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PhD Thesis

A RESILIENCE TRANSITION
FOR SUSTAINABLE URBAN DEVELOPMENT:
A process design methodology
to support participatory decision making

Supervisors

Prof. Xavier ALVAREZ del CASTILLO

Emeritus Prof. Leo JANSEN (in memoriam)

Author

Nicola TOLLIN

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ABSTRACT

Following a review of sustainable development principles and key urban challenges, as climate and global environmental changes, the thesis develops a process design methodology for urban resilience transition. The methodology is based on broad stakeholders' participation, following co-design and co-evolution principles. The process design methodology delivers a significant innovation, contributing to planning theory and practices for urban resilience, through an integrated cross-scale approach including both time and space dimensions, which is novel compared to current state of the art. Moreover, the process design methodology is based on a participatory approach, which re-defines the role of planner in a wider perspective, considering it as a facilitator of planning and design processes, more than a demiurge.

KEY WORDS

Sustainable Urban Development, Urban Resilience, Transition, climate change adaptation and mitigation, process design

PROLOGUE

Frame

Today over 50% of world population lives in urban areas (75% in EU), and cities account for 60-80% of global energy consumption and the same share of GHG CO2, producing 50% of global waste, consuming 75% of natural resources and producing 80% of global GDP.

Cities are facing key global challenges, related to climate change and global environmental change, with high negative impact worldwide. This requires immediate cross-scale action, to mitigate the negative externalities of cites activities on climate and environment, and to adapt cities to the global changes and their negative impact; at the same time reducing and preventing slow and rapid on-setting risks.

Theme

Sustainable development is a dynamic and continuously adapting process, not a final state. For this reason it has to be managed as a transition pathway from the current state of unsustainability, to a more sustainable one. This transition process is characterized by constant mutations and changes occurring in time and space, which are evolving in parallel to our knowledge development, allowing an increasing better understanding of present uncertainty factors.

Knowledge gaps

There are evident knowledge gaps, that this thesis is addressing, as described within the state of the art section, including:

- Very limited research on urban resilience, able to integrate mitigation, adaptation and risk management; and inexistence of formalized resilience planning methodologies;
- Limited research on urban transition to sustainability, and lack of spatial determinants within transition studies;
- Very limited research on how to define, in a participatory way, the target scenarios of backcasting processes.

The objective

The objective of this thesis is to develop a participatory process design methodology, addressing the knowledge gaps mentioned above, able to guide and support decision making, involving stakeholders and particularly local communities, in a constant dialogue under the principles of co-design and co-evolution.

Methodology

The research methodology, used for developing the process design method, consists in a background analysis of the conceptual development of "sustainability" and "urban sustainability", which is used to determine a working definition of sustainable urban development. This preliminary phase is followed by

3

the analysis of current theories regarding transition, system thinking and resilience, demonstrating the need of basing the participatory process design method, on spatial-temporal integration and integrated evaluation. Finally the process design method is developed and testes, using a knowledge brokerage setting in a real-life environment.

The development of the process design method was also based on the collaboration and discussion with many colleagues, at international level, through the development of EU FP7 and H2020, all of them marked above the thresholds after rigorous peer evaluation by EU, and some of them financed.

Results

The main result is a complete process design methodology for resilience transition based on participatory planning, integrating multiple spatial and temporal dimension, using a systemic approach and supported by an integrated evaluation system, which is ready to use in any operational environment.

The process design methodology has been developed, with reference to EU Technology Readiness Level (TRL), from a starting point of "TRL 1: idea inception" to a final point of "TRL7: prototype demonstration in operational environment".

The key innovations achieved include:
- The integration of mitigation, adaptation and risk for urban resilience planning.
- The integration of spatial dimensions within sustainability transition processes.
- The integration of a participatory selection process of desirable/realistic target futures within participatory backcasting.

The process design methodology includes also a shorter simulated version, called "knowledge brokerage", which is used to introduce the methodology to potential users and to collect preliminary information for its later application.

4

ACKNOWLEDGMENTS

TABLE OF CONTENTS

9

LISTS OF FIGURES AND TABLES

LIST OF ABBREVIATIONS AND SYMBOLS

A21 Agenda 21

AESOP Association of European Schools of Planning

DPSIR Drivers, Pressure, State, Impact, Response

EEC European Economic Community

EU European Union

FP6 Frame Program 6

FP7 Frame Program 7

H2020 Horizon 2020

IAIA International Association of Impact Assessment

ICLEI International Council for Local Environmental Initiatives

IFHP International Federation for Housing and Planning

ISDRS International Sustainable Development Research Society

ISOCARP International Society of City and Regional Planners

LA21 Local Agenda 21

LCA Life Cycle Assessment

LLP Long Life Learning Programme

PSIR Pressure, State, Impact, Response

SUD Sustainable Urban Development

UN United Nations

UNDESA United Nations Department of Economic and Social Affairs

UNEP United Nation Environmental Programme

UNESCO United Nations Educational, Scientific and Cultural Organization

UNHABITAT United Nations Human Settlements Programme

UNISDR United Nations Office for Disaster Risk Reduction

1 THE GENERAL RESEARCH FRAME

1.1 INTRODUCING THE RESEARCH

 "Today, more than two thirds of the European population lives in urban areas and this share continues to grow. The development of our cities will determine the future economic, social and territorial development of the European Union." (European Commission, 2011):VI

This section is providing an overview on the key research questions and the hypothesis; and is defining its general scope and specific goals. Furthermore, this section defines the boundaries and limits of the thesis work.

1.1.1 JUSTIFICATION OF THE RESEARCH

 "Cities are key to the sustainable development of the European Union.
Today, more than two thirds of the European population lives in urban areas and this share continues to grow. The development of our cities will determine the future economic, social and territorial development of the European Union.
The administrative boundaries of cities no longer reflect the physical, social, economic, cultural or environmental reality of urban development and new forms of flexible governance are needed." (European Commission, 2011):VI

Urban areas and their regional systems dually represent the biggest threat (e.g. negative externalities and consumption) and the biggest opportunity (e.g. innovation and creativity) for sustainable development, due to the concentration of human activities; the strategic importance of urban systems is of central importance when facing major challenges as climate change, natural resource management and sustainable production and consumption.

Urban areas are complex systems facing multiple local and global interlinked challenges, in a rapidly mutating and increasingly interconnected world; moreover, the decision system for the urban development confronts itself with conflicting interest and stakeholders' agenda, as well as competitive sectorial priorities.

Such hyper-complex situation and multi/level, multi/scale challenges cannot be addressed by sectorial approaches; new forms of planning and governance are required, also to foster the active participation of urban actors. These new planning and governance framework shall be able to empowering the collaboration, the knowledge transfer and the co-creation ability of stakeholders, including scientists, politicians, practitioners, civil society, and businesses.

The governance of urban complexity is a key area of investment for the EU and national states in Europe, as well as, the resilience of urban systems and their capacity to adapt and respond to the vulnerability of social, economic and environmental systems. (European Commision, 2013)

Currently urban development patterns are proving largely unsustainable, the use of resources is too intense, beyond the planet carrying capacity; the generation of negative externalities is impacting natural and social systems, beyond their absorption capacity. Thereby it is necessary to define methods, processes and plans to support the transition toward resilience, through more sustainable development pathways.

Furthermore, cities and regions are increasingly vulnerable to social, economic, ecological and technological threats and risks; the adaptive capacity and resilience of urban systems is an increasing priority, requiring actions able to go beyond the mere mitigation of the negative externalities of urban activities.
In order to cope with such multi-faced, and in some ways unpredictable, risks it is necessary to define new process and tools to forecast risks and to strategically plan a long term oriented resilient transition. There is a clear need for strategic planning processes, where alternative development pathways are evaluated and monitored in an integrated manner; planning processes able, during their implementation, to self-adapt to the changes of conditions, counter balancing systemic uncertainty.

The urban resilient transition process needs to be based on informed and participative decision making, which requires an integrated and adaptive evaluation approach, based on system thinking, which can facilitate the understanding of alternative development pathways, understanding their implication at multiple time and spatial implications.

This resilience transition processes requires to re-think radically the form of planning, as not any longer aimed to the realization of physical structures/infrastructures, but on the management of liquid processes, requiring the very re-definition of the role of planner as process facilitator.

In this context, it is important to analyse and to build upon the research results of some pioneering projects on knowledge brokerage, collected and analysed by EU FP7 Research Project PRIMUS "Policies and Research for an Integrated Management of Urban Sustainability" (Davidson, 2012); including five case studies of European cities that experimented different settings to facilitate stakeholders collaboration and exchange of information, with the aim to structure a self-learning process and to foster evidence based decision and policy making (McGuinness, 2012).

13

The transition toward sustainable and resilient cities shall be founded on a holistic and integrated approach considering multiple spatial and temporal dimensions across sectors, reconciling competitive and antagonist objectives, on the ground of common visions and systemic understanding of key challenges and opportunities, in the present and in the future.

In this context, "Foresight is a specially relevant tool for managing transitions, overcoming conflicts and contradictions between objectives, and developing a better understanding of realities, capacities and objectives." (European Commission, 2011):VII.

Furthermore, the European Commission recognizes the importance of developing new foresight participative processes: "Foresight as a participative governance tool to manage complexity urban governance must be focused on understanding the possible development trajectories of the city and the switch to sustainable trajectories according to a long term and shared vision of the city. A solid knowledge base alone is insufficient to build a long-term vision to guide actions; cities also need appropriate tools and instruments for strategic planning and collective visioning. The ability of cities to conduct forward-looking exercises and to formulate their own visions of the future is fundamental in this context." (European Commission, 2011):72.

Thereof, this thesis work aims to address the current key challenges for sustainable development in cities and their regions, trying to structure a methodological framework with the objective of facilitating decision making processes and transition management using a novel integration of future scenario methodology within a knowledge brokerage/living urban lab setting.

1.1.2 RESEARCH QUESTIONS

Cities and urban systems are at the core of sustainable development in the European Union and worldwide; cities represents the major problem for sustainability and, at the same time, can contribute substantially for the creation of innovative solutions for sustainable development, specifically de-coupling quality of life from resource use and depletion.

Cities are facing multiple and complex global and local challenges, and need to adapt continuously to rapid changing conditions; through an adaptation dynamic that requires to establish continuous learning processes fostering knowledge development, which is indispensable to address such mutating challenges. Thereby transition toward sustainable and resilient cities is essential and urgent, requiring to foster a radical change in our way to decide, to regulate and to plan urban development.

The main question that this research work is:

How to facilitate the transition toward urban sustainable development supporting the creation of resilient cities and regions, decoupling quality of life from natural resource consumption and depletion?

In order to answer this question, which define the scope of the thesis itself, has been necessary to define four sub-ordinated questions, which are directly referred to the specific objectives of the research, and are also reflected in the structure of the work.

Here bellow the four sub-ordinated questions guiding the development of the research:

1. What is urban sustainable development and which are the key trends and drivers affecting it?

2. Which is the state of the art of the scientific theories that can support a systemic transition approach based on integrated evaluation and governance/participation?

3. How to address and integrate multiple temporal and spatial dimensions in the decision making and planning processes for urban sustainable development transition, favouring also a knowledge transfer and learning process among stakeholders?

4. How to structure a theoretical and a practically applicable framework that facilitate decision making, planning and implementation process for resilient transition toward sustainable urban development?

On the base of these research questions the hypothesis has been defined, contributing to structure and to guide the entire research work.

15

1.1.3 HYPOTHESIS

How to facilitate the transition toward urban sustainable development supporting the creation of resilient cities and regions, decoupling quality of life from natural resource consumption and depletion?

The central hypothesis of this research work is that to adress resilient transition toward sustainable urban development a new form of open and participative decision making and planning, based on process design, is required and shall be explored.

The process design shall be based on an integrated evaluation of alternative transition pathways, and their implementation, with the aid of the integration of future scenarios participative methods, in order to address complex issues in a systemic way, integrating multiple temporal and spatial dimensions holistically and transdisciplinarity favouring stakeholder's co-creation of innovative processes and approaches to sustainable development in urban context.

Here bellow are listed the specific hypothesis referred to the research key sub-questions.

1. What is sustainable urban development and which are the key trends and drivers affecting it?

The first sub-hypothesis is that sustainable urban development is a process, not a final state; it is a dynamic and complex process that requires to be managed within multiple time and space perspectives, needing to address major challenges as climate change, resource management and access, sustainable consumption and production, justice and democracy, and urban sprawl dynamics. The core of this dynamic process there are societies and individuals, which are both affected and affecting by the pathways and the consequences of sustainable urban development.

2. Which is the state of the art of the scientific theories that can support a systemic transition approach based on integrated evaluation and governance/participation?

The second sub-hypothesis is that sustainable urban development needs to be understood through system and system transition theories, and that evaluation and governance fundamental for supporting a systemic resilient transition. Thereby it is indispensable to integrate complementary bodies of knowledge in order to be able to structure a process design methodology able to facilitate decision making and planning in the context of sustainable urban development.

3. How to address and integrate multiple temporal and spatial dimensions in the decision making and planning processes for sustainable urban development transition, favouring also a knowledge transfer and learning process among stakeholders?

16

The third sub-hypothesis is that the integration between multiple spatial and temporal scales requires an urban/regional approach with specific reference to metabolic theories, including not just resources but also social and intangible flows. With regard to different temporal dimensions, the integration can be supported through the use of visioning and forecasting methods, complemented by participative backcasting.

4. **How to structure a theoretical and a practically applicable framework that facilitate decision making, planning and implementation process for resilient transition toward sustainable urban development?**

The fourth sub-hypothesis is that transition toward sustainable urban development can be managed through process design, framed within knowledge brokerage settings, and centred on stakeholder's co-creation principles. This methodological framework should also aim to foster a learning and knowledge transfer process; in order to facilitate this processes it is necessary to re-think planning in terms of process and to re-define the role of planner as facilitator.

1.1.4 SCOPE AND GOALS

The scope of the thesis work consists in contributing and advancing current knowledge on sustainable urban development, developing the knowledge on resilience transition planning, as well as in proposing a methodological framework to facilitate stakeholders' active participation and exchange of knowledge.

The innovative focus of this research is focusing on the importance of time and timescapes in sustainable urban development, including their perception, and the integration of different participative future scenarios methodologies. Furthermore, the general scope includes the application of process design through knowledge brokerage settings.

The specific goals of the research are listed here, with direct reference to the research sub-questions previously defined.

1. What is sustainable urban development and which are the key trends and drivers affecting it?

The first goal is to give a working definition of sustainable urban development, understanding both sustainable development frame and urban context; the working definition is also supported by the identification of key major urban challenges as climate change, resource management ad access, sustainable consumption and production, justice and democracy, and urban sprawl dynamics.

2. Which is the state of the art of the scientific theories that can support a systemic transition approach based on integrated evaluation and governance/participation?

The second goal is to analyse the state of the art of theoretical development and practical experiences related to system thinking, sustainability transition, resilience, evaluation of sustainability and governance; in order to propose a process design approach based on the integration of these fields.

3. How to address and to integrate multiple temporal and spatial dimensions in decision making and planning processes for sustainable urban development transition, favouring also a knowledge transfer and learning process between stakeholders?

The third goal is to integrate multiple temporal and spatial perspectives in decision making and planning enhancing the knowledge on timescapes of sustainability and urban/regional metabolic dynamics. The sub goal is to enhance the integration of different future scenarios methodologies as forecasting, visioning and participative backcasting, and interconnect the derived integrated methodology with planning.

18

4. **How to structure a theoretical and a practically applicable framework that facilitate decision making, planning and implementation process for resilient transition toward sustainable urban development?**

The fourth goal is to design a novel theoretical and practical process design methodology for the resilient transition toward sustainable urban development, based on facilitating stakeholders' involvement in co/designing process and plans, also through knowledge brokerage setting. The process design methodology consists of a theoretical part and application guidelines, describing how to use the methodology in a practical way.

1.1.5 RESEARCH FRAME, BOUNDARIES AND LIMITS

The research initially referred to European cities and regions, as a semi homogenous urban development system, within specific socio-economic conditions, although later on the scope has been widened, including field work in Latin America.

The main outcome of the research is a process design methodology, including a knowledge brokerage setting, to support decision making and planning practice for resilient transition of sustainable urban development, based in stakeholders' participation. The development of this methodology requires to needs to address its test, validation and evaluation. A full evaluation of the methodology can only be realized in a real-life setting, thereby requiring a real planning need and the decision of a local planning authority to adopt tis specific methodology, involving a large number of stakeholders for a consistent period of time.

It is clear that this requires consistent investment, of both human and financial resources, over-passing the scope and timeframe of a single doctoral thesis work. In fact it is necessary to consider that a full validation cannot just rely in one single test but should be based on benchmarking several applications of the methodology in different situations and within different locations, encompassing different socio-economic and cultural frames.

