TM can be regarded as an instrument to enable sustainable development and emphasises that a variety of actors need to be involved in the process of inducing transition.

TM includes four process steps which provide guidance for the management of transitions. These steps are not intended as an off-the-rack framework that can be used in any context, but need to be adapted to the specific conditions of a particular transition process.

The process steps run from identification of problem areas and the involvement of different actors to the experimentation and diffusion of innovation.

TECHNOLOGICAL INNOVATION SYSTEMS

The Technological Innovation Systems (TIS) framework focuses on processes that are essential for innovations to develop and diffuse. While taking a technology (knowledge and artefacts) as a point of departure, the framework accounts for social aspects of the innovation process as it includes the social networks (political or knowledge) of actors (companies, public bodies and universities) that interact in order to develop and diffuse innovation, as well as the institutions (norms, laws and regulations) that condition the interaction.

A well-functioning innovation system enables a systemic change. This change may be in the magnitude of a transition. To understand this change, the framework breaks down the larger process of development and diffusion of innovation into a number of functions. This provides insights to what is happening in the TIS and how well it works. The functions are often used to identify barriers to innovation. For instance, actors that significantly benefit from the existing system will be particularly unwilling to change. Moreover, the functions can also be used to provide a systems perspective on innovation for other needs, such as understanding the emergence of innovation in sustainable urban development.

THE MODEL

Taking the previously mentioned frameworks as a point of departure, the model in this report offers a tool for capturing and explaining the process for creating innovation in urban development. It is structured around six steps in an innovation process for sustainable urban development. Eight functions are identified as relevant, and ordered in the model depending on the step of the process in which they are considered important. Many different actors contribute to the functions through their activities, and these actors are arranged in four key groups. The model enables mapping of the actors as well as the functions that need to be in place in order for the process to unfold and innovations to emerge.

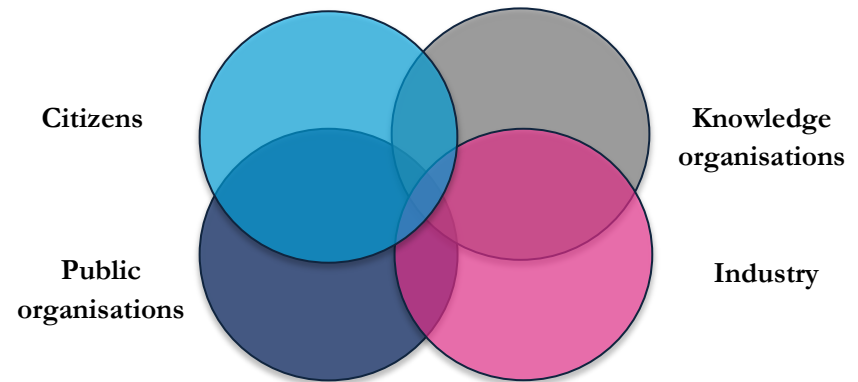
GROUPS OF ACTORS

A variety of actors is needed in order for innovation in sustainable urban development to materialise. Hence, it becomes important to be able to identify this diversity. To facilitate the recognition of the actors that need to be involved, four groups of actors based on different actors' role in urban development are suggested. The groups are: *Public organisations*, *knowledge organisations*, *industry* and *citizens*.

Public organisations have the role of decision-making in the urban development process, and of involving and providing incentives for other actors. Hence, this group of actors must be included in the innovation process, as they are ultimately responsible for its development. *Knowledge organisations* have the role of contributing new knowledge while *industry* mainly aims at generating growth. *Citizens* may be seen as end-users for urban innovations and are important actors for change and creativity.

These key groups of actors may be divided into a number of subgroups as displayed in the table on the next page. This facilitates the categorisation of actors which can be considered to belong to multiple groups. For example, it may be unclear whether Science Parks belong to *industry* or *knowledge organisations* as they are bridging organisations between the two. Moreover,

they are often publicly funded, which also creates a categorisation challenge. However, their main role is to help small businesses grow and not to develop knowledge, which is the main role of *knowledge organisations*. Therefore, Science Parks are included in the subgroup *supportive organisations* in the *industry* group.