For this reason the thesis is containing guidelines for testing, validation and evaluation of the same methodology and the knowledge brokerage, in order to facilitate its use once that appropriate resources are gathered to allow a complete testing; specifically the research results can be used as a methodological frame to structure Horizon 2020 proposals for Research and Innovation Actions.

The research itself is based on research priorities set in past and current EU Frame Programme calls, as in the case of foresight activities and knowledge brokerage, for which substantial budget has been allocated, particularly within the Societal Challenges in Horizon 2020.

The research is based on the current scientific and policy advances on sustainable urban development, specifically in relation to climate change mitigation and adaptation, but also to natural resource management and sustainable consumption and production.

The thesis is based on direct experience matured along 15 years of research and knowledge transfer activities, specifically undertaken within over 10 EU funded projects.

The methodology has been prototyped using a knowledge brokerage setting, which has been demonstrated in operational environment, using it in the frame of the development of a Master Plan for the risk park of Altos de la Estancia in Bogota, Colombia.

20

1.2 STRUCTURING THE RESEARCH

This section describe the general methodology adopted, defining in detail the methodology adopted for the development of each knowledge section, as well for the development of the framework (methodology and tool).

Furthermore in this section is also briefly explained the structure of the entire thesis and its sub-sections.

1.2.1 STRUCTURE

This sub-section describes the general structure of the research work, explaining how each section has been structured and articulated; furthermore it clarifies the inter-linkages between the different chapters of the work and the interrelation between chapters, as shown in Figure 1-1.
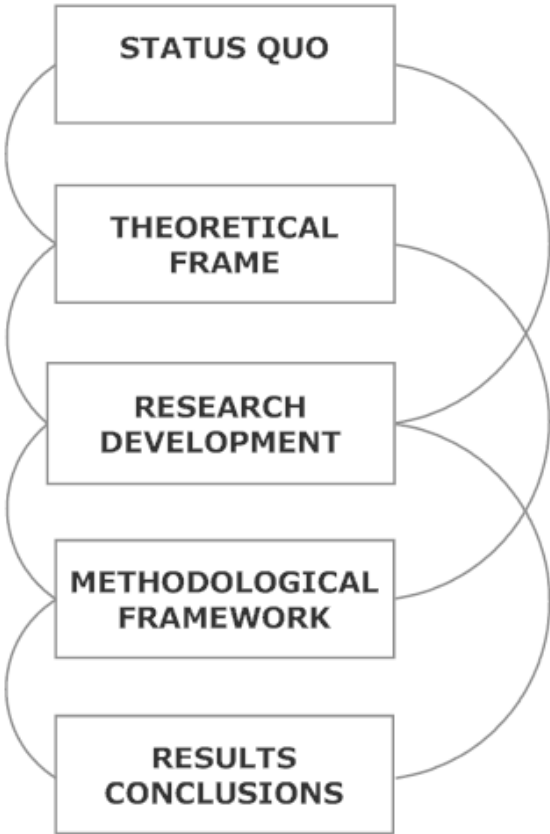
Figure 1-1 General structure (Source: own graphic)

This chapter describes the frame, the context and the major trends and drivers used, that is the starting point of the entire research and is used to reach a working definition of sustainable urban development.

The first and the second sections are dedicated to analysing sustainable development, the frame of the research, and the urban systems, as context of the research. These sections give an historical account of the concepts genealogy and pathways, which support the understanding of the key challenges and the development of the working definitions for both sustainable development and sustainable urban development.

The first section is drawing a complete timeline of sustainable development, based mainly on UN official documents, resolutions and events, ending with a working definition of sustainable development.

The second section ends with a clear and complete working definition of sustainable urban development, based on the analysis of major challenges, including:

-**Climate change**, particularly with reference to adaptation and mitigation and including resilience and extreme/catastrophic events.

-**Resource efficiency**, particularly with reference to decoupling natural resource use and environmental impacts from economic growth and human development, including sustainable consumption and production,

-**Governance and participation**, particularly looking at governing the commons and inter / intra generational justice and wellbeing.

The key trends and drivers and the working definition of sustainable urban development are used to substantiate the definition of an appropriate theoretical frame.

This chapter aims to present the theoretical foundation of the research work, understanding the evolution of the different concepts and the state of the art in their use with reference to sustainable development in cities and regions.

This chapter is structured in four sections:

-**System thinking:** aimed to understand complexity and how to operate within complex and uncertain conditions; this section refers primarily to the work of : K. Boulding and E. Morin (Boulding, 1965, Boulding, 1973, Boulding, 1984, Boulding and Boulding, 1995, Morin, 1999) .
This section ends proposing a soft system/mental maps approach.

-**Transition theory and practice:** aimed to understand how systems change and innovate through transition processes, and how to foster, to steer and to manage such processes. This section mainly refers to the work of ICIS, DRIFT (Rotmans J and van Asselt M, 2000, Rotmans J. et al., 2000, Rotmans et al., 2001).

-**Resilience and co-evolution**, aimed to understand the latest development of urban resilience theory and practice, particularly in relation to co-evolution approach. This section is based on the work developed within the last 3-4 years, (Cimellaro et al., 2015, Pizzo, 2015, Caputo et al., 2015)

Each section is structured in the same way, starting with defining genealogy of the key concept, state of the art, collection of example of their use in the frame of sustainable development within the context of urban systems, and ends proposing and ad-hoc approach that is used for the further development of the research (Chapter 4) and the development of a new methodology (chapter 5).

Finally the last section present an integrated approach created from the re-conjunction of the previous sections.

1.2.1.3 THE RESEARCH DEVELOPMENT

This chapter represents the core of the research work, it develops and expands the current knowledge on sustainable urban development approaching it through three main line of investigation/integration:

 - spatial integration.

- temporal integration

- integrated evaluation

This chapter addresses and answers the main research questions, as stated in the introduction:

The first section addresses the issue of **spatial integration** within sustainable urban development, using a metabolic approach, including both material and in-material flows; and it proposes an urban/regional approach to sustainable urban development. This section is based on the work of K. Marx on social metabolism, taking into account latest developments on metabolic approach and circular economy. (Marx, 1984, Foster, 1999, Martinez-Alier, 2004, Broto et al., 2012)

The second section addresses the issue of **temporal integration** within sustainable urban development, it starts from the work of Adams on Time/Society and introducing the concept of time-scapes. The sections continues through analysing the main future scenario methodologies, and defining the theoretical approach for the development of an innovative and integrated future scenario methodology. (Hall, 1986, Stokke et al., 1991, Alcamo et al., 1996b, Ravetz, 2000, Kok et al., 2006)

The third section refers to how develop a basic frame for **integrated evaluation** of sustainable urban development. It is mainly based on the defined and structured frame for evaluation of sustainability, as developed under Bellagio principles, and it is oriented to give a systemic evaluation frame which is process based and participatory. (Hardi P. and (eds), 1997, den Boer et al., 2007, J.O. and M., 2007, Loorbach, 2010, Fratini et al., 2012, Cimellaro et al., 2015)

The fourth section resumes and integrates the four approaches presented within the first three sections, proposing a novel integrated approach to sustainable urban development. Specific attention is given to planning processes and the role of planners, which both need to be reformed and adapted to the present conditions.

This chapter aims to introduce the process design methodological framework to foster and manage the resilient transition toward sustainable urban development; the methodology is based on the novel use of future scenarios methods to support decision and policy making within a knowledge brokerage framework.

The methodological framework is presented in two sections:

-**General methodology**, based on process design

-**Specific toolkit**, a knowledge brokerage simulated process to introduce the general methodology

The first section defines the methodology from a theoretical perspective, describing the different phases of the process design, from the stakeholders' analysis and involvement, through the decision making process, and finally to its implementation and monitoring.

The methodology introduces a variation on participatory backcasting, integrating it with visioning and forecasting. The methodology is based on a triple integration of multiple spatial and temporal scale, and a systemic approach involving different specific sectors of sustainable development.

The second section defines the methodology from a practical perspective, it gives practical instruction for organizing the process design, with clear practical explanation on how to implement and manage each phase of the process.

The toolkit and the process design practical framework, are highly adaptable to different requirements of planning processes and practices, and able to be adapted to different situation and involvement of different actor intentionally. Such structure can be defined as a plot "cannovaccio" in the *Commedia dell'arte*.

The toolkit is developed from direct work experience within the development of research and education EU projects, and it is based on the results achieved by several EU Framework 7 collaborative projects, mainly within the working areas Environment and Socio-economic Sciences and Humanities, which results have been analysed and evaluated.

This chapter aims to give an example of process design, or plan without plan, realized in the city of Roskilde in Denmark, and to give a demonstration of the knowledge brokerage realized in Bogota, Colombia.

The first section introduces the case study of the process design approach used in the Musikon quarter in the Municipality of Roskilde in Denmark. For the development of this area the city council opted for a plan without plan approach, meaning that just generic regulation of engagement and strategic development lines have been established. This was aimed to favour a bottom up approach, leaving the initiative to establish temporary activities and more permanent uses of the space to the same stakeholders, whom would show interest and active engagement in the development of the same area.

This case study gives a very useful insight regarding the use of a process design approach and it represents one of the very first implemented cases of urban development explicitly refereeing to an in-tangible/im-material approach.

The second case study aims to demonstrate the possibility to use the process design methodology in a real life environment; the demonstration is based on the use of the knowledge brokerage setting with the twofold objective of informing/introducing local stakeholders on the use of process design, and to start gathering relevant information to be used within the current process of development for a master plan.

The demonstration was realized in Bogota, Colombia, as part of the development of a master plan for the Altos de la Estancia area, which has been declared risk park by the local authorities; becoming a pilot for resilience planning facing climate change and risk, together with development of the informal settlement.

1.2.1.6 THE RESULTS AND THE CONCLUSIONS

This chapter aims to resume and to present in an organic form the results achieved in this thesis work, together with the key deliverables; moreover this chapter will draw some conclusions on the undertaken research and will define means for its future implementation, including full testing and validation, highlighting a clear and achievable practical/working use of the results and deliverables, this including also a subsection on present and future impacts.

This chapter is dived in four sections:

- Results
- Deliverables
- Conclusions
- Future implementation

The first two sections are presenting the theoretical development achieved on sustainable urban development, with specific reference to the multiple integration of both spatial and temporal scales, which represents the main innovative contribution to the scientific development of the field. More over here are also are summarized the development of a process design methodological framework for resilience and sustainable urban development, as well as the toolkit and the user guide for the practical use of the methodology.

Section three and four are drawing the conclusion of the research, mainly referring to a new understanding of planning, particularly in its time and intangible (non-physical) dimensions , and a new role of planner as facilitators, also as moderators between different stakeholders mind-sets and knowledge.

The last section particularly draws the attention to the further development of the research, both in its theoretical and practical dimension, and defines clear possibilities for an appropriate validation and evaluation of the methodological framework, specifically in the context of EU Horizon 2020 collaborative projects.

1.2.2 METHODOLOGY

From a methodological point of view the research is divided in four main parts:
- STATUS QUO
- THEORETICAL BASE.
- DEVELOPMENT OF THE THEORY.
- DEVELOPMENT OF A METHODOLOGICAL FRAMEWORK.

For each part a different methodological approach has been used, as later explained in detail.
Each part is ending with the presentation of the outcomes used as starting point/foundations for the next part; all parts are aimed to constitute the final results of this research work.

Giving a reverse account of the work, the Chapter 5 THE METHODOLOGICAL FRAMEWORK, composed by a process design methodology and a knowledge brokerage tool, is drawn on the base of the original theoretical development of the field of study proposed in Chapter 4 THE RESEARCH DEVELOPMENT. Such original development is itself linked to the analysis and integration of different paradigmatic approaches to sustainable development, with specific focus on time dimension of sustainable urban development, as proposed in Chapter 3 THE THEORETICAL FRAME. The theoretical frame is itself based on a working definition of sustainable urban development, derived by the definition of the frame and the context of the research, with direct reference to major trend and drivers here considered, as analysed in Chapter 2 THE STATUS QUO .

It is important to highlight that all section in chapter 2, 3 and 4 are based on a state of the art of the different theories used as foundation of the thesis, and/or originally developed along this research. For each section there are clear references to the body of studies and a specific approach is followed and justified in order to make clear the selection processes that has been necessary to adapt a very vast body of knowledge to the specific frame and context of this research work.

The specific structure of the research is governed by a general scientific research structure, outlined in Chapter 1 THE GENERAL RESEARCH FRAME, which is also following the requirement defined by UPC for the development of a doctoral thesis. This research structure included a justification of the research, definition of clear research questions and hypothesis, definition of scope and goals, and finally definitions of boundary and limitations. Furthermore also expected outcomes and impacts are stated, in order to link this to the final part of the thesis presenting the results and conclusions, as well discussing future implementation possibilities and present/future impacts.

The thesis has been developed starting from the thesis project proposal (through the award of the MPhil) as defended and approved by the academic tribunal; as it can be expected by a work developed in a quite

long time, the initial project has been maturing and thereby partially modified. In this sense the overall objective of defining a methodology to support decision and policy making for sustainable urban development has been kept, but a more soft system thinking approach, instead of system dynamic, has been preferred, particularly in connection with recent developments in the field of knowledge brokerage and direct working experience in knowledge transfer.

Moreover a clearer focus on time perspective of resilience, resilience planning and transition has been defined, together with the reference to urban-regional metabolism, this in relation to recent UN/EU policy prioritization regarding natural resources management and sustainable consumption and production.

The foundations of the thesis, its theoretical base and the theoretical development has been written analysing a number of information sources, mainly scientific literature, policies at EU and international level, financed collaborative projects under FP7, and the analysis of a number of case studies; as reported in both scientific literature and EU FP7 project results. Furthermore, different parts of the thesis work have been presented at international scientific conferences and published in proceedings; as well, part of the work here presented has been used in the actual implementation of EU FP projects as STAR/City, Atom and Bits.

The scientific literatures analysed includes, journal, books and international conference proceedings publications. The journals have been consulted mainly though Web of Knowledge, Science Direct, Willey Online Library and Springer Link. A large number of journals have been consulted but in particular:

- The International Journal of Urban Policy and Planning (Cities).
- Ecological economics.
- Environmental Impact Assessment Review.
- Futures.
- International journal of Forecasting.
- International Journal of Urban and Regional Studies.
- Journal of Cleaner Production.
- Technological Forecasting and Social Change.
- Environmental Innovation and Societal Transitions.
- International Journal of Sustainable development.
- Journal of Environmental Policy and Planning.
- System Dynamic Review.
- Technology in Society.
- Time and Society.
- Landscape and Urban Planning.

The books consulted were in large part published by respected scientific publishers as Edward Elgar, Springer, Sage, Earthscan, Polity, Willey and Sons; and were particularly used with reference to the key scientific concepts explored as: system thinking, evaluation of sustainability, urban systems, governance, time.

The proceeding of international conferences consulted included the annual events organized by main professional association in the fields of reference of this research work: Association of European Schools of Planning AESOP, International Society of City and Regional Planners ISOCARP, International Council for Local Environmental Initiatives ICLEI, International Alliance of Research Universities IARU, International Federation for Housing and Planning IFHP, International Human Development Programme IHDP, International Ecological Economics Society IEES, International Society for Sustainable Development Research ISDRS, International Association for Impact Assessment IAIA; plus a number of conferences organized in the frame of EU funded research projects.

The research has been largely based on international policies and policies analysis reports as prepared by international organization as: European Union, United Nations, Organization of Economic Co-operation and Development. With reference to EU has been used extensively the work of European Environmental Agency, Joint Research Centre; furthermore the work has been steered by the EU research priorities as outlined in the European Research are and in the Multiannual Financial Framework.

With reference to UN, the main references are coming from United Nations Educational, Scientific and Cultural Organization, United Nation Department for Economic and Social Affairs, United Nation Environmental Programme, particularly the Division of Technology, Industry and Economics, United Nation Human Settlement Programme, United Nation Framework Convention for Climate Change. It is important to highlight that UNESCO, UNEP and UNHabitat hve been partner in consortia developing collaborative research work, in which frame the methodological framework object of this thesis has been employed.

For this thesis one of the key reference sources have been projects financed under Framework 6 and Framework 7, particularly in the areas of foresight activities and future scenarios, urban and regional development, sustainable development, knowledge brokerage and sustainable consumption and production. Being the list quite long direct reference to such projects has been made along the text.

Regarding the methodological framework, as previously stated in section 1.1.6 RESEARCH FRAME, BOUNDARIES AND LIMITS a full validation of the methodological frame would require to set trial processes in different urban contexts along a prolonged period of time; thereby such validation could possibly and realistically happen just in the frame of an international or European collaborative funded

project, as defined within the section on the limitation and boundaries of this work. For this reason, from a methodological point of view, the methodological framework presented within this thesis is prepared in a form that could be used in structuring Horizon 2020 proposal.

Currently the process design methodology here developed, has been used for a large EU H2020 project proposal, successfully passed the first stage, and currently awaiting for the final second stage evaluation. The project proposal aims to develop integrated urban planning solutions to reduce GHG emission, mitigating climate change in cities, and increasing quality of life and wealth.
The process design methodology will be used for three integrated urban plans in three cities in Finland, Italy and Germany.