GROUPS AND SUBGROUPS OF ACTORS	DESCRIPTION
Citizens	
Individual citizens	Includes individuals from diverse parts of society.
Interest groups	Includes two or more individuals that join together because of a common interest. This includes groups of citizens that are not yet, or will never be, organised in a formal organisation.
Non-profit organisations	This includes co-operatives and economic associations that do not generate and distribute profits but uses surpluses to achieve other goals. An association for urban gardening is an example.
Public organisation	
Authorities, regions and municipalities	The main part of this sub-group consists of decision-making organisations such as municipalities and governmental agencies. Examples are the City of Gothenburg and the region of Västra Götaland.
Supportive teams	Focus groups with the aim of managing and monitoring the development of a city. This includes transboundary teams between different authorities, regions and municipalities.
Knowledge organisations	
Research institutes	This subgroup can be exemplified by technical research institutes, such as SP, and test arenas, such as HSB Living labs.
Academia	Includes university and colleges, such as Chalmers and Gothenburg University.
Other educational organisations	This includes schools that have a specific focus of relevance for sustainable urban development issues, such as an agricultural school.
Industry	
Private companies	This subgroup includes a diverse set of private companies, such as manufacturing corporations like Volvo or Ericsson, general distributors like Willys, and banks.
Municipal companies	This group consists of companies that are municipally owned. Swedish examples are Gothenburg Energy, Business Region Göteborg or Älvstranden Utveckling AB.
Supportive organisations	This subgroup includes companies that have a supportive function in the form of expertise. Swedish examples are Johanneberg Science Park or Mistra Urban Futures.

FUNCTIONS AND THE ROLE OF ACTORS

In order for innovations to emerge, a number of functions need to be in place. In the case of urban development, eight relevant functions are identified and adapted drawing on the functions in the TIS framework. These are displayed in the table on the next page. The functions are mapped with respect to one or several of the steps of the innovation process. The mapping is based on whether the function is considered important for the particular step to unfold.

The TIS framework maintains that some actors may influence multiple functions and one function can be influenced by many different actors. This is consistent with experiences from urban development. Experiences also reveal that certain groups of actors have crucial roles in the development of functions. Therefore, it is essential that these crucial actors are involved at the right moment in the process. Certain groups of actors tend to have a greater impact on the realisation of certain functions, although actors from other groups may of course contribute.

An example regarding the function inducing creativity and experimentation includes citizens (e.g. individual citizens and interest groups) that usually tend to be creative and initiate grassroots innovations. These are innovations that often arise as bottom-up solutions to resolve local societal issues and to promote sustainable development.

The table on the next page describes the functions, as well as the key groups of actors that need to be in place in order for each of the functions to develop well. It reveals the importance of, at one point or another, engaging all groups of actors in the process of creating innovations for a sustainable city.

FUNCTIONS	DESCRIPTION	KEY GROUPS
F1: Inducing creativity and experimentation	Supporting the emergence of innovations requires inducing creativity and creating spaces and opportunities for experimentation. This includes searching for potential markets or application areas.	Industry and citizens
F2: Creating and diffusing knowledge	The creation of new knowledge and the combination of existing knowledge in new ways is an important part of the innovation process. This also includes disseminating and transforming knowledge through feedback and learning.	Knowledge organisations and citizens
F3: Understanding the roles	As described, different actors hold different roles in the development of a city, and collaboration between these actors is essential. To facilitate collaboration, it is important to create a common understanding and recognise each other's roles and contributions. This will also assist in involving the right people at the right moment.	All actors
F4: Building trust	Collaboration also requires trust and social coherence, which needs to be built up between actors engaged in the process.	Public organisations
F5: Creating motivation	The process of innovation will require actors to participate and dedicate resources. For this to take place, actors need to feel motivated. If motivation is lacking, incentives may need to be developed.	Public organisations
F6: Identifying and formulating need	If innovations are to be diffused, a demand in terms of need or interest must be identified and formulated.	Industry and citizens
F7: Mobilising resources	The unfolding of an urban innovation process requires that substantial resources in the form of funding, human capital and infrastructure are mobilised.	Public organisations and industry
F8: Creating acceptance of change	Implementing innovations will require varying degrees of change for actors. This may require that actors are indeed willing to change. If not, a change in attitude and behaviour needs to be created.	Citizens

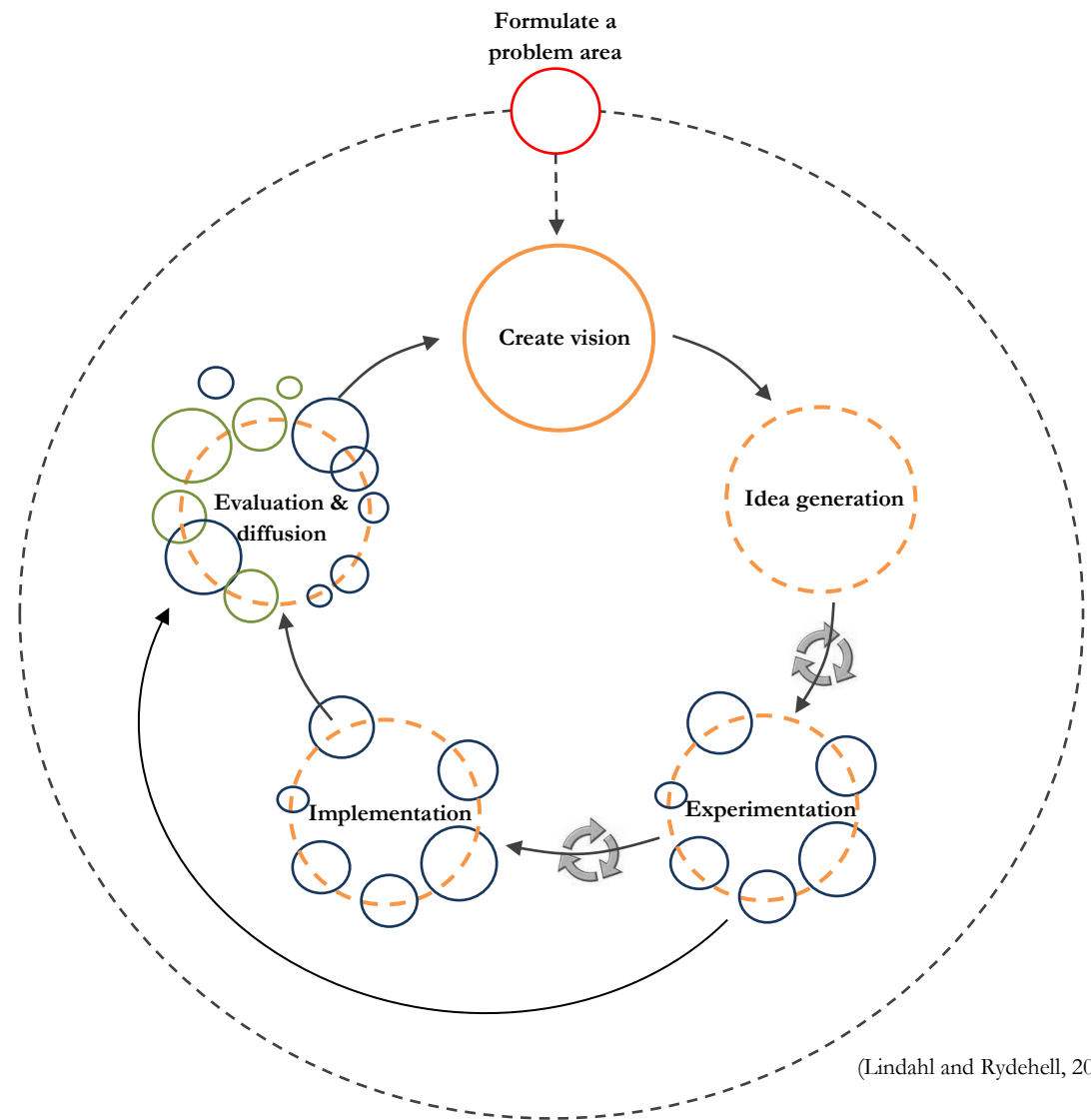
THE INNOVATION PROCESS

Drawing on previously presented frameworks and experiences from urban development, the innovation processes for sustainable urban development will now be presented. The functions and actors are mapped in relation to six steps in the innovation process: *Formulate a problem area*, *Create vision*, *Idea generation*, *Experimentation*, *Implementation* and *Evaluation & diffusion*.

The process starts with an initiative based on an identified *problem area*. Thereafter, a number of stakeholders are involved to define the problem and *create a vision* for a long-term solution. This is followed by an *idea generation* and *experimentation* step that will develop and test new ideas and solutions. Eventually, the solutions are verified further through various projects, as illustrated by the smaller blue circles. *Idea generation* and *experimentation* are iterative steps, as illustrated by the bold feedback arrows between the two.