The use of the methodology in the development of a large EU H2020 proposal, of over 8 million euro, already positively evaluated by the European Commission, and counting on a consortium of over 25 partner organization, represents itself a validation by peers of the process design methodology.

A almost complete version of the process design methodology has been also used for an EU FP7 on a circular economy approach to urban and regional planning, which could also be considered a peer pre-validation, or at very least a definition of interest in such a method by 25 key public and private organization which agreed in its use within the preparation of the proposal. The proposal, although not founded was positively evaluated scoring 4.0 on 5 for its scientific quality, including the process design methodology.

The research also has beenfit from a three months visiting researcher placement at the Technical University of Denmark, Department of Management Engineering, where the section on benchmarking different future scenarios methodology has been developed. Moreover the thesis has been finalized during a two and half year job placement as senior research fellow at University of Bradford, Centre for Sustainable Environments, were the development of the methodological framework has been conducted also in collaboration with numerous international organization in the frame of collaborative research programmes.

1.3 DELIVERING THE RESEARCH

1.3.1 INNOVATIVE POTENTIAL

The innovation potential of the research work is twofold, regarding the theoretical advancement within the field of sustainable urban development transition and the development of a new methodological framework to support decision making and planning in the frame of sustainable development of urban systems.

The main theoretical development refers to the time dimension of sustainable development; meanwhile the issue of spatial scale of sustainable urban development has been extensively explored (i.e. think globally act locally), timescapes of urban sustainable development, as well as time implication of climate change and related events, and time dimension in sustainable consumption and production, have been limitedly researched in a systematic way.

From a practical and theoretical point of view the time dimension of sustainable urban development is innovatively explored defining a future proofing methodology that will take into account both facts and values, and will be linked directly to planning and implementation. This has been achieved in merging in an integrated frame visioning, forecasting and participatory backcasting methods.

Moreover this integrated frame is exploiting the knowledge exchange/brokerage and learning potential of future scenarios, particularly focusing in understanding how this process can facilitate not just stakeholders' decision making but co-design and co-creation processes.

Moreover, the research is giving new insight on the importance of process design, against master plan based planning systems, and the use of soft system planning methods for sustainable urban development; these methods challenge the "normal" understanding of planning oriented to achieve a final physical state, proposing a more articulated and strategic process approach that better adapt itself to liquid times.

Furthermore, the research is giving new insight on the role of planner in sustainable urban development, where they can play a facilitating role, not any longer acting as demiurge; facilitation that is more in line with a process management and the stakeholders' co-design and co-creation role.

Finally, the research is delivering an integrated methodological framework potentially able, on the base of already existing experiences in knowledge brokerage, to support process design in sustainable urban development transition; methodological framework that is including a cookbook with clear instruction for structuring and evaluating a participative process design process based on the use of the presented future scenario methodology.

1.3.2 ACHIEVED RESULTS

The main achievement of this research work is the theoretical and practical contribution to sustainable urban development transition, particularly in integrating temporal, spatial and sectorial perspective, and also in developing the knowledge on the temporal dimension of sustainability in cities and regions.

As preliminary results are here listed peer review journal and conference papers and presentations, and invited conference speeches delivered in the period of the doctoral research and directly referring to the work undertaken in the frame of this research. Moreover, here are also listed a number of EU projects where the preliminary results of this research have been deployed and further expanded, including also EU project proposals, under evaluation, using the methodological framework developed within the thesis.

Since the enrolment within the Ph.D. programme I had the possibility to develop and to disseminate the research preliminary results within, as reported in the ANNEX 1:
- Twenty international conferences papers and presentations.
- Two IF journal articles.
- Seven invited presentation to conferences.

The preliminary results of the research work have been disseminated and used in the frame of 7 EU funded projects, under Frame Programme 6 and 7, and Life Long Learning Programme, as reported in ANNEX 1; these projects involved over 40 partners organizations and accounting a total value close to five millions euro.

Within this project can be highlighted the use of systemic planning and future scenarios methodologies for the transition toward sustainable urban and regional development, inter alia developing future plans for the city of Obidos in Portugal, the city of Venice in Italy and Alderney in the Channel Islands.

1.3.3 EXPECTED RESULTS AND FUTURE IMPACT

This research main result is to enhance the current knowledge on sustainable development and urban resilience transition, including particularly the use of knowledge transfer and process design in this context, with specific reference to temporal scale and inter scale integration and the use of participative future scenarios in planning.

Moreover the research work will result in a methodological frame, which validation could follow in multiple benchmarking real life contexts, and could be used directly for structuring future collaborative research work at international level.

Such proposal for major funds, more than one million euro, in an international research collaborative frame, are clearly of great importance and impact, as well are normally delivering high level research results and also including real life experimentation in specific urban and regional contexts; such projects' results are normally leading to a very high level diffusion of the methodology and approaches used at international level.

The research results are going to be submitted to both international conferences and peer reviewed scientific journal with impact factor; here bellow is outlined a publication plan:

Time and sustainability: Time and Society

Process design and new role of planner: Planning Theory and Practice

Time and natural resource management: Journal of Cleaner Production

Future scenario in planning sustainable urban development: Futures

Visioning, forecasting and backcasting benchmark: International Journal of Forecasting

Process design at Musikon: Planning Practice and Research

The definition of such publication plan is aimed to enhance the dissemination and impact of the project result and to facilitate the adoption of the methodology on the base of international scientific peer review process.

The work realized in developing this thesis has been used to define the core structure for the international program on Urban Resilience RESURBE, counting on a consortium of more than 40 organizations, including UNHABITAT, UNISDR, UNDP and WHO, and over 150 individual participants.

The work here realized will be used within the first 7 books of the book series Resilient Cities: Re-thinking Urban Transformation, book series for which I am editor in chief, edited by Springer, to be published by the end of 2016.

2 THE STATUS QUO

Sustainable development pathway will help to give an operative/working definition of sustainable development. Subsequently key challenges and opportunities for sustainable development are highlighted, and further explored with the paragraph on trends and driver. The state of the art of policy and policy implementation defines the key directives to address sustainable development key challenges, and also to justify the importance of an urban centred focus.

The paragraph on urban system is giving a working definition of urban systems, introducing the urban/regional approach, including the historic development of such concept. Key challenges and opportunities for urban systems will be listed and discussed. The chapter ends with the definition of key trajectories for the transition toward sustainable urban and regional development.

2.1 FRAME: SUSTAINABLE DEVELOPMENT

2.1.1 SUSTAINABLE DEVELOPMENT TIMELINE

The term "sustainable development", first appears in an official United Nations' document in 1980 (United Nations, 1980), it was formalized in 1987 within the Brundtland Report (United Nations, 1987a); although the more directly related modern precursor of such definition can be dated back to the sixties, related to the raising concern for an irreparable ecological disaster lead by human mismanagement and negative impact on nature (Carson, 1962).

The milestones and the genesis of sustainable development are shown within key historical events at global level, giving a better understanding of the overall fame condition under which the concept has developed and changed.

The timeline presented here includes different categories:
-    International governance process:
Aimed to highlight the process of institutionalization of the concept of sustainable development and related issues, as environment, economy, society, climate change and urbanization.
-    Institution of key organization:
Aimed to define the governance frame of sustainable development and related challenges, also listing and the key institutional, outside UN and EU system.
-    Key publications
This includes a list of key scientific publications, particularly report and books, which are considered key references / milestones.

It is here reported a quite articulated time line highlighting the relation between the institutional process of sustainable development, key publications, major disasters, twilight events and historical milestones. This overview will permit, on the next session to provide a working definition of sustainable development.

Although the first definition of sustainable development first appeared in the Brundtland report in 1987, the timeline starts in 1960 with some events that are widely considered as direct precursor of the development of the first definition.

2.1.1.1 INSTITUTIONAL TIMELINE

- 1968 - Intergovernmental Conference of Experts on the Scientific Basis for Rational Use and Conservation of the Resources of the Biosphere.

Deterioration of environment and resource use is happening at increasing rate, also due to urbanization and population growth patterns, it is thereby necessary to plan the use of resources in an integrated multidisciplinary way, and assess impact at multiple time and spatial scales. "Solution has to be fund in regional planning" .(UNESCO, 1968):34

- 1968 - The UN General Assembly authorizes the Human Environment Conference.

The United Nation General Assembly resolves in holding a conference on Human Environment in Rio in 1972. (United Nations, 1968) (United Nations, 1969)

- 1971 UN resolution on Development and Environment.

The resolution, conscious of urgency of environmental problems, and of its importance for future of mankind, states that adequate equilibrium between need of development and preservation/enhancement of the environment should be sought. (United Nations, 1971)

- 1972 Polluter pays principle.

OECD Council establishes that those causing pollution are responsible and should pay for the pollution impact.(OECD, 1972)

- 1972 United Nations Conference on Human Environment held in Stockholm.

States the importance of development and quality of life coupled with defence and improve of environment for the future generation. The conference leads to the establishment national environmental protection agencies and the UN Environmental Programme. (United Nations, 1973)

- 1972 United Nations Environment Programme (UNEP).

UNEP is established to safeguard and to enhance the environment for the beenfit of present and future generations. (United Nations, 1972)

37

- <u>1972 EEC Environmental Action Programme launched.</u>

European Economic Community (EEC) aims to find solutions for stable growth; with attention to intangible values and environmental protection, it invites the Community Institutions to establish an environmental action programme. Stating also that economic growth is not an end by itself. (EEC, 1972)

- <u>1972 Convention on the protection of the world cultural and natural heritage.</u>

The convention defines cultural and natural heritage and aims to protect it also from the changing social and economic conditions. (UNESCO, 1972)

- <u>1973 EEC Environmental Action Programme</u>

The Programme recognizes that the improvement of quality of life and protection of the environment are fundamental task of the Community, to be coupled with continuous and balanced economic growth. The objectives include adressing environment in town planning. The principle of prevention is developed beyond the polluters pay principle. The Programme sets key principles of sustainable development, and includes urban areas. (EEC, 1973)

- <u>1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora.</u>

The Convention is agreed and enters into force in 1975 and aims to protect endangered species and reduce the trade of such species and derived products. (CITIES, 1973)

- <u>1975 EEC Waste Framework Directive</u>

The Directive aims to define a common legislative frame on waste in order to reduce environmental impact on waste and diminishes the use of raw materials and natural resources. (EEC, 1975) (European Union, 2006)

- <u>1976 Vancouver Declaration on Human Settlements, and Action Plan.</u>

The Declaration highlights the increasing economic, social and environmental deterioration, and the importance of urban environments for quality of life. It affirms the importance of participation, as right and duty, in planning and management of urban settlements, as well the importance to alt irrational exploitation of natural resources. (United Nations, 1976)

- <u>1979 Convention on long-range transboundary air pollution.</u>

The Convention contributes to the development of international environmental law, defining an essential framework for controlling and reducing the damage to human health and the environment caused by air pollution. (UNECE, 1979)

- 1980 First appearance of the term sustainable development in UN documents.

The term sustainable development appears in the UN Yearbook, as "sustainable ecological development" and "environmentally sustainable development process". (United Nations, 1980):497, 719

- 1981 WHO Global Strategy for Health for All by the year 2000

The strategy states that "*all* people in *all* countries should have at least such a level of health that they are capable of working productively and of participating actively in the social life of the community in which they live". (WHO, 1981):15

- 1982 UNEP special session for Stockholm +10 anniversary and Nairobi Declaration.

The Declaration expresses concern for the state of environment also due to the action plan only partially implemented with unsatisfactory results, with inadequate long term perspective. First concerns for the atmosphere are raised. It is stated the need for environmental management and assessment; moreover it calls for alternative consumption patterns. (UNEP, 1982)

- 1982 UN adopts the World Charter for Nature.

The Charter states that mankind is part of and depends on nature, that civilization is rooted in nature, and that every form of life is unique; it urges to maintain stability and quality of nature and also to preserve natural resources. (United Nations, 1982)

- 1983 World Commission on Environment and Development.

The UN general assembly approves the decision of UNEP to establish a Special Commission (Brundtland Commission) to define Environmental Perspective for Year 2000 and beyond. It also gives mandate to propose long-term environmental strategies for achieving sustainable development to the year 2000 and beyond. (United Nations, 1983)

- 1985 EEC Environmental Impact Assessment Directive

The Directive defines both discretionary and mandatory procedure to assess environmental impacts in order to support decision making process, prior finalizing a decision, regarding projects that may have significant impact on the environment. The impact assessment should define direct and indirect effects on human beings, fauna, flora, soil, water, climate, landscape, air, material assets and cultural heritage. (EEC, 1985) (EEC, 1997) (European Union, 2003a) (European Union, 2009)

1985 Vienna Convention for the Protection of the Ozone Layer.

The Convention is a framework multilateral agreement aimed to protect the ozone layer, approved in 1985 it enters into force in 1988. (UNEP, 1985) (UNEP, 2001)

- 1987 Our Common Future published by the Brundtland Commission.

The Commission addresses global problems and gives a light but incisive definition for sustainable development, although still optimistic on human abilities and very oriented toward economic growth. "Humanity has the ability to make development sustainable to ensure that t meets the needs of the present without compromising the ability of the future generation to meet their own needs. The concept of sustainable development does imply limits – not absolute limits but limitations imposed by the present state of technology and social organization - on environmental resources and by the ability of the biosphere to absorb the effects of human activities. But technology and social organization can be both managed and improved to make way to a new era of economic growth."(United Nations, 1987a):24 (United Nations, 1987b)

- 1987 Montreal Protocol on Substances that Deplete the Ozone Layer

The Protocol aims to phase out the production and the use of ozone depleting substances. The treaty, related to the Vienna Convention, is later amended in 1990 (London), 1991 (Nairobi), 1992 (Copenhagen), 1993 (Bangkok), 1995 (Vienna), 1997 (Montreal), and 1999 (Beijing). Its wide adoption and successful implementation makes it an exceptional case of international cooperation. (UNEP, 1987) (UNEP, 2000)

- 1988 Inter-governmental Panel on Climate Change IPCC

The UN General Assembly expresses its concern for "certain human activities that could change global climate patterns, threatening present and future generations with potentially severe economic and social consequences", asking to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts. Thereby UNEP and WMO establish jointly IPCC with the aim to assess climate change. (United Nations, 1988):133

- 1989 Basel Convention on transboundary movements of hazardous wastes.

The Convention, approved in 1989 and entered into force in 1992, is aimed to control movement of hazardous wastes across international borders, avoiding the transfer of hazardous waste from developed to developing countries. (UNEP, 1989)

- 1990 First Human Development Report and Index

"The Report addresses the question of how economic growth translates - or fails to translate - into human development. The focus is on people and on how development enlarges their choices. The Report discusses the meaning and measurement of human development, proposing a new composite index. But its overall orientation is practical and pragmatic"[1] (UNDP, 1990)

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[1] http://hdr.undp.org/en/reports/global/hdr1990/ [accessed 15/VIII/2013]

- 1992 Rio Declaration (United Nations, 1992f),

The Declaration proclaims that human beings are entitled to a healthy and productive life in harmony with nature.

It includes also principles as, coupling development and environmental needs, common and differentiated responsibility of States, elimination of unsustainable production and consumption patterns, promotion of endogenous capacity-building, participation of all concerned citizens in decision making, application of precautionary approach, and importance of environmental impact assessment.

- 1992 the Agenda 21(United Nations, 1992d),

The Agenda 21 calls for a global partnership for sustainable development, integrating environment and development concerns. It includes also a call for local authorities, that in dialogue with their citizens, to adopt and implement a Local Agenda 21.

- the Convention on Biological Diversity (United Nations, 1992b),

The Convention aims to conserve the sustainable use of biological diversity for the beenfit of present and future generation, calling for international cooperation in working toward this objective.

- the Framework Convention on Climate Change(United Nations, 1992c),

The Convention acknowledges that human activities are responsible for climate change, and express concern for the impact of such changes on ecosystems and humankind. It finally calls for the stabilization of greenhouse gasses concentration preventing the deterioration of the climate, in a time that would still enable economic growth to proceed sustainably.

- 1992 the non-binding Forest Principles (United Nations, 1992g).

It defines non-legally binding principles for a global consensus on the management, conservation and sustainable development of all types of forests.

- 1992 EEC Habitats Directive (EEC, 1992)

The Habitats Directive is a corner stone of the EU policy for the environmental conservation. The Directive defines habitats, flora and fauna and means for their protection, it also aims to design special areas of conservation and restoration. The Directive has been amended and consolidated in 2006. (EEC, 1992)

- 1993 EEC 5th Environmental Action Programme (EEC, 1993)

The Programme sets long term objectives and opts for a global approach; it aims primarily to integrate environmental aspects in all major policy areas.

41

The Programme addresses seven key themes, defining appropriate targets: climate change, acidification and air quality, urban environment, coastal zones, waste management, management of water resources, protection of nature and bio-diversity. (EEC, 1993)

- 1994 Aalborg Charter and European Sustainable Cities and Towns Campaign.