The ideas that are ready for implementation (i.e. have a targeted market or a societal application) proceed to the next step, which also is iterative. Finally, the process, as well as the ideas, is evaluated and experiences are disseminated. Ideas that are not suitable for implementation are also evaluated, as illustrated by the direct outer arrow. Evaluation of the process can lead to new ideas, which are symbolised by the green circles.

The last four steps in the model are open for the involvement of additional actors, as illustrated by the dashed circles that symbolise these steps.



FORMULATE A PROBLEM AREA

To formulate a problem area makes up the first step of the model and includes 3-5 people forming a so-called *transition team*. The *transition team* can be seen as a management group that monitors the process. The group has formed because a set of individuals have identified a problem area which they want to solve. An example of a problem area could be increased urbanisation where urban development actors join forces to find innovative and sustainable ways to solve housing shortage. A key activity in this step is for the *transition team* to map actors in order to involve and engage the relevant ones in a so-called *arena group*. The *arena group* consist of 10-15 people, and even if the *transition team* initiates the innovation process, it is the *arena group* that drives it. The work of the *arena group* is embarked on in the next step.

It is essential that the *arena group* is represented by heterogeneous actors with different backgrounds who have the ability to think outside the box. This is important in order to avoid setting up a group of individuals with the same way of thinking and to contribute with diversity and creativity to the process of generating innovations.

The mapping and selection of actors for the *arena group* can be facilitated by taking the groups of actors (including subgroups) as a starting point. This may increase the probability for diversity and creativity in the group and, thus, the chances for succeeding with a transition. Preferably, individuals from all of the different groups of actors should be involved. This may require that the *transition team* choose actors that they usually do not work with.

A valuable way to start the mapping and selection of actors for the *arena group* might be to approach an actor who is creative, knowledgeable as regards the

problem area and has a well-developed network. In the case of urban development, such an actor is often found in *supportive organisations*, such as Science Parks (in the *industry* group), since these have connections to both *knowledge organisations* and *industry*. The more actors that are identified for each group of actors the better, since it increases the chance for diversity. In some cases it may be difficult to identify actors from each group (such as *individual citizens*) and it may be necessary to proceed with just a few alternatives. It can then be problematic if those few actors are unwilling or unable to participate in the *arena group*. Thus, the more actors identified from each group, the easier it will be to form a heterogeneous *arena group*.

This first step of the process requires that the *transition team* understands the role of different actors. Creating trust is also vital for getting different actors to participate and interact. In addition, actors need to feel motivated as well as understand why their participation is important and what they can contribute.

Urban transitions can involve different system sizes – larger systems (such as a city) or smaller systems (such as in various urban development projects). Depending on the size, the *transition team* can consist of individuals from *public organisations*, as well as from other groups of actors. For transitions that include the city's larger system, the *transition team* should consist of *public organisations*, as they have the key role in the functions required in this step.

Key functions: **Understanding the roles** (F3), **Building trust** (F4) and **Creating motivation** (F5).

CREATE VISION

The second step includes creating a vision for the problem that the innovation process targets. When initiating this step, the *arena group* has already been formed and their first task is to produce this vision that aims to capture the issue formulated in the problem area.

The *arena group* breaks down the underlying problem within the problem area noted by the *transition team*. In this step, it is thus essential that the members of the *arena group* create a common understanding of the problem. They also need to understand each other's roles and expectations in order to create a vision with long-term objectives.

It is also important that members of the *arena group* are open to new ideas and approaches and not easily get stuck in old habits. Moreover, persons selected for the *arena group* should be aware of what their role is, which should be communicated by the *transition team*.

This step needs to be given a good portion of time. It is indeed a time-consuming process to get all the actors involved to understand the expectations that exist within the group, as well as to create a shared idea of how to approach the selected problem area. Everyone needs to be aware of what needs to be done and the direction of the group.

Thus, this step involves the *arena group* creating social cohesion and a common vision. This indicates the need to understand each other's roles and for actors to feel mutual trust.

Key functions: **Understanding roles** (F3) and **Building trust** (F4).

IDEA GENERATION

In order to find solutions for the targeted problem, you need to have a set of options of different paths that may meet the vision created in the previous step. The third step is therefore about idea generation. This involves developing a number of optional solutions for the problem which will include short and long term goals and actions. In this step, the *arena group* formulates targets and identifies paths that have the potential of solving the defined problem. The paths should include a) a description of the transition that must take place in order to reach the target, and b) a transition agenda that includes what needs to be done and by whom. The *arena group* also needs to prioritise between different paths in order to take the relevant ideas to the next step in the process. In order for the process to generate sustainable urban innovations, the ideas should target creating a societal value and the solutions should be sustainable for the particular city.

Succeeding in this step requires that actors generate many different ideas, which calls for creativity and motivation. It may be useful to involve

additional actors in the step to increase creativity and bring out more ideas. As illustrated by the dashed circle in the figure on page 8, the step opens up for involving more actors. Actors previously have been difficult to identify and engage, such as individual citizens. These actors may instead be involved in this step. An example is involving residents in an area under redevelopment. In order to involve more actors it becomes important to be able to motivate them and provide incentives for their involvement. If a vision can be firmly established among the involved actors in the step, it will be easier to engage them. The more actors engaged in the process, the more important it becomes to be able to understand each other's roles and contributions.

Key functions: **Inducing creativity and experimentation** (F1), **Understanding the roles** (F3) and **Creating motivation** (F5).

EXPERIMENTATION

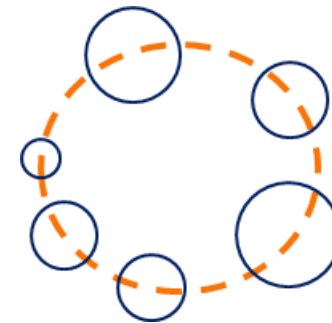
In this step, experiments are introduced with the aim of testing different ideas and options. This includes testing and demonstrating developed ideas and solutions to see if they are viable. Experiments also provide the opportunity to develop existing ideas and solutions one step further. The ideas and solutions are tested in the form of projects that are symbolised by the small rings in the figure on page 8, and below. The experiments should be short-term and specific enough to be feasible, yet sufficiently radical to be seen as a change to the existing system.

This step includes investigating if there is an actual market for the idea, i.e. if there is a need or interest. The targeted market may not always be of a commercial nature, but can also include a non-commercial need, such as green areas or inclusive spaces. Additional actors, such as *citizens*, may also be involved in this step, in order to assist and engage in experimentation.

Experimentation is resource intensive and therefore it is important that resources are available in order for the step to proceed successfully.

All ideas and solutions are not always ready to move on to the implementation step. The experimentation step may reveal unfeasible features of some ideas and solutions that have to be rejected. It may still be fruitful to spread knowledge and experiences gained from experimenting with the rejected idea in order to learn from mistakes and stimulate the creation of new ideas. Ideas that are not ready or unsuitable for implementation can thus proceed to the evaluation & diffusion step, as symbolised by the outer arrow between these two steps in the figure on page 8.

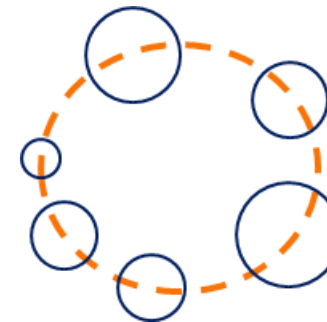
Key functions: **Inducing creativity and experimentation** (F1), **Creating and diffusing knowledge** (F2) and **Mobilising resources** (F7)



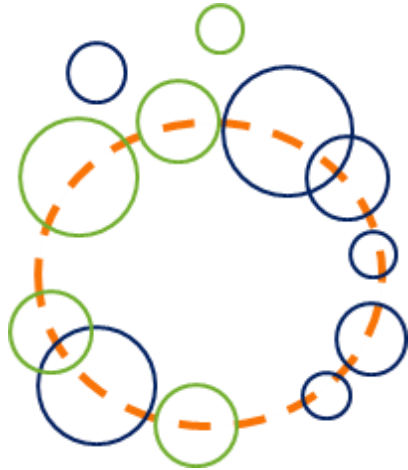
IMPLEMENTATION

In this step, the idea is physically implemented into the urban environment. For an idea to evolve into a true innovation it must be implemented and the knowledge about it must be diffused. For this to occur, a market and an acceptance of change must exist. The implementation of an idea into the urban environment often requires that substantial resources are mobilised. In this step, additional actors can be involved in order to assist with the implementation. For some type of innovations, social media has been highlighted as an important tool for accelerating the implementation, and thus the transition, as ideas can be spread more quickly. Social media may also induce the acceptance of change in society.