The First European Conference on Sustainable Cities and Towns resolves in the adoption of the Aalborg Charter, calling local authorities to engage with Local Agenda 21 processes and provides a framework for sustainable urban development at local level. The Conference establishes the initiation of the European Sustainable Cities and Towns Campaign. (European Conference on Sustainable Cities & Towns, 1994)

- 1995 Intergovernmental Panel on Climate Change second assessment report.

The Intergovernmental Panel on Climate Change states that the balance of evidence suggests a human influence on climate change and that climate is expected to continue changing in the future, although rapid and large climate changes are difficult to predict. (IPCC, 1995)

- 1995 World Summit for Social Development and Copenhagen Declaration

The Declaration recognizes the significance of social development and human well-being for all, on the conviction that economic development, social development and environmental protection are interdependent and mutually reinforcing components of sustainable development, committing to enhance global social development. (United Nations, 1995)

- 1995 EEA Europe's Environment: the Dobris Assessments.

The Assessment is the first pan-European complete environmental assessment on the state of environment. It analyses different environmental sectors, including: air, water, soil, nature, wildlife and urban environments, human health. (European Environmental Agency, 1994)

- 1996. Conference on Human Settlements (HABITAT II): Istanbul Declaration and Habitat Agenda

"In order to sustain our global environment and improve the quality of living in our human settlements, we commit ourselves to sustainable patterns of production, consumption, transportation and settlements development; pollution prevention; respect for the carrying capacity of ecosystems; and the preservation of opportunities for future generations." It recalls also the urban/rural interdependency and the importance of participation in decision making. (United Nations, 1996):8, 9

- 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change

The countries which ratify this Protocol commit themselves to reduce their emissions of carbon dioxide and five other greenhouse gases, else they commit themselves in engaging an emissions trading in the case they will maintain or increase emissions rate of these gases. (United Nations, 1998)

42

- 1998 UNECE Aarhus Convention

The Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters is adopted in 1998 and enters into force in 2001. The Convention provides for three key rights: access to environmental information, public participation environmental decision-making, access to justice; this latest regarding the possibility for the public to challenge public decision made in disregards of the previous two principles. (United Nations Economic Commission for Europe, 1998) (United Nations Economic Commission for Europe, 2000)

- 2000 Cartagena Protocol on Bio-safety

Based on the precaution principle stated in Rio Declaration, the Protocol focuses on "ensure an adequate level of protection in the field of the safe transfer, handling and use of living modified organisms resulting from modern biotechnology that may have adverse effects on the conservation and sustainable use of biological diversity, taking also into account risks to human health" (United Nations, 2000a):3

- 2000 Millennium Declaration

The Declaration aims to elimination of poverty and sustained development. It states as principle *inter alia* democratic and participatory governance, the respect of nature including elimination of unsustainable patterns of consumption and production; it affirms the importance of our common environment recalling the principles of Agenda 21 and asks for the entry into force of Kyoto protocol for the reduction of greenhouse gasses. (United Nations, 2000b)

- 2000 Report of the Secretary-General

The Declaration is accompanied by the Report "We the peoples: the role of the United Nations in the twenty-first century". It highlight one overall challenge, "And so the challenge is clear: if we are to capture the promises of globalization while managing its adverse effects, we must learn to govern better, and we must learn how better to govern together." (United Nations, 2000c):7

- 2000 Millennium Development Goals

The goals are the results of the Millennium Declaration and of the agreements and resolution adopted by UN in the past decade. They are defined as a series of eight measurable goals to be achieved by 2015:

– Eradicate extreme poverty and hunger
– Achieve universal primary education
– Promote gender equality and empower women
– Reduce child mortality
– Improve maternal health
– Combat HIV/AIDS, malaria, and other diseases

43

–   Ensure environmental sustainability

–   Develop a Global Partnership for Development

• <u>2001 EEC Directive on Strategic Environmental Assessment.</u>

The Directive establishes as mandatory the strategic environmental assessment for plans and programs prepared for agriculture, forestry, fisheries, energy, industry, transport, waste/ water management, telecommunications, tourism, town & country planning or land use, and requiring an assessment under the Habitat Directive, and which set the framework for future development consent of projects listed in the EIA Directive. (EEC, 2001) (Commission of the European Communities, 2009b)

• <u>2001 EU Sustainable Development Strategy.</u>

The Sustainable Development Strategy defines a common coherent strategy for sustainable development for the European Union. The Strategy sets overall objectives and concrete actions addressing seven thematic challenges:

-   Climate change and clean energy

-   Sustainable transport

-   Sustainable consumption & production

-   Conservation and management of natural resources

-   Public Health

-   Social inclusion, demography and migration

-   Global poverty and sustainable development challenges

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A revision process of the Strategy started in 2005 and leading to the adoption of a review strategy in 2009. The Strategy is based on a clear guiding principle: "Sustainable development will not be brought about by policies only: it must be taken up by society at large as a principle guiding the many choices each citizen makes every day, as well as the big political and economic decisions that have. This requires profound changes in thinking, in economic and social structures and in consumption and production patterns."[2] (Commission of the European Communities, 2001) (Commission of the European Communities, 2002) (Commission of the European Communities, 2005) (Commission of the European Communities, 2009a)

• <u>2002 World Summit on Sustainable Development held in Johannesburg.</u>

The WSSD in Johannesburg results in a report, including the Johannesburg Declaration on Sustainable Development and the Implementation Plan. The Summit stresses the inter-linkage between development, environment and use of resources, it also re-affirm the importance of defined and concrete targets for

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[2] http://ec.europa.eu/environment/eussd/ [accessed 13/VIII/2013]

achieving sustainable development, as the ones defined by the Millennium Development Goals. (United Nations, 2002b)

- 2003 EU carbon trading emission law

Europe adopts the first law for carbon emission trading, aiming to reduce greenhouse gas emissions in the frame of the Kyoto protocol. (European Union, 2003b)

- 2005 - Kyoto Protocol into action

Kyoto Protocol came in action after the ratification of Russia; Europe ratification is from 2002 (European Union, 2002), with strong limitation and aware of the fact that the objectives are almost impossible to achieve although extremely limited in their magnitude.

- 2005 - World Summit

The Summit reiterates the importance of Millennium Development Goals, asking for national implementation plans by 2006, and acknowledging a significant raise in world financial resources allocated for this purpose. It affirms the importance to undertake concrete action for sustainable development, specifically recognizing the importance of eradication of poverty, change unsustainable patterns in consumption and production, and protecting and managing natural resources.(United Nations, 2005a)

- 2005 Millennium Ecosystem Assessment

The objective of the Assessment was "to assess the consequences of ecosystem change for human well-being and the scientific basis for actions needed to enhance the conservation and sustainable use of those systems and their contribution to human well-being." It also recognize the importance of ecosystem service for human life and their unprecedented human lead change which is to continue in the coming decades unless human attitudes are changing radically.
(Millennium Ecosystem Assessment, 2005) (The Board of the Millennium Ecosystem Assessment, 2005):3

- 2009 Climate Change Conference in Copenhagen

The Conference ends without a real outcome, the Conference of the Parties only take notes of the existence of a document called Copenhagen Accord. Such non-accord aims to let each country to decide unilaterally the climate emission reduction in a non-legally-binding way. (United Nations, 2009a)

- 2011 Climate Change Conference in Durban

The main outcome of the Conference is to establish a legally binding agreement for all countries by 2015, which will enter into force in 2020; the agreement, named Durban Platform, includes USA, China and India. Moreover has been agreed that the Kyoto protocol will continue ad interim. (United Nations, 2011)

45

- 2012 United Nations Conference on Sustainable Development Rio +20

The Conference main outcome has been The Future We Want report, inter alia launching a process to establish Sustainable Development Goals, aiming to integrated Agenda 21 and Millennium Development Goals for the post 2015 period.

The Report renews the commitment toward sustainable development,(Rio principles and action plans) highlighting the need to mainstream it at all level, and give a central place to green economy for both poverty eradication and natural resource management.. The report places human beings at the centre of sustainable development process and call for addressing cross sectorial issues as: just sustainability, sustainable production and consumption, climate change and climate change/disaster risk reduction. (United Nations, 2012c) (United Nations, 2012a) (United Nations, 2013b)

- 2013 Post 2015 Agenda

The high-level panel for post 2015 Development Agenda finalizes its report highlighting how to reach MDGs and to integrate those with key issues that are still missing. The report calls for bolt commitment in five key areas: leave no one behind, put sustainable development at the core, transform economies, build peace and effective and accountable institutions, and forge a new global partnership. The report also address key cross cutting issues as: climate change, cities and sustainable consumption and production patters.(United Nations, 2013c) (United Nations, 2012b)

2.1.2 SUSTAINABLE DEVELOPMENT PATHWAY

2.1.2.1 FROM GRASSROOTS TO INSTITUTIONS

Since the beginning of the 60's large grassroots movements, based mainly in Scandinavia and North America, started to understand the critical relation between the human activity and the environment imposed by the present developing patterns. The Silent Spring and the Population Bomb first highlight the effect and impact human activity on the environment and start to question the pattern of human future development, under the threat of its own unlimited growth.

The international context it is dominated by the beginning of Cold War and the arms race, with the consequent nuclear escalation and the risks related to both its military and civil uses; it is the time of a growing uncertainness and instability strictly related to the future of the entire human species and the planet itself, in relation with catastrophic theories and a decreasing confidence in technology.

Driven by this feeling of uncertainness, the Club of Rome commissioned a research aimed to define future trends and perspectives, under a holistic approach. The research was based on the strategic analysis of the world problems through the implementation of a system dynamics model, having as outcome the publication of the Limits to the Growth. Here are highlighted the limits of the natural resources exploitation and the negative impact of human activity on the environment. During the years, this report has been criticized for the difficulties to understand and assess the scientific and technological innovation potential and impact, which under the detractor's point of view have not been considered properly. Although the report scenarios were not completely accurate, still defining main trends correctly, they had the merit to bring to an institutional level instances that before were just relegated to grassroots movements or academic niches.

In 1987 the Brundtland commission, under the World Commission on Environment and Development, after 3 years of work, release the report Our Common Future giving the first, and until now most accepted, institutional definition of sustainable development, stressing the interrelation between society, economy and environment in a strategic time dimension based on the principle of an inter and intra generational equity.

This report is praiseworthy for having brought the principles of sustainable development clearly into the international institutional agenda and helped its diffusion among the public opinion, although it has not been able to define any instrument for the possible implementation of these principles, which remains vague and open for the most different interpretations.

47

2.1.2.2   FROM DEFINITION TO IMPLEMENTATION

The United Nations Conference on Environment and Development, held in Rio in 1992, adopt the Agenda 21 (United Nations, 1992d) as a comprehensive action plan to implement SD globally, nationally and locally. It is then recognized the important role played by local authorities in the operational implementation of specific actions toward sustainability. Furthermore it is stated that decision making processes should be structured on governance processes based on large consensus building and awareness rising.

Starting from the basic principles of sustainable development, as stated in the Brundtland report, it is clear the difficulty in bridging the gap between theoretical vague definitions and operational praxis (Bill Hopwood, 2005); thereby the extreme difficulties for decision makers to manage the complexity in defining and evaluating the dynamic interrelation between the three pillars in a strategic perspective and under a multi scale approach (Costanza et al., 1993)

The LA21 defines the fundamental role of information for decision making as mean for implementation, particularly in relation to the collection, analysis and assessment of data and the development of indicators; furthermore it is highlighted the importance of the production of information to support decision making both for planning processes and public awareness.

Through the LA21 it is stated clearly that local authorities are responsible to implement the principles of A21 at local level, although the methods and means to put principle in practice are not clear. City and town administrations find themselves at a stake, that they have been able to bypass through the processes started with the Aalborg Charter (European Conference on Sustainable Cities & Towns, 1994).

This pathway, started from the grassroots of city and town administrators, has reached its higher institutional point in Europe though the adoption of the Thematic Strategy on Urban Environment (European Commission, 2006) , as it is going to be better explained along the next chapter.

During the last decade the frame structure for the local implementation of sustainable development has been structured institutionally, and also through many best practices; although a more deep analysis and evaluation it is still needed in order to fully understand which are in practice the results, their outputs and outcomes both in a multi scale and time perspective, and particularly which are the perspectives of the present practices toward sustainable development.

The principles of sustainability are universal but generic and the path toward sustainable development need to start from the local context through the commitment of decision makers and an active and participative public support; based on governance and founded on local values and specificity.

Thereby, an integrated evaluative approach is required to manage the complexity of a system that is not just represented by the summa of its parts, analysed separately, but from the understanding of the interconnections between the different elements both internal and external to the same system.
A veritable integrated approach to sustainable development should be aimed to a vertical integration, given by the relation between global and local, a horizontal integration, between the different sectors under a multidisciplinary view, and a time integration, given by a strategic approach.

For these reasons the use of static indicators or sectorial approaches are just apparently effective but, in reality, just aimed to little incremental advancements toward sustainability, stating partially the present situation and having effects to reduce some aspect of un-sustainability, more then to promote a durable and integrated sustainable development.

It might be that, the well-studied best practices and the very little analysed cases of failure in implementing LA21, are mainly based on a weak (Finco and Nijkamp, 2001) sustainability approach that shows to be able to give some results at the local level, for a limited time lap, but unable to foster a clear change in the global unsustainable development patterns.

The reason of this soft approach to sustainable development may be linked both to the evaluation of policies, plans and actions and to the participative decision making process, particularly with focus on the information and knowledge management.

Finally, as it will be explained in the next chapter, it is evident that city and town play a central role, both in terms of threat and opportunity, in the implementation of policy and practices toward sustainable development and, at the same time, due to their intrinsic complexity, urban areas are facing the greatest challenges.

2.1.3 SUSTAINABLE DEVELOPMENT GOALS: FUTURE CHALLENGES

Having reconstructed and analysed the pathways of sustainable development during the past decades, it is now time to outline the future perspective of sustainable development, defining which are the future challenges and pathways.

This paragraph is aimed to describe and analyse the United Nation pathway for the post-2015 agenda and its development, focusing in particular in the description and analyses of the Sustainable Development Goals that will guide the global pathway through a common agenda integrating development and sustainability.

2.1.3.1 THE END OF THE MILLENNIUM DEVELOPMENT GOALS

The Millennium Development Goals (MDG) entered into force in 2000, as a landmark global commitment aimed to eradicate poverty and increase development, ultimately to improve life conditions and future perspective of peoples around the world (United Nations, 2000b).

The MDGs consist of the following eight specific goals, with quantitative targets to be achieved by 2015:

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS, malaria and other diseases
7. Ensure environmental sustainability
8. Develop a global partnership for development

The MDGs were overambitious, and eventually under financed, as proven by the quantitative results achieved, which despite some valuable progress are still far from the achievement of the goals themselves, as originally set (United Nations, 2009b, United Nations, 2015b).

In particular, the progress has been uneven across region and countries and inequality persists; and for the concern and the purpose of this thesis it is important to outline the following short comings (United Nations, 2015b):

- Big gaps exist between the poorest and richest households, and between rural and urban areas.
- Climate change and environmental degradation undermine progress achieved, and poor people suffer the most.
- Millions of poor people still live in poverty and hunger, without access to basic services.

The achievements made through this global accord, signify that MDG agenda has proven that global action works, and for this reason it is now important to use this momentum to renew and enhance the commitments taken toward new ambitious global goals, beyond 2015.

2.1.3.2   THE POST-2015 AGENDA

With the Millennium Development Goals coming to an end, in 2013 the High Level Political Forum on Sustainable Development has been established (United Nations, 2013a), in order to determine an agenda for sustainable development post-2015, coupling both sustainability and development agendas at global level.

The post-2015 is a country-led process aimed to identify the Sustainable Development Goals (SDG) under a universal agenda at global level, following the outcomes and mandate of the Rio+20 (United Nations, 2012b) which led to establish an Open Working Group of the General Assembly on Sustainable Development Goals.

The Open Working Group, under the auspices of the Future We Want (United Nations, 2012a), has elaborated the report "Transforming Our World: the 2030 Agenda for Sustainable Development" (United Nations, 2015c), outlying 17 Sustainable Development Goals and 169 specific targets, to be adopted in September 2015 at the United Nations High-level Summit.

2.1.3.3   FUTURE CHALLENGES: THE SUSTAINABLE DEVELOPMENT GOALS

"This Agenda is a plan of action for people, planet and prosperity that also seeks to strengthen universal peace in larger freedom. All countries and all stakeholders, acting in collaborative partnership, will implement this **people-centred Agenda**. We are resolved to free the human race within this generation from the tyranny of poverty and want and **to heal and secure our planet for the present and for future generations**. We are determined to take the **bold and transformative steps** which are urgently needed to shift the world onto a **sustainable and resilient path**. As we embark on this collective journey, we pledge that no one will be left behind". (United Nations, 2015c):1

The SDGs are a transformative step to shift the world toward a sustainable and resilient path, aimed to achieve sustainable development, in an integrated and balanced manner, in its three dimensions; toward inclusive and just societies, protecting the planet and its resources, fostering sustained and inclusive economic growth.

The SDGs are of fundamental importance to shift the current unsustainable patterns of growth of our world today:

"We are meeting at a time of immense challenges to sustainable development. Billions of our citizens continue to live in poverty and are denied a life of dignity. There are rising inequalities within and between states. There are enormous disparities of opportunity, wealth and power. Unemployment, particularly youth unemployment, is a major concern. Global health threats, natural disasters, spiralling conflict, violent extremism, humanitarian crises and forced displacement of persons threaten to reverse much of the development progress made in recent decades. Natural resource depletion and adverse impacts of environmental degradation, including desertification, drought, land degradation and ocean acidification, add to and exacerbate the list of challenges which humanity faces. Climate change is one of the greatest challenges of our time and its negative impacts undermine the ability of all countries to achieve sustainable development. The survival of many societies, and of the biological support systems of the planet, are at risk". (United Nations, 2015c):4

Here bellow the goals, highlighting in bolt the ones with a stronger relation to the present work:

Goal 1. End poverty in all its forms everywhere

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Goal 3. Ensure healthy lives and promote well-being for all at all ages

Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Goal 5. Achieve gender equality and empower all women and girls

Goal 6. Ensure availability and sustainable management of water and sanitation for all

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Goal 10. Reduce inequality within and among countries

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable

Goal 12. Ensure sustainable consumption and production patterns

Goal 13. Take urgent action to combat climate change and its impacts*

Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development

2.1.4 WORKING DEFINITION OF SUSTAINABLE DEVELOPMENT

This paragraph aims to give a working definition of sustainable development to be used as a base for the further development of the thesis itself: The working definition is grounded in the institutional timeline of sustainability in the last decades, but rely particularly on the work developed of the post-2015 agenda and the SDGs, which clearly is built on the past actions and development and facing current and future world challenges.

The working definition is based on key principles as stated, inter alia, within Transforming Our World: the 2030 Agenda for Sustainable Development (United Nations, 2015c), underlying that sustainable development should focus on:

- **The people**: aiming to achieve well-being and a healthy environment for all, with equal access to natural resources, securing participations of all people and groups.

- **The Planet:** aiming to safeguard our common home, maintaining the ability of the planet to support the need of present and future generations, with sound management of natural resources through sustainable consumption and production, taking action to combat climate change and its effects, promoting safe and inclusive cities, increasing disaster risk reduction and resilience.

- **The Prosperity:** aiming to empower all human being to enjoy the fruit of economic, social and technological progress, ensuring sustained and sustainable economic growth, through sustainable industrialization, agriculture and infrastructures.

- **The Peace:** aimed to build a peaceful, safe and inclusive society, though strengthening governance to build effective, inclusive and accountable institutions

- **The Partnership:** aimed to establish a partnership among all countries and stakeholders, focusing on a people centred approach.

The working definition of sustainable development is formed by the following key principles:

- **Participation:** is central for sustainable development requiring means of governance people centred, through the inclusion of stakeholders and local communities, taking into account also future generation

- **Systemic:** sustainable development is of high complexity involving multiple factors at different spatial and temporal scales, and requiring a systemic and integrated approach;

- **Process:** sustainable development is not a final state but a dynamic process, a transition approach is thereby required to shift from the current unsustainable patterns of development toward sustainable ones.

- **Evaluation:** sustainable development require clear qualitative and quantitative measure, process based, able to tackle its complexity through an integrated evaluation approach.

- **Resilience:** some key global dynamics, like climate change, are extremely complex and embedded with high uncertainty, thereby it is fundamental to build resilient system able to dynamically adapt, prevent and fast recover from high risk and events.

- **Spatial integration:** sustainable development shall be tackled taking into account complex dynamics of change with cross scale effects, requiring to integrate local and global actions.

- **Temporal integration:** sustainable development shall be tackled taking into account complex dynamics of change with cross temporal causes and effects, requiring to integrate past, present and future integration.

These principles will need to be further expanded tackling at urban level, as elaborated in the next chapter, key issues as management of resources, climate change, justice and democracy and urban transformation, as well as cross thematic issues as water and energy.

2.2 CONTEXT: URBAN SYSTEMS

"…recognize cities and towns as centres of civilization, generating economic development and social, cultural, spiritual and scientific advancement." (United Nations, 1996):7

"A world where human habitats are safe, resilient and sustainable "(United Nations, 2015c):3

The importance of cities and human settlements for sustainable development has always been recognized and considered central for its achievement, since the institution of Local Agenda 21 (United Nations, 1992a, United Nations, 1992d, United Nations, 1992e).

There has been an extraordinary and consistent effort during the years in defining and supporting the pathway toward urban sustainable development, through an incredible number of initiatives at global, regional and national/sub-national level, focusing on the whole urban sustainability or on specific thematic challenges.

2.2.1 SUSTAINABLE URBAN DEVELOPMENT BRIEF TIMELINE

For the purpose of this thesis only a brief outline of milestones is realized, considering the UNHABITAT global processes related to World Urban Forums and to HABITAT conferences; and considering at EU level the Sustainable Cities and Towns Campaign.

Finally, re-focusing toward the future of sustainable urban development, this chapter is including a full list of the Sustainable Development Goal 11 "Make cities and human settlements inclusive, safe, resilient and sustainable", subsequently highlighting few key challenges for the future of urban sustainability.

2.2.1.1 HABITAT: TOWARD HABITAT III

The first UN Conference on Human Settlement was organized in Vancouver in 1976, resulting in the Vancouver Declaration on Human Settlement (United Nations, 1976), and the creation of the UN Centre for Human Settlement, later becoming United Nations Human Settlement Program under General Assembly resolution in 2001 (United Nations, 2002a). The same resolution institutes the World Urban Forum, to take place in years in alternation with the UNHABITAT Governing Council.

The second UN Conference on Human Settlement (HABITAT II) took place in Istanbul in 1996, resulting in the Istanbul Declaration on Human Settlement (United Nations, 1996), aiming to couple the sustainable development of human settlements and the achievement of adequate shelter for all.

HABITAT II was followed by the 25th Special Session of the General Assembly, also known as ISTANBUL+5, adopting the Declaration on Cities and Other Human Settlement in the New Millennium (United Nations, 2001), assessing Habitat Agenda and proposing actions for further implementation.

The United Nations Generally Assembly in 2012, decided to convene the third United Nation Conference on Housing and Sustainable Urban Development (HABITAT III), to take place in Quito in October 2016, "to reinvigorate the global commitment to sustainable urbanization that should focus on the implementation of a "New Urban Agenda", which should build on the Habitat Agenda, the Declaration on Cities and Other Human Settlements in the New Millennium and the relevant internationally agreed development goals, including those contained in the United Nations Millennium Declaration, and the Johannesburg Declaration on Sustainable Development and the Johannesburg Plan of Implementation, and the outcomes of other major United Nations conferences and summits" (United Nations, 2001):3

HABITAT III will result in the adoption of a new Urban Agenda for 2030, focusing on the transformative power of urbanization.

2.2.1.2   *WORLD URBAN FORUM: MEDELLIN DECLARATION*

The World Urban Forum is the world's premier conference on cities convened by United Nations Human Settlement Programme, it is a non-legislative technical forum organized since 2002 every two years in different cities; the first one being held in Nairobi.

The last World Urban Forum 7 (WUF7) took place in Medellin Colombia in April 2014, titled "Urban Equity and Development- Cities for Life", the main outcome of the WUF7 was the Medellin Declaration aimed to contribute to the post-2015 agenda and the Third UN Conference on Housing and Sustainable Urban Development (HABITAT III), building on the outcomes of the UN Conference on Sustainable Development Rio+20.

The WUF7 main outcome was the adoption of the Medellin Declaration, committing to promote equitable urban development. The city is considered an opportunity for innovation, providing opportunities for access to resources and services, as well economic and social welfare. At the same time the city is also cause of environmental degradation and resource depletion, being vulnerable to impact of climate change, as well as natural and man-made disasters.

The Declaration calls for a new urban agenda for responding to the expansion of cities, the intensive resource use, the increasing climate impacts, the urban inequality and exclusion; responding with new technologies, integrated participatory planning approaches, and reliable urban data.

The key message is referring to the need for stronger means for participation and inclusion through planning and management of the city, in order to respond to key urban challenges and promote sustainable and resilient urban development.

Here bellow the list of the specific provisional targets, prepared for adoption in September 2015, related to the Sustainable Development Goal 11 on cities:

11.1

By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums.

11.2

By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.

11.3

By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.

11.4

Strengthen efforts to protect and safeguard the world's cultural and natural heritage.

11.5

By 2030, significantly reduce the number of deaths and the number of people affected and decrease by [x] per cent the economic losses relative to gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations.

11.6

By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.

11.7

By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities.

11.a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning.

11.b By 2020, increase by [x] per cent the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, develop and implement, in line with the forthcoming Hyogo Framework, holistic disaster risk management at all levels.

11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials.

The institutional pathway for sustainable urban development outlined above, helped to define some key urban challenges that are further described in the following sections.

2.2.2 CLIMATE CHANGE

"Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen". (IPCC, 2014):1

"Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane and nitrous oxide that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century." (IPCC, 2014):4

"In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans. Impacts are due to observed climate change, irrespective of its cause, indicating the sensitivity of natural and human systems to changing climate." (IPCC, 2014):6

"Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems. Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks." (IPCC, 2014):8

2.2.2.2 TOWARD RESILIENCE: COUPLING MITIGATION AND ADAPTATION

Climate change is unequivocal and having human activities as dominant cause; human activities that are concentrated in urban settlements, and which pattern growth patterns will lead to an increase of such activities, including emissions with negative impact on climate change dynamics.

Impacts of climate change on human and natural systems has been observed as increasing during the last decades, endangering directly human system, particularly urban settlements where human activities is concentrated, and indirectly through the negative impact on natural system which are supporting human life on the planet.

United Nations Framework Convention on Climate Change (UNFCCC), is preparing for an historical meeting in Paris in December 2015, for the Conference of Parties 21 (COP21) aiming to achieve a global agreement to address universally climate change through adaptation and mitigation commitments.

The agreement text for COP21 is under preparation through the established UNFCCC negotiation process that included the Climate Change Conference in Geneva, in February 2015, where the Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP) (United Nations, 2011) adopted a negotiating text, then streamlined an consolidate during UNFCCC Climate Change Conference in Bonn in June 2015. (United Nations, 2015d)

For the first time there has been a breakthrough in trying to overcome the dualism between mitigation and adaptation, aiming to integrate both under the common concept of resilience, which is retired numerous time in the text. Please note that this is a negotiating text that includes several alternative options, for this reason a final count of the word resilience would not be significant.

In March 2015 in Sendai took place the Third UN World Conference on Disaster Risk Reduction (WCDRR), which resulted in the Sendai Framework for Disaster Risk Reduction 2015-2030, adopted by the General Assembly (United Nations, 2015a), the first major agreement adopted under the post-2015 agenda.

The Sendai Framework, following the Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters (United Nations, 2005b), determine a 15 plans for addressing with urgency disaster (both slow and rapid onset disasters) and risk reduction, including urban environments.

A new understanding of resilience as coupling mitigation, risk and adaption to climate change need to be established in order to develop an integrated approach, which would be indispensable particularly for urban environments, where the level of mitigation, adaptation and risk prevention/reduction activity need to be concentrated.

2.2.3 RESOURCE EFFICIENCY

The human activities are growing increasingly well overcoming the ability of the planet to planet to reconstitute it, this is an established dynamic at the core of the same concept of sustainable development. Cities and urban habitats concentrates human activities, which is responsible to the overuse of natural resources, as well as for the production of negative externalities that impact natural resources.

More specifically:

• Cities occupy 3% of the total land surface

• Cities produce 50% of global waste

• Cities account for 60-80% of global GHG emissions

• Cities consume 75% of natural resources

• Cities produce 80% of global GDP (UNEP-DTIE, 2013):4

Thereby for achieving sustainable development it is fundamental to start a transition toward a more sustainable resource management, through a life cycle approach, implementing strategies and actions to move toward for sustainable production. (The Board of the Millennium Ecosystem Assessment, 2005, UNEP, 2012, UNEP, 2007, IPCC, 2014)

Sustainable consumption and production is "The use of services and related products, which respond to basic needs and bring a better quality of life while minimising the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardize the future generations".(UNEP, 2010)

The United Nation Conference on Environment and Development (United Nations, 1992f) already established that sustainable consumption and production is an overreaching theme linking development and environmental agendas toward sustainable development; Agenda 21 states that the deterioration of global environment and natural resources depletion is due to unsustainable patterns of consumption and production. (United Nations, 1992a)

The World Summit on Sustainable Development (United Nations, 2002b) established the Johannesburg Plan for Implementation, calling for changing unsustainable patterns of production and consumption, and for the development of a 10 Years Framework of Programmes through the Marrakech Process, finally adopted at Rio+20 (United Nations, 2012c), aiming to de-couple economic growth and environmental degradation.

"Cities consume 75% of the world's natural resources, 80% of the global energy supply and produce approximately 75% of the global carbon emissions. In general, fossil fuel prices (coal, natural gas and crude

oil) have risen steadily since the late 1990s. This raises serious questions about the future sustainability of cities in terms of energy supply, their role in meeting global carbon emission reduction targets and their ability to participate in the carbon economy." (UNEP-DTIE, 2013):1

2.2.3.1 TOWARD A SYSTEMIC URBAN TRANSITION

Decoupling development and natural resource use/depletion is of fundamental importance to achieve sustainable urban development, through a systemic transition toward sustainable consumption and production, facilitating systemic eco-innovation of socio-technical-institutional structure.

This may entail to re-think our way of planning and managing cities, as planning has been traditionally interlinked with specific economic and production/consumption structures and patterns, in order to define strategies and actions to foster the sustainable and resilient transition of cities, based on absolute decoupling and circular economy principles. (Ellen MacArthur Foundation, 2013a, Ellen MacArthur Foundation, 2013b, Ellen MacArthur Foundation, 2014)

"Such strategies encourage systemic sociotechnical change in the organization of cities in order to prepare for climate change and resource constraint. They are usually underpinned by wider social visions about the type of city that is being constructed and wider forms of engagement with stakeholders about the construction of the vision, although the depth and scope of this may be variable. The cultivation of a strategic orientation for the reconfiguration of socio-technical systems – infrastructure, buildings, and social relations – also requires the purposive, strategic development of new forms of knowledge, capacity and capability to translate these into action." (UNEP, 2013):71,72

The redefinition of urban planning and management forms for systemic urban transition, able to address the call for absolute decoupling of natural resource use and socio-economic development, shall be based in re-developing a urban metabolic approach in a circular manner, taking also in account social metabolism, and calling for integrated and systemic evaluation.

2.2.4 PARTICIPATION AND GOVERNANCE

2.2.4.1 BACK TO BASIC: THE AGENDA 21

The basis of participation for fostering sustainable development transition, have been long and well established since the Rio Declaration, including it in the following three principles:

- Principle 10

"Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided."

- Principle 20

"Women have a vital role in environmental management and development. Their full participation is therefore essential to achieve sustainable development."

- Principles 22

"Indigenous people and their communities and other local communities have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development." (United Nations, 1992f):1-7

These principles states the importance of involving stakeholders, concerned citizens, women, indigenous peoples and local communities, in participative decision making process; encouraging awareness rising and effective participation through information sharing.

Moreover the Agenda 21 it is clearly declining these principles, and setting the very foundations for participation of stakeholders and local communities.

"Agenda/21 addresses the pressing problems of today and also aims at preparing the world for the challenges of the next century.........The broadest public participation and the active involvement of the non-governmental organizations and other groups should also be encouraged". (United Nations, 1992f, United Nations, 1992a):15

"Experience has shown that sustainable development requires a commitment to sound economic policies and management, an effective and predictable public administration, the integration of environmental

concerns into decision-making and progress towards democratic government, in the light of country-specific conditions, which allows for full participation of all parties concerned." (United Nations, 1992a):18

"Empowering communities.

Sustainable development must be achieved at every level of society. Peoples' organizations, women's groups and non-governmental organizations are important sources of innovation and action at the local level and have a strong interest and proven ability to promote sustainable livelihoods. Governments, in cooperation with appropriate international and non-governmental organizations, should support a community-driven approach to sustainability, which would include, inter alia:

(a) Empowering women through full participation in decision-making;

(b) Respecting the cultural integrity and the rights of indigenous people and their communities;

(c) Promoting or establishing grass-roots mechanisms to allow for the sharing of experience and knowledge between communities;

(d) Giving communities a large measure of participation in the sustainable management and protection of the local natural resources in order to enhance their productive capacity;

(e) Establishing a network of community-based learning centres for capacity-building and sustainable development." (United Nations, 1992a):32

Agenda 21 define also the specific need for participation in relation to sustainable urban development and human settlements.

"Human settlement objective.

The overall human settlement objective is to improve the social, economic and environmental quality of human settlements and the living and working environments of all people, in particular the urban and rural poor. Such improvement should be based on technical cooperation activities, partnerships among the public, private and community sectors and participation in the decision-making process by community groups and special interest groups such as women, indigenous people, the elderly and the disabled. These approaches should form the core principles of national settlement strategies. In developing these strategies, countries will need to set priorities among the eight programme areas in this chapter in accordance with their national plans and objectives, taking fully into account their social and cultural capabilities. Furthermore, countries should make appropriate provision to monitor the impact of their strategies on marginalized and disenfranchised groups, with particular reference to the needs of women." (United Nations, 1992a):73,74

"Improve the urban environment by promoting social organization and environmental awareness through the participation of local communities in the identification of public services needs, the provision of urban infrastructure, the enhancement of public amenities and the protection and/or rehabilitation of older buildings, historic precincts and other cultural artefacts." (United Nations, 1992a):79

"Human resource development and capacity-building.

7.45. With the assistance and support of funding agencies, all countries should, as appropriate, undertake training and popular participation programmes aimed at:

(a) Raising awareness of the means, approaches and beenfits of the provision of environmental infrastructure facilities, especially among indigenous people, women, low-income groups and the poor;

(b) Developing a cadre of professionals with adequate skills in integrated infrastructural service planning and maintenance of resource-efficient, environmentally sound and socially acceptable systems;

(c) Strengthening the institutional capacity of local authorities and administrators in the integrated provision of adequate infrastructure services in partnership with local communities and the private sector;

(d) Adopting appropriate legal and regulatory instruments, including cross-subsidy arrangements, to extend the beenfits of adequate and affordable environmental infrastructure to unserved population groups, especially the poor." (United Nations, 1992a):86

2.2.4.2 *TOWARD A CO-EVOLUTION AND PARTICIPATIVE APPROACH TO PLANNING*

"It will become important in the coming decades to govern by mobilising social energy. There is a future for an innovative, vital society founded on sustainability. Innovations mean scope for action and initiative, accepting the fact that mistakes will be made, and making certain that the best improvements are identified and distributed rapidly. This calls for a different type of government. Such a government sets clear objectives before going on to create room for other parties, implements knowledge, know-how and regulations to help promote promising combinations of initiatives, and creates the institutional frameworks within which citizens, organisations and entrepreneurs can develop and directly beenfit from sustainable innovation." (Hajer, 2011):10

Planning practice is required to achieve a sustainable urban development, based on participation of stakeholders and local communities, establishing a learning circle to foster innovation through awareness raising and capacity building, empowering the stakeholders and local communities to foster socio-technical innovation following co-evolution and co-design principles.

2.2.5 WORKING DEFINITION OF SUSTAINABLE URBAN DEVELOPMENT

This paragraph aims to give a working definition of urban sustainable development, which is used for structuring the rest of the thesis work; it highlights key elements and introduces approaches.

The definition is based on the working definition of sustainable development, previously elaborated, which is used as base and further expanded through the definition of urban context and urban challenges, which are resumed here bellow.

A new understanding of resilience as coupling mitigation, risk and adaption to climate change need to be established in order to develop an integrated approach, which would be indispensable particularly for urban environments, where the level of mitigation, adaptation and risk prevention/reduction activity need to be concentrated.

The redefinition of urban planning and management forms for systemic urban transition, able to address the call for absolute decoupling of natural resource use and socio-economic development, shall be based in re-developing a urban metabolic approach in a circular manner, taking also in account social metabolism, and calling for integrated and systemic evaluation.

Planning practice is required to achieve a sustainable urban development, based on participation of stakeholders and local communities, establishing a learning circle to foster innovation through awareness raising and capacity building, empowering the stakeholders and local communities to foster socio-technical innovation following co-evolution and co-design principles.

The key elements for sustainable urban development are:

- **Systemic:** sustainable urban development is of high complexity involving multiple factors at different spatial and temporal scales, different thematic issues from energy to waste, water, transport, and requiring a systemic and integrated approach;

- **Transition/transformation Process:** urban systems current growth patterns are highly unsustainable, requiring a radical transformation/transition process toward sustainability; a dynamic process of systemic innovation;

- **Resilience:** some key global dynamics, like climate change, are extremely complex and embedded with high uncertainty, thereby it is fundamental to build resilient system able to dynamically adapt, prevent and fast recover from high risk and events, coupling mitigation/adaptation/risk related actions;

Thereby to move toward a sustainable urban systems it is indispensable to address:

- **Spatial integration: metabolic approach.** Sustainable urban development shall be tackled taking into account complex dynamics of change with cross scale effects, requiring to integrate local and global actions, and cross thematic issues, this through a metabolic approach, including social metabolism, tackling material and immaterial flows, addressing also natural resources challenge.

- **Temporal integration:** sustainable urban development shall be tackled taking into account complex dynamics of change with cross temporal causes and effects, requiring to integrate past, present and future integration; recovering knowledge from the past to address present and future challenges with a strategic perspective, taking into account the yet not expressed needs of future generations.

- **Evaluation:** sustainable urban development require clear qualitative and quantitative measure, process based, able to tackle its complexity through an integrated and systemic evaluation approach; such systemic evaluation can support the continuous learning process which is fundamental to foster transition processes.

- **Participation:** is central for sustainable urban development requiring means of governance people centred, through the inclusion of stakeholders and local communities, taking into account also future generation. Thereby the planner role need to be reconstructed making of it a facilitator of participative planning, co-design and co-evolution processes.

3 THE THEORETICAL FRAME

3.1 SYSTEM THINKING

This chapter is analysing the development of the concept of system thinking, particularly with reference to sustainable development and natural resource management.

This chapter is also including a section giving a brief introduction to system dynamics and mental maps, explaining why for this thesis work the second is preferred to the first.

Specific attention will be given to system thinking as learning process and its potential in innovation.

A systemic re-structure and re-thinking of our knowledge is needed to confront and to manage rapidly increasing challenges we are facing and their intrinsic unpredictability, aware that our patterns of growth are deeply un-sustainable; in this context UNESCO's project "Education for Sustainable Development" (Morin, 1999) and system dynamics logic can give to decision makers a strong support in evaluation.

The first principle that should be followed for this scope it is to learn how to connect the whole system with the parts that are composing it, both in terms of complex interconnections and in terms of multidisciplinary approach, with particular attention to the context and its specificity.

It should be also clear that every person has a commonly complex identity, being at the same time individual, part of a society and of the human species; this is particularly important knowing that the observer, just in the act of observing, it is changing the same object of its observation; just a deep awareness and a full transparency in decision making process can diminish errors and misjudgements effects.

Uncertainness and future unpredictability need a strong preparation of decision makers in facing and dealing with changes, requiring and additional ability and appropriated instruments to acquire constantly new information and to adjust and modify the responses to it.

Systems dynamics logic and models can be a useful support for decision makers to restructure and re-organise both knowledge and thinking patterns, in evaluating project aimed to sustainable development.

3.1.1 SYSTEM THINKING AND DYNAMICS

Systems dynamics as scientific discipline has been developed during the last 45 years, based on the work of his founder Jay Forrester (Forrester, 1968, Forrester, 1969, Forrester, 1973); it is based on the analysis of systems as composed by interrelated elements which are transformed through time both in their own essence and interrelation. Systems dynamics aim to understand the systems through the complex interrelation between its elements within the whole, and to simulate its future development.

The systems thinking is based on an holistic view of the non-linear systems and their dynamic, in opposition to the reductionist view given from Descartes , and on the fact that a part of the system, when isolated from the others and the whole, will behave differentially and mutate its own characteristics as .

For this reason the main focus of systems dynamics it is to understand and analyse the feedback loops between the systems part, and with the extern, in order to understand the complex of the dynamic behaviour of the systems framed in a contextual relation.(Alcamo et al., 1996a, Alcamo et al., 1996b)

This kind of dynamic and systemic approach it is particularly relevant for decision makers that can step forward from the use of reductionist technique, based on the analysis of single isolate aspect of the problems; and to move from the deterministic input-output logic, taking into account both internal and external interconnections.

The time dimension under systems dynamics approach it is neither given by the summa of static picture of the system in the future but it is more based on the analysis of the continuous and complex developing behaviour of the system in conjunction with its part and the external context, that it is also framed in a dynamic process of change along the time.(Richardson, 2005, Bockermann et al., 2005, Fang et al., 2005, He et al., 2006)

Systems dynamics and the models from here derived offer the possibility not just to collect information about single elements but to structure knowledge and understanding of the elements of the systems and their dynamics, giving for this reason an important support for decision makers in a post-normal science era, defined by the importance and the magnitude of the stakes in relation with increasing degrees of uncertainness and complexity.

It is important to remember that a systems dynamic model it is first of all a logic model aimed to understand complex behaviour of the system as a whole, and moreover can become also a mathematic model useful for forecasting simulations.

A transparent model of systems dynamics can be the base for a democratic process of decision making, where all the possible options can be evaluated, confronted and benchmarked, following clear parameters

70

that can be structured starting from the same value set of the decision makers themselves, through the weight that is given to the single variables in relation with the others and their context.

Moreover a set of systems dynamics models can be constructed together in order to understand both the general behaviour of a system, for example a city, defining the key elements composing the system itself and introducing some variable as "external factor" in order to build a strong vertical integration. Subsequently model can be connected with specific sub-models, designed at a lower scale, referring to specific key fields (for example the waste management into the city).

This cascade interconnected way to structure the system can guarantee, at least in principle, the opportunity to combine at the same time vertical integration, horizontal integration and time perspective; also under a post normal science approach (Funtowicz and Ravetz, 1993, Funtowicz and Ravetz, 1994)with focus on democratic and participatory decision making processes, which stake starts from the same open definition of the values beenath the model definition and analysis.

At this point it is relevant to better define in which way our approach to systems behave and dynamics it is strictly related to our thinking structures and knowledge organization, particularly if decision making have to deal with evaluation of sustainability. (Ernstson et al., 2010, Scott et al., 2012, Saritas and Nugroho, 2012, Frantzeskaki et al., 2012, Coenen et al., 2012)

3.1.2   NEED FOR A PARADIGMATIC SHIFT

As previously stated, systems dynamic models should be based on a clear definition of the shared values beenath it, representing all the actors involved in the evaluation process; but should be clear that those common values are the result of negotiation practice between the actors that are comparing and sharing their own visions.

Such a kind of vision and value negotiation it cannot be objective, the definition and implementation of sustainable development cannot follow static and universally sure solutions; so, in defining the keys for the local peculiar sustainability pathway, it is necessary that the systems dynamics models, as well as decision makers themselves, can be able to deal with both intellectual and perception errors (Checkland, 1981, Joshua Klayman, 1993, Barry, 1993).

For this reason the model, on which the evaluative process is structured, should be able to be flexibly modified and scaled, and very adaptable to different situations/environments, and capable to represent the reality through a multi-scale approach, virtually compressive of global drivers, local general models and sectorial in-deep sub-models.

At the same time should not be forgotten, or underestimated, that a model it is just a representation of the reality, a reductive representation, that due to need of understanding, will just select a contained set of information, or information categories. The models should be focused and targeted clearly, in order to give consistence and legitimacy to the model itself, and prevent particularly bias and perception errors.

The transparency in the model building it is strictly related to legitimacy, and extremely important in decision making processes aimed to evaluate alternatives toward sustainable policies and actions. Furthermore legitimacy it is vital in democratic processes and for consensus building, both import dimensions of processes under principles of sustainability, but also relevant for creativity and innovation. (S and D., 1997, Robert et al., 2002, Ormerod, 2005, Gattie et al., 2007, Cosgrave et al., 2013)

The logical construction of systems dynamics multi-integrated models, can trigger creative and innovative processes in-between the local community, through the definition of threats and opportunities in a compressive and dynamic way, calling for the integration of different expertise and through a negotiation process on the visions of the world. In fact, systems dynamics models are a precious tool to organize and to analyse systematically the information and to enlarge the accessibility to the information itself, although the positive effects, from here derived, are strongly linked to an in-progress learning processes.

A learning process aimed to the construction of a "pertinent knowledge" (Morin, 1999), that under a multidisciplinary view, can define universal problems and particular solutions through a special multidisciplinary focus on both context and complex, framed in a time perspective.

Furthermore, it is going to be better investigated the time perspective, in terms of future previsions and simulation, because this aspect it is particularly relevant and critic in the evaluation of sustainability; for two main reason, the first is the understanding of the present trends and their evolution, and the second it is the effect of policies and actions in terms of outcomes: something sustainable today might be deeply unsustainable tomorrow.

3.1.3 FUTURE FORECASTING AND BACKCASTING

The concern about future it is deeply related to the same concept of sustainable development, as well as it has been always strictly related to its own genesis; the concern about future represent the first and most important driver of paradigmatic shift in the world developing patterns.

The path way of sustainable development concept and definition, from grassroots to institutions, is strongly related to future studies and to the definition of future scenarios (Meadows et al., 1972) mainly through forecasting methodologies based on system dynamics approach (Forrester, 1968).

Scenarios are acknowledged as effective tools for synthesizing and communicating complex information for stake holders (Decker et al., 2000), to support their decision making toward sustainability; furthermore they can be used effectively in participatory environmental assessment (Toth, 2001)

Forecasting scenarios are useful to explore present and future trends focusing on socio-economic dynamics, environmental changes and resilience, scientific and technological innovative shifts, and in case of policy based scenario, also institutional and political impacts (Dortmans, 2005).

The main problem of forecasting scenarios is related to the difficult to foresee inventions and radical innovations (Hall, 1986, Hall and Preston, 1988) meanwhile is not yet been define a methodology to asses organizational innovation impact, particularly in relation with sustainable development , or to determinate the importance of urban milieu innovation potential (Castells, 1989, Manuel, 2000). For this reason forecasting scenarios have been mainly used for global prevision of expected futures, in order to understand main trends, particularly environmentally related, but presenting problems in the use of this by decision makers to implement sustainable development policies at local level.

Instead backcasting scenarios are based on visions of desired future situation and is focused on the support of organizational changes and strategic planning toward these desired situation (Dreborg, 1996, Carlsson-Kanyama et al., 2008)
Backcasting scenarios have been widely used from the 70' in participatory urban planning, also through visioning and game methodologies, and from the 90' for evaluation of sustainable development (Quist and Vergragt, 2006, Quist et al., 2006)
Particularly, backcasting scenarios can have a key role in fostering local milieu innovation (Aydalot and al., 1986) and creative destruction value based (Weaver et al., 2000), supporting urban creativity (Landry, 2000) and sustainable development operational implementation (Jansen, 2003).

Nevertheless backcasting scenarios can lack a vertical integration being mainly problem oriented and limited to the frame of action of the local stakeholders participating in the scenario building process.
74

The potential and the lack of the two presented methodologies for future scenarios highlight the need of an integrated frame for evaluating sustainability (Rotmans J and van Asselt M, 2000) and of methodologies and tools toward a sustainable development, and particularly of systems dynamic approach and logic.

Nevertheless systems dynamic it is not the ultimate tool for universal resolution of every world problem, neither can give crystal ball based prophetic visions of the future, or to clearly foster our future visions along the pattern of the rights.

Many has been the experiences, particularly in future forecasting field, that has been based on systems dynamics models, still there is a deep need for implementation of the model capacity building; but even more important there is to found the model building logic on the sustainable development principles.

3.1.4   SYSTEM DYNAMIC AND DECISION MAKING

The European Environmental Agency has been working along years on scenarios building, analysing different approaches on forecasting and future studies, on the base of this work it is possible to describe shortly some of the systems dynamics future models that has been developed until know, try to highlight their weakness and the potential of further implementation of systems dynamics models.

Starting with World 3 (Meadows et al., 1972) it is clear that the model is focused on the horizontal integration between variables structuring a strong relation between variables, also in terms of feedback loops and trade-offs, although lacking institutional and socio-cultural dimension, and being very weak in terms of vertical integration, on a scale perspective.

International Futures can be considered an evolution of World 3 presenting integration with political and social variables; the model is divided in 14 sub-regional models, which structural variable can be modified and adapted in order to give better support to decision making processes, although a clear vertical integration it is still missing.

A step forward to solve the vertical integration lack it is done in TARGETS (Rotmans and de Vries, 1997), which it is integrating along its main model some simplified expert models on key sectors, giving a wider usability for decision makers, at least for understanding which are global dynamics and drivers; in fact the model it is strongly based on a PSIR approach (Pressure, State, Impact, Response; later becoming DPSIR with the introduction of the category Driver).

Threshold 21 represents a very transparent model able to complement the previous three models horizontal integration in a very transparent way; furthermore the model is highly modifiable and useable from decision makers, which can adapt it to national level, although a veritable vertical integration it is still missing.

As lesson learned, it is possible to say that fully integrated models for sustainable development evaluation, to be veritably used by local decision makers, still are missing, here we have analysed global models that are the closes to reach the triple integration (vertical, horizontal, temporal) but still, due to their scale and the lack of a strong vertical dimension they can be scarcely used by local decision makers.

At the local level it is possible to find different specific models that are focusing on precise key sector, but lacking a veritable and sound horizontal integration between different factor and dynamics.

Being assumed that the solution of global problems should start from local, it is necessary to give to local decision makers useful and understandable information, in order that can be built a set of alternatives and priorities, able to take into account vertical trade-off mechanisms, and horizontal proof inter-linkage of the composing elements, the path to the use of systems dynamics for decision making and evaluation it is still long.

76

3.2 TRANSITION THEORY

This chapter is analysing the theoretical development of sustainability transition theory and its origin. This includes prominently the work developed by ICIS, DRIFT and TU-Delft.

This chapter is giving also a brief account of key transition methodologies and practical transition tools (mainly based on future scenario and backcasting).

3.2.1 TRANSITION AND SYSTEMIC INNOVATION: AN INTRODUCTION

Sustainable urban development require long-term oriented structural innovation, to shift from unsustainable growth pathways; such structural innovation is intrinsically a process of change which is systemic and can be resumed with the word transition.

This definition of transition, implying a structural innovation, will require to re-think and to re-structure socio-economic and technical structures of a city, at a cross spatial and urban scale level, involving a multiplicity of actors during its different stages.

The transformation of the status quo of a system or a sub-systems, is fundamentally a disruptive/radical innovation processes changing the same structure of the system, its elements and its elements' interrelation, this including also the same actors participating and their structure of relations. (Weaver et al., 2000)

Transformation, innovation and transition are neutral terms that are not implying any pre-determined positive or negative characteristic or result, furthermore for their process, and not final state, characterization, given by multi scalar temporal and spatial perspective it is quite difficult to define them as positive or negative in general terms.

Moreover sustainable development is a quite generalist concept governed by maximal principles, which require specific and detailed declination for each specific case, through a systemic approach coupling multiple time and spatial perspectives; this further complicating the assessment of transition processes and their effects. (Rotmans J and van Asselt M, 2000, Rotmans Jan et al., 2000)

Thereby to trigger and to manage sustainable transition through systemic innovation, requires to define specific values, ambitions and goals, which may be conflicting, overlapping and subject to high uncertainty; uncertainty that is directly proportional to the increment of temporal and spatial perspectives, involving all actors that may influence or be influenced by the innovation process. (de la Mothe, 2004, Dieleman, 2013, Jansen, 2003, Partidario and Vergragt, 2002)

3.2.2 TRANSITION THEORIES

Sustainable transition studies and theories have been principally developed to address major sectors key challenges, like energy, water and transport, for which the normal complexity level of sustainable development within socio, economic and environmental interrelations is associated with technologies which are leading the path and locking-in production and consumption practices and life styles.

There are several theoretical framework for transition, as shown in Figure 3-1 (Markard et al., 2012):

-transition management, combining system theories with technology transition and governance approaches (Kern and Smith, 2008, Rotmans et al., 2001, Loorbach, 2010)

-strategic niche management, policy oriented aiming to achieve regime changes through strategic niches interventions (Kemp et al., 1998, Raven and Geels, 2010)

-multi-level perspective, approaching transition as a correlation dynamic between niches, regimes and landscapes. (Geels, 2002, Geels and Schot, 2007)

-technological innovation systems, related to new emerging technologies and related changes in institutions and organizations (Jacobsson and Johnson, 2000, Hekkert et al., 2007)
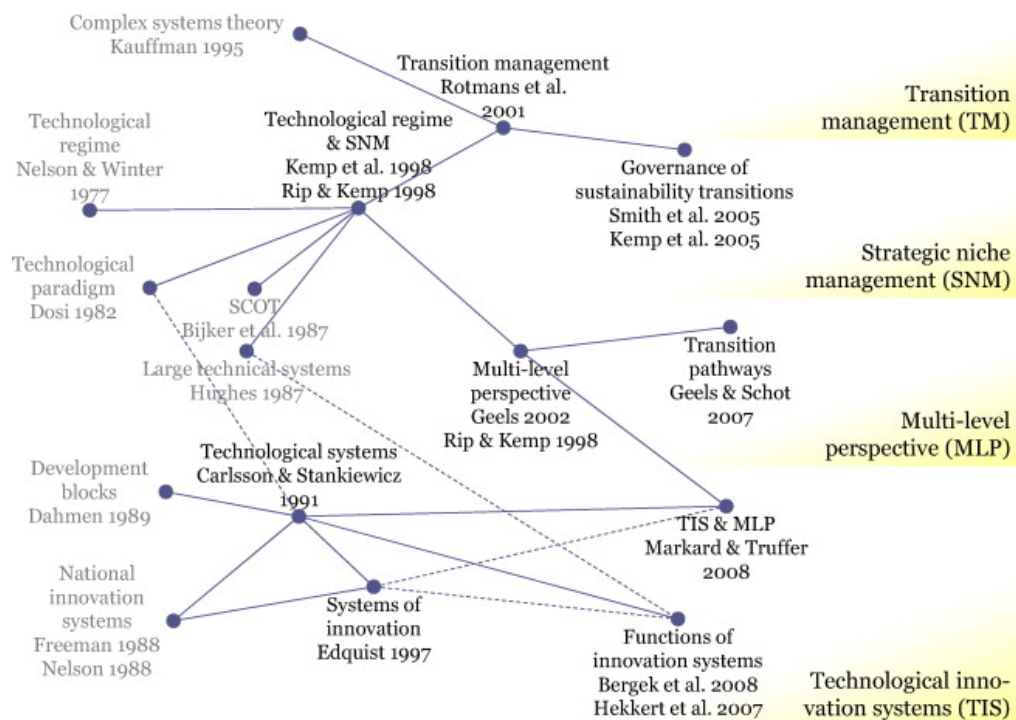
Figure 3-1: Map of key contributions and core research strands in the field of sustainability transition studies (Source: Markard et al., 2012:957)

3.2.3 TRANSITION CRITICISM AND LIMITS

"Work on transitions and system changes has expanded under different terms, e.g. regime transformation, technological revolutions, technological transitions, system innovation and transition management. Authors have proposed different pathways in transition processes, often illustrated with single case studies."(Geels and Schot, 2007):399 with reference to (Poel, 2003, Perez, 2002, Geels, 2002, Geels, 2005, Rotmans et al., 2001)

The figure bellow exemplifies, although it does not simplify, three different approaches to transition (socio-technical landscape, socio-technical regime and niches of innovation, here integrated under a new multi-level approach to transition.
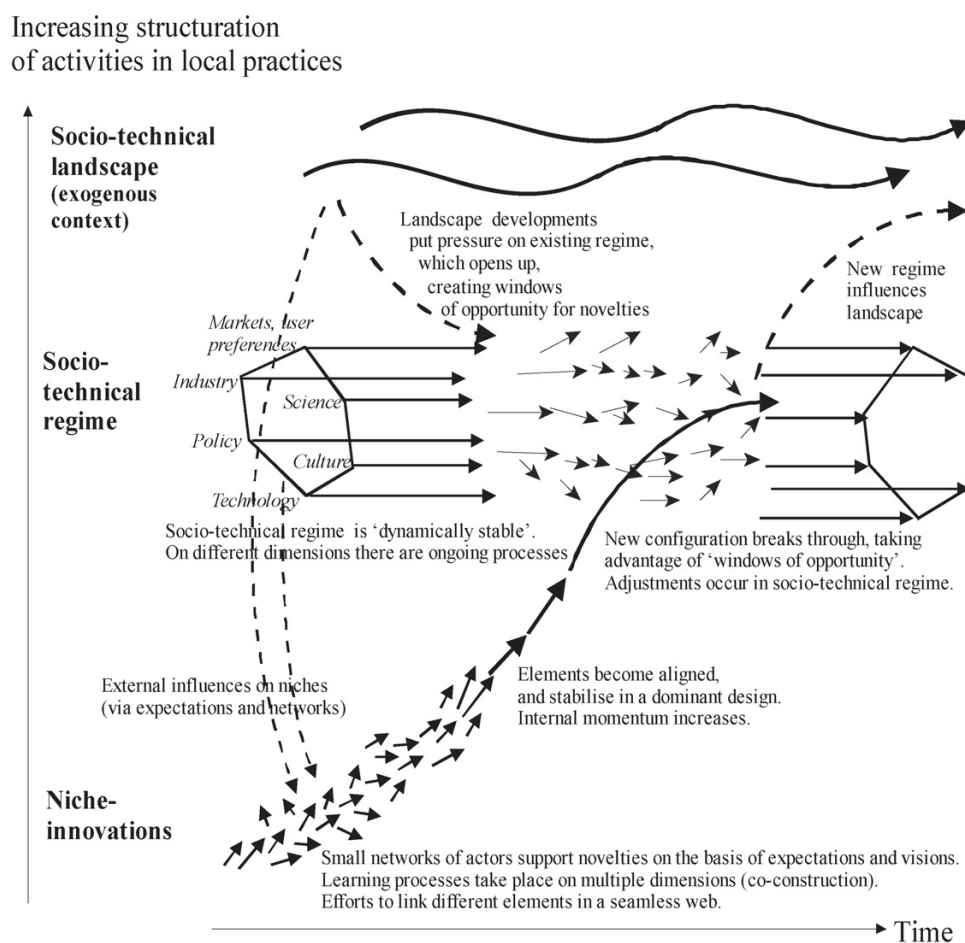
Figure 3-2: Multi-level perspective on transitions (Source: Geels and Schot, 2007:401)

The fact that the authors have proposed different approaches based on very limited empirical evidences, drawing on comparative or single case studies, almost exclusively within The Netherland, Scandinavia, United Kingdom, Germany and Austria, it is not the only criticism of transition theories and its conceptual development. "Little reflection about the specific spatial contexts and conditions in which these studies are situated, not the least from a comparative perspective" (Coenen et al., 2012):976, it is a further critique to

79

transition studies, and particularly to transition studies and theories applied to sustainable urban development.

Transition studies have shown a limited, concerns and ability to address spatial context, and physical planning processes and practices "spatial context is all too often treated at best as a passive background variable providing little causal explanation or theoretical purchase. We argue instead that explicitly focussing on territorial embeddedness helps in disclosing the institutional contingencies and particularities of the various contexts where transitions take place" (Coenen et al., 2012):976

Traditionally, transition studies have been referred to specific socio-technological systems, mostly energy and transport related, but with incursions in water and waste, and with a limited attention, in the last few years only, to urban systems as whole.

Transition pathways are slow-on-setting but can be accelerated by specific disruptive events, which facilitate the creation of systemic conditions of change, or that are disrupting the current equilibrium of the system allowing the acceleration of changes leading to a different equilibrium; this conceptualization is not much different from the invention-innovation-dissemination studied by Kondratiev and Schumpeter (Schumpeter, 2009)

Panta rei, everything flows. Cities are constantly mutating, developing, changing, transforming; thereby the preliminary definition of transition as shift between two states of dynamic equilibria may be not fully appropriate to describe urban systems and dynamics. The equilibrium, although, dynamic, is a state of stability; wording it otherwise, it is a steady state, a defined point in space and time, which can only be defined by an observer considering specific spatial and temporal scale.

The concept of equilibrium, applied to a city that is an alive system, more similar to a biological than mineral element (the difference of the two is that the timeframe of their mutation is significantly different) is ultimately an abstraction, the abstraction of a single shot of a picture, artificially crystalizing time and space, but far from the reality and far from the intrinsic dynamic characteristic of a urban system, governed more by unbalance states.

This consideration about transition, lead to define transition as a different name given to normal processes of changes that are continuous in cities, and giving the possibility to go reconsider the same importance and significance of the concept of transition, which key issues is the grade of control and management that can be applied to complex and dynamic processes of change that are governing urban systems.

Moreover the venture seeking a steady state or a balance, even if dynamic, is underestimating the simple fact that evolution exist, for good and for worse, by what we call evolution which is a dynamic capacity triggered by disequilibrium and shocks, and eventually not by equilibrium but a projection toward equilibrium.

3.2.4   TOWARD PROCESS DESIGN FOR TRANSITION

I will carefully avoid to enter the transition theoretical debate, and to choose between the plethora of different so simile-different theoretical approaches, as the purpose of this thesis is basically to define a practically applicable methodology to guide and support decision making in real situations, which normally tend to be a little more complex, even more complex that the very complicated theorization about change/innovation and transition.

The complexity of reality does need to be simplified to better understand it and facilitate action, although maintaining a systemic and multiscale perspective, certainly not to be overcomplicated by the creation of artificial elements of confusion utilizing

The real question is how we can influence, steer drive, or even before than that understand, urban transformative dynamics, and fundamentally how to steer a radical transformation from specific situations of overconsumption of natural resources, over generation of negative externalities, low level of injustice in redistribution of wealth, vulnerability, toward more sustainable system, that are following a resilient development pathway, ultimately to guarantee good and better living condition inter and intra generations.

The spatial dimension of sustainability transition has been quite neglected, also because it still requires a profound redefinition and restructuring of the entire sustainability transition theory, through a demystification process: "Thus far, the spatial and institutional contexts in which sociotechnical transitions unfold have not received much attention in the literature." and " both the technological innovation systems approach and the multi-level perspective lack "territorial sensitivity" in their analysis of technological transitions" (Markard et al., 2012):962-963 and (Coenen et al., 2012)

The temporal dimension of sustainability transition has also been quite neglected in terms of target scenario or best desirable future, that mot normally once decide is never revise or challenged, as crystalized. "Perspective goes a step further by highlighting the inter-temporal challenges involved in any journey that attempts to reconcile the "needs of the present" with the "needs of the future." From this point of view, sustainability journeys are not to be regarded as pre-definable regime shifts, but as an ongoing process that constantly is "in exchange" with past experiences and potential futures. As a result, the problem of sustainability may require that we "go back to the future." For transition studies, such a perspective certainly represents very novel terrain for research, with many open issues still to be explored." (Markard et al., 2012):963 and (Garud and Gehman, 2012, Garud and Karnøe, 2003)

Finally the use this work is making of transition theories is more related to the process orientation of socio-technical innovations and transformations, but targeting specifically the gaps related to spatial and temporal integration, considering as core part of sustainable urban transition space and territories and a continuous

82

temporal interlinkage , as a double backcasting maintaining the interrelation and interconnectedness of past present and future, through the ability of process design of constantly monitor and re-assess dynamically the target future on the base of the constant generation of knowledge and a circular learning process.

3.3 RESILIENCE AND CO-EVOLUTION

This section is discussing resilience and the capacity of systems to be prepared, to recover and to adapt to shocks, both if consequence of long term negative processes (climate change dynamics) or specific punctual negative events (extreme natural events).

The first part will analyse the development of resilience concept and understanding, from different disciplinary perspective, then define the author approach and specific working definition, and finally discuss how co-evolutionary processes are central for planning and managing the transition toward resilient systems, through co-design and process design

3.3.1 UNDERSTANDING RESILIENCE

The terms resilience is derived from Latin verb *resilio* meaning to leap back, to spring back, to rebound, to shrink, to retreat, to give up. It is a composite word formed by the prefix *re*, normally defining the reiteration of an action, sometimes used to reiterate a concept, and the verb *salio* meaning to jump, to bounce, but also to flow, when referred to liquids.

Resilience concept has not a unique meaning and there is not broad consensus on its use.
The term is used in different disciplines and context with much differentiated understanding and references. Thereby it is necessary, before introducing a working definition, to explore and analyse the main disciplinary and contextual understanding of the term.

The common ground of all the different concepts of resilience is that our societies, our cities, our way of living, as humanity , is threatened by local and global dynamics and events, which nature is very diversify varying from extreme meteorological events, natural disasters, human accidents, terrorism and war, social unrest and economic instability. This events are difficult to foreseen, and the limit of our forecasting capabilities is quintessential part of the issues; such inability is related to both the random nature of some specific events, the lack of implementing properly precautionary principles, the high complexity of global dynamics.

This uncertainty, although not new to humans, at the contrary of what stated by (post normal science) (Funtowicz and Ravetz, 1993, Funtowicz and Ravetz, 1994) is also due to the inability to address global issues and challenges at global level , finding appropriate consensus and taking decision and action. The post normality, and the change of paradigm shift, in this case is linked to the shortcoming and short-looking ability of present decision makers to take actions and decisions which will have affects beyond their mandate time.

84

3.3.2   DISCIPLINARY APPROACHES TO RESILIENCE

A search on Scopus of the word "resilience" made 12 April 2015, in article titles, abstract and key words, limited to articles and reviews, show the following results giving an outlook of the number of articles published under different subject areas, as shown in figures 3-3 and 3-4.

Figure 3-3: Scopus' Resilience Subject Areas List (Source: own graphic via Scopus)

Figure 3-4: Scopus' Resilience Subject Areas Pie Chart (Source: own graphic via Scopus)

The research gave 26.965 results, of which 24.097 are articles and 2.868 are reviews; resilience is used alone as key words 5.816 times. The number of record is below 50 until 1985, and bellow 100 until 1995, after that date the progression is exponential, reaching 3.711 articles in 2014.

85

A google books Ngram search of resilience from 1970 to 2008, as shown in figure 3.5, gives a smooth progression in the appearance of the word resilience in books, meanwhile the use of terms urban resilience and resilient cities spike from 2001
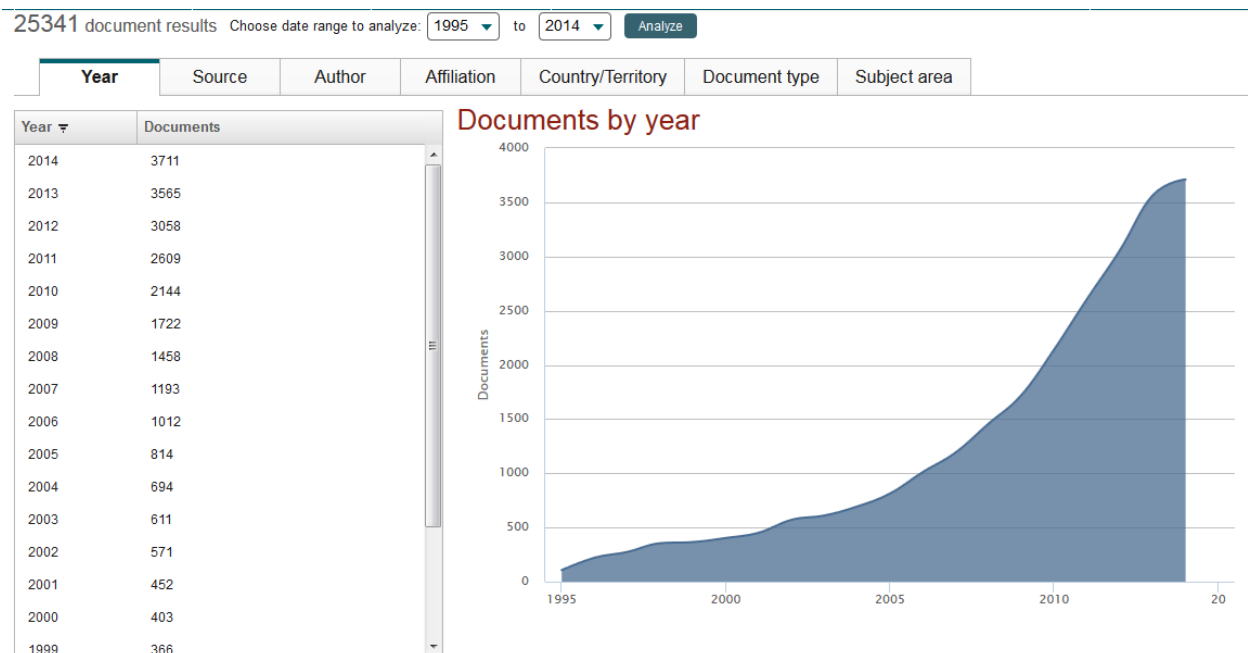
Figure 3-5: Scopus' Resilience Documents by Year (Source: own graphic via Scopus)

3.3.2.1   *RESILIENCE IN ECOLOGY*

The use of resilience in ecology and environmental studies dates the 60' (Holling, 1961, Folke, 2006, Holling, 1973), in relation to research made to conduct studies in line with ecological stability theory, defining how plants and animal can absorb and adapt to different types of change, further including human activities as one primary driver of such changes.

This is a living systems, in dynamic equilibrium, all it is about the time intensity of the required adaptation process or the damages provoked by a shock in relation to the velocity of the adaptive capacity of a system. An ecological system is a simple system, also here the survival of the system is related to the overall survival that can include also the elimination or suppression of one or more species. The survival of the whole may include the renounce to a part. At the contrary of other living systems in a dynamic equilibrium there are not moral and ethical issues, as the only concern here is the overall system survival.

In the 90' the concept of resilience in ecology was retaken through a multidisciplinary perspective starting a series of studies on socio-ecologic resilience (Folke et al., 1996, Costanza et al., 1993, Arrow et al., 1995, Olsson et al., 2004), stating that the division between nature and humans and their activities is artificial, leading to the development of integrated system thinking and system dynamics models.

86

3.3.2.2 RESILIENCE IN ENGINEERING

Resilience in engineering is about the ability of a structure or other physical systems to retake their function after a disturbance or an extreme events. In this case the focus is in the time necessary to re-establish the state of the pre event conditions, or as much close to it, and on the other side to avoid the possibility that extreme events will affect the main functionality of a structure or a system (Cimellaro et al., 2010, Cimellaro et al., 2015, Madni and Jackson, 2009). There may be a difference in terms of specific and general functionality, like in the case of parts of large system, where the functionality of the system can be preserved or re-establish even not reversing the negative impact on a specific element but through subsidiary elements.

Here the concept of fail-safe structures is particularly important, as these structure can be designed and realized as hyper static, or better particularly prone to maintain their equilibrium, even within a context of extreme changes. The core issue here is the preservation of the equilibrium, meaning the ability of a structure to operate, and the ability to return to full operability in the shortest time as possible. Structures are not made to evolve but to stay and maintain their physical and operational integrity.

Engineering structures are design and constructed in order to be able to respond to known, measureable and quantifiable adverse conditions, the logic behind it is the statistical probability that extreme events could happen, because such human made structure are depending also to financial and technical capability (Ouyang and Wang, 2015) (Cimellaro et al., 2015) (Reed et al., 2009) (Park et al., 2013). This may be the kind of resilience that more rely and is bounded to forecasting capacity, and the reliability of such capacity that, as previously discussed, is very limited, particularly increasing the time frame / timeline.

This above is more related to physics, material and complex physical material systems as buildings, including industrial plants; it is static equilibrium, of a non-living systems

3.3.2.3 RESILIENCE IN PSYCHOLOGY

The concept of resilience has been developed over the past 45 years within psychology and medical science, and it is principally referring to the capacity of individuals to cope with adversities and trauma and their ability of recovering from the levels of stress associated with such traumatic circumstances.(Masten, 2001, Bottrell, 2009). Resilience at individual level is assumed as being an ordinary rather than extraordinary processes, which is considered as being a normal function of humans own adaptation system. (Masten, 2001).

Resilience of individuals and their ability to cope with adversities has multidimensional variables, including individuals specific ones like sex, cultural origins and age and other more related their living environment as context and time(Richardson, 2002) (Connor and Davidson, 2003). Connor and Davidson state that an individual, in homeostasis due to a bio-psych-spiritual balance, can adapt to current life circumstances,

influenced by internal and external stressors causing disruptions; thereby resilience can be viewed as a measure to assess the ability of individuals for successfully copping with such stressors.

The concept of allostasis refers to the process of physiological adaptive response to acute stress, meanwhile with allostatic load defines the burden suffered by an individual body and mind in adapting to challenges. (Charney, 2004)

3.3.2.4   RESILIENCE IN ECONOMY

The use of resilience in economy is somehow more limited, and mostly related to urban and regional economics, particularly in relation to evolutionary economic geography (Hassink, 2010), regional footprint related to global change (Hudson, 2010), in relation to competiveness following cultural political economy (Bristow, 2010).

The economic resilience research also moves in line with a more quantitative approach to region, derived from environmental and ecological economics, and increasingly looking at decoupling cities and regions from the use of natural resources, this including also approaches related to ecosystem services and their valuation (Gómez-Baggethun and Barton, 2013)

3.3.2.5   RESILIENCE IN SOCIOLOGY

Social resilience focuses in understanding the ability of society, groups and communities to cope with disturbances and stress caused by environmental, economic and social changes, as well as to preserve itself and to recover from catastrophic events. (Adger, 2000).

The social resilience approach have been further expanded through large number of article and research made in relation to both climate change and natural resources, as well as to human made and climate related disasters, this basically acknowledging that human-social systems are depending from their habitats, which ultimately is dependent from natural resources and ecosystems stability/change. (Adger, 2003, Cutter et al., 2008, Manyena, 2006, Thomalla et al., 2006)

A considerable share of the research realized on social resilience is directly related to urban and regional systems(Davies, 2011), as the habitat where most intense social interactions are concentrated, this including panarchy derived evolutionary regional theories (Simmie and Martin, 2010), and addressing directly economy related issues, including labour and innovation.(Clark et al., 2010, Jackson, 2004)

3.3.3 URBAN RESILIENCE

The concept of urban resilience is still to be roughly explored and established, a research for reference in Scopus, realized in August 2015, shows on a very limited number of record:

- "URBAN RESILIENCE": 169 entries, concentrated in 2012-2015, 25-45 per year, including only 100 articles
- "CITY RESILIENCE": 30 entries, in 2012-2015, including 18 articles
- "RESILIENT CIT*": 119 entries, concentrated in 2013-2015, including 65 articles

For both the research has been done searching article title, abstract and key words.

The most cited source was the 2012 special issue on Urban Resilience of Planning Theory and Practice, for which the key article from Dovoudi (Davoudi et al., 2013) et al., has been cited 69 times only.
Most of the articles (Pizzo, 2015, Caputo et al., 2015, Boyd and Juhola, Ernstson et al., 2010, Vanolo, Moffat, 2014, vale, 2014, Godschalk, 2003, Pickett et al., 2004, Jabareen, 2013, Pickett et al., 2014) primarily focus is to analyse and understand the implication of the concept of resilience applied to urban environments, and trying to give more precise definitions and characterization, sometimes already proposing the introduction of a specific approach to urban resilience as Dovoudi's "evolutionary resilience" (Davoudi et al., 2013)

The key issue for understanding and defining resilience applied to cities and urban habitats is to integrate the interpretations already developed and established in different fields as ecology, psychology, engineering, economy and sociology. As the approach to urban resilience regards the city as a complex systems where individuals and society are interacting with the natural environment and the built environment, thereby taking into account social, economic, environmental and engineering issues in a systemic manner.

Moreover, it is important not to limit the concept only to risk prevention and management and/or to adaptation but to expand it also to mitigation, as the urban resilience will require facing great challenges as climate change and global environmental change, which are interrelated, re-thinking and transforming our ways to produce, manage and consume the city in a more sustainable manners. This with the aim to reduce the risk and vulnerability of cities against slow and rapid on-setting nature and human (including socio-economic ones) driven catastrophic events, mitigating their same causes, and at the same time foster the dynamic adaptability of cities fostering the innovative and creative potential.

3.4 INTEGRATED THEORETICAL APPROACH TO SUD

A systemic approach

That integrate multiple dimension of sustainability related to environment, economy and society, including different cross-thematic issues as energy, water, transport and waste to face the key challenges as climate change and natural resource management in a multi temporal and spatial scale dimension.

This coupled with a systemic evaluation approach, integrating ex-ante, ex-post and monitoring, to constantly re-asses not only planning and implementation processes but the very same best desirable future targets, on the base of a constantly evolving learning process, to cope with systemic uncertainty.

A transition approach

Based on the assumption that the urban "development" patterns and trajectories are at the moment largely unsustainable and a radical shift, including the way in which we plan, construct and manage our cities is desperately needed and required. At the same time aware that within the city is to be found the greatest innovation and creative potential and force that can trigger and foster such radical change, and the key issue is exactly how to aggregate and vitalize this forces, which can be done adopting a co-evolution approach involving all stakeholders for co-designing transition processes, plans and co-constructing their implementation toward a more sustainable cities; this including concertized future targets and the integration of multiple spatial dimensions.

A resilience approach

Resilience ultimately is the ability of the urban system to prevent, resist and recover shocks due to both slow and rapid on-setting disasters, this including the mitigation of human activities on local and global dynamics causing such disasters. This ability is a preventing and adaptive capacity at once, it is a dynamic and mutating characteristic, because entails a long term process approach facing uncertainties and system conditions which are yet to be fully understood and/or discovered.

A resilience approach is based on a systemic and structured ability of the urban system to positively develop in concertation with all its parts, the built and natural environment, its society and individuals which are part and motors of a resilient city based on a dynamic capacity.

3.4.1 CO-EVOLUTION AND CO-DESIGN FOR RESILIENT CITIES

Based on the results of the theoretical frame development, it is possible to resume the quest for defining solutions for a sustainable urban development, stating that sustainable urban development is requiring a complex, dynamic and systemic multi-scale spatial and temporal integration, which can be approached in re-thinking the very way in which urban planning and urban management is conceived.

Sustainable urban development it is not a crystalized steady-state to be achieved and then kept until the end of time, but it is a process, a dynamic process of co-evolution (Geels, 2005, Folke, 2006, Loorbach, 2010, Hassink, 2010) based on continuous learning, the co-creation of knowledge which mutate the same drivers and aspiration of a society, a polis, which is mirrored by our relation to our habitat, at once built and natural, and our way to live it. (Nevens et al., 2013)

The generation and management of such co-evolution process requires a new approach to planning, starting from the definition of common drivers and inspiration, generated by the dialogue among diverging and converging positions of different stakeholders, and then to define planning implementation and management means to walk toward a best desirable and realistic future, ultimately to improve our life condition in a just and democratic way.

This is ultimately the goal of the process design methodology to be developed, based on participation, and entailing spatial and temporal scale integration through a systemic evaluation process.

4 THE RESEARCH DEVELOPMENT

4.1 SPATIAL INTEGRATION: CIRCULAR METABOLIC APPROACH

This chapter is discussing the use of a metabolic approach for sustainable urban development, particularly with reference to its multi scale approach at spatial level.

First the development of the concept of metabolism is discussed and analysed in an historic perspective, and then better understood in terms of resources' flows, tangible and intangibles (including economic ones)

Sustainability is multiscale, as previously stated, and at urban level it requires spatial integration, coupling regional, urban and neighbourhood scales in the frame of global dynamics. The approach guiding spatial integration is the one of urban metabolism here intended as circular, also in relation to the development of the sustainable production and consumption paradigm of circular economy, and in-line with the understanding of city not as an isolated system but a system integrated within its biological region.

4.1.1 THE ORIGINS: MARX'S SOCIAL METABOLISM

The idea of urban metabolism includes cultural, social, political, environmental, and ethical issues, well beyond the most common understanding of energy and material flows; for this reason this chapter will start from a key mile stone in the understanding of social metabolism, and the metabolic rift, generated by Karl Marx's work.

The word metabolism is the most appropriate translation of the original German Stoffwechsel, which is often translated as interchange of matter or interchange of commodities; Marx used the concept of metabolism as twofold (Martinez-Alier, 2004).

The first one indicating the relation between man/society and nature/earth:

"Labour is at first a process between man and nature, a process by which mediates, regulates and controls his metabolism with nature through his own actions.

He confronts the natural materials as a force of nature. He sets in motion the natural forces that belong to his own body, his arms and legs, head and hands, in order to appropriate the natural materials in a form useful for his own life.

While acting upon external nature and changing it, he also changes his own nature.

He develops the potentialities slumbering within his nature, and subordinates the play its powers to his command" (Marx, 1984):vol.I

The second meaning indicates the circulation of commodities:

"But if actual payments have to be made, money does not come onto the scene as a means of circulation, as a merely transient and intermediary form of the social metabolism, but as the individual incarnation of social labour, the independent existence of exchange-value, the absolute commodity."(Marx, 1984)

"Of more significance, it will be contended that Marx provided a powerful analysis of the main ecological crisis of his day—the problem of soil fertility within capitalist agriculture—as well as commenting on the other major ecological crises of his time (the loss of forests, the pollution of the cities, and the Malthusian spectre of overpopulation). In doing so, he raised fundamental issues about the antagonism of town and country, the necessity of ecological sustainability, and what he called the "metabolic" relation between human beings and nature. In his theory of metabolic rift and his response to Darwinian evolutionary theory, Marx went a considerable way toward a historical-environmental-materialism that took into account the coevolution of nature and human society." (Foster, 1999):373 and (Marx, 1984)

The social metabolism is thereby the way in which individual and society are mobilizing labour, and now-a-days technology over labour, to increase the exploit of nature and natural resources, and also the interchange in-between society/individuals of these spoils.
The key issue being that the intensity of needs created by the life in cities, also but not solely due to concentration of populations, is requiring a constant increase of nature productivity, this leading to disturb the original metabolic interaction, hindering earth's own metabolic operability, reducing the nutrients that the nutrient the earth is receiving back and increasing instead the level of pollutants.

Marx elaborate this theory with specific reference to agricultural production, and two convergent dynamic, from one side the concentration of land property in very large allotments and from the other the use of fertilizers to increase production, this impacting negatively the labour and nature itself and its productive capacity, through what he define a metabolic rift.

"Men were part of Nature, men used Nature's materials, we could increase its produce by the development of the so-called productive forces but we could also undermine the natural conditions of production. This was the case with capitalist agriculture. Marx wrote: "Capitalist production disturbs the metabolic interaction between man and the earth, i.e. it prevents