Key functions: **Creating and diffusing knowledge** (F2), **Identifying and formulating need** (F6), **Mobilising resources** (F7) and **Creating acceptance of change** (F8)



EVALUATION & DIFFUSION



In this step, ideas and solutions should be evaluated in order to create a learning process and generate new projects and ideas. Ideas that emerge from the process can lead to spin-off projects and new ideas, which are symbolised by the green (new ideas) and blue (spin-off projects) small rings that are detached from the step in the figure on page 8. It is the *transition team's* role and responsibility to capture innovations and make sure that they are further disseminated. They also have the task of motivating different actors to adopt new visions and ideas that are in line with the innovation developed in the process. The changes come to life by being adopted by other actors and implemented through actions. This will further diffuse the innovation and increase its impact. Also, new additional ideas may have been generated throughout the process, and these can be followed up by new *transition teams*, and so a new innovation process takes off.

Diffusing and implementing innovations widely into other areas may require adoption to new contexts. This includes recognising differences between contexts that may create barriers for adoption. Different cities or regions hold diverse cultures, demographical patterns, natural environments and institutional set-ups. These differences may bring out new challenges for the diffusion of an innovation. For instance, the diffusion may be dependent on a certain actor or environment that only exists in a specific area. Also, particular laws and regulations may hinder the diffusion, or the innovation may be particularly expensive to implement in a particular setting. An evaluation can be undertaken in order to identify such barriers.

Key functions: **Creating and diffusing knowledge** (F2) and **Creating motivation** (F5)

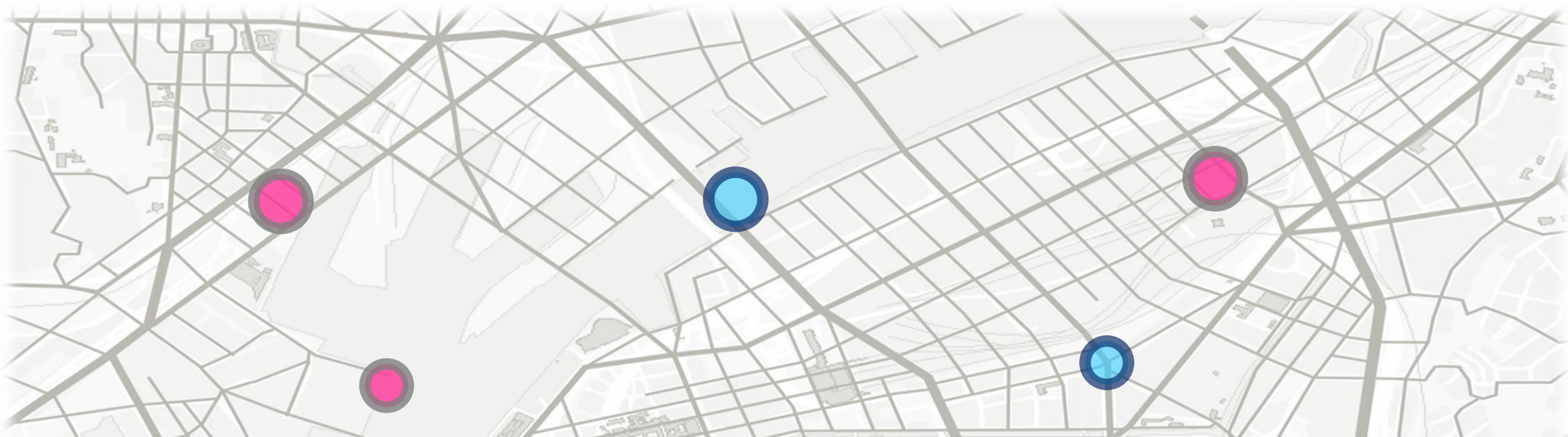
CONCLUDING REMARKS

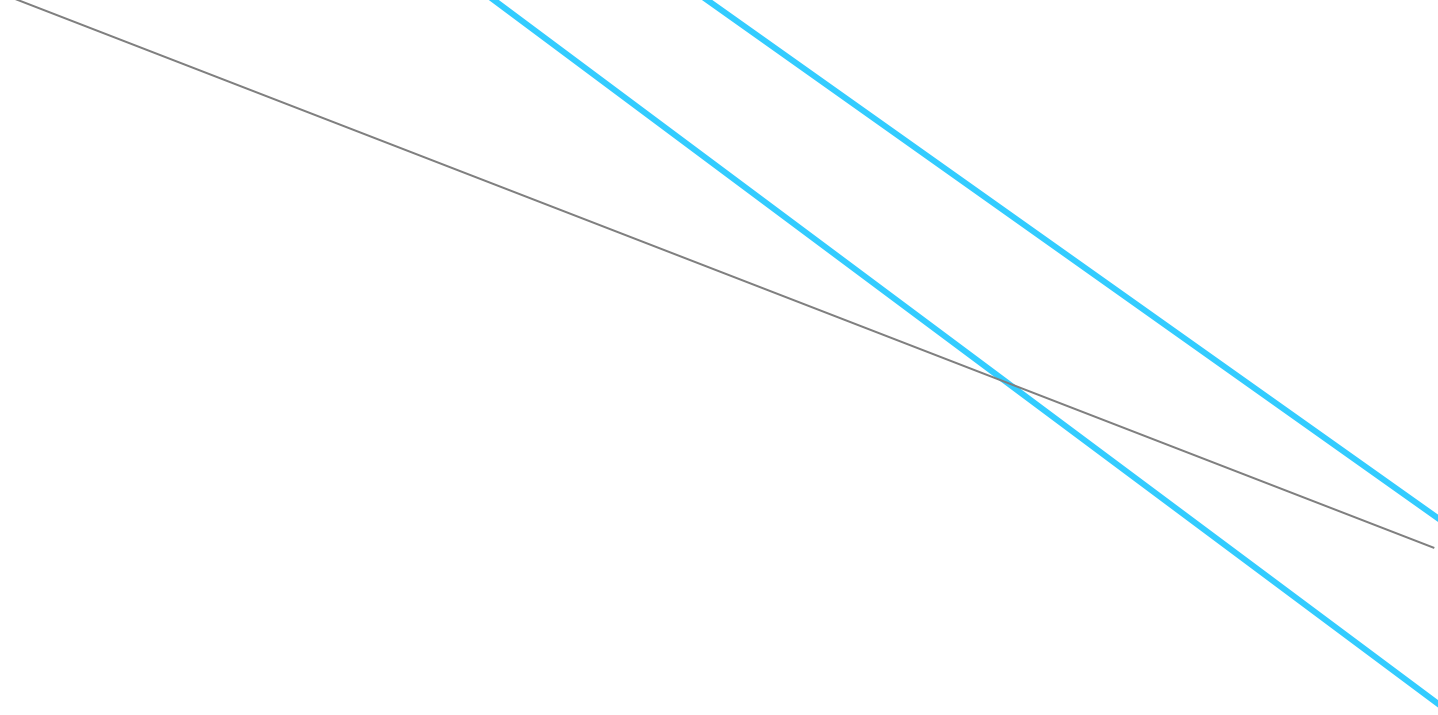
This report has offered a model for understanding the emergence of innovation in sustainable urban development. The model provides an inclusive framework for urban development projects that offers orientation as regards how far into an innovation process a project has come, as well as guidance on what needs to be done given a particular process step. The categories of groups and subgroups of actors make it easier to get an overview of the engaged actors and provide guidance for involving heterogeneous parties in the process. The connection between groups of actors and functions also contributes to the understanding of why different actors need to be involved in different steps of the process.

This model has provided the city of Gothenburg with a valuable tool for working with innovation and sustainability in urban development. Currently, the city applies the model in their work with developing an innovation platform for urban development. For instance, this has allowed individuals within the innovation platform to develop knowledge about their specific role

in the innovation process, as well as provided them with a general understanding about innovations in sustainable urban development. Although experiences so far only include the city of Gothenburg, the model aims at offering a generic tool. The process steps and the groups of actors do not appear to differ much between cities. Thus, the model appears to be viable to other cities than Gothenburg. Yet, applications of the model into new and diverse context will most probably require revisions.

In conclusion, the model contributes to the general understanding of how the process of innovation in sustainable urban development comes about. It also provides recognition of the groups of actors that needed to be involved in order to create a sustainable city through a well-functioning innovation system.





For more information refer to the master thesis: **Lindahl, E. and Rydehell, H. (2014). *Sustainable Urban Transitions – A model for understanding the emergence of innovation in sustainable urban development.***

Elin Lindahl
elin.m.lindahl@gmail.com
070-610 24 78

Hanna Rydehell
h.rydehell@gmail.com
070-978 13 91

Eugenia Perez Vico
eugenia.perezvico@sp.se
070-512 59 87

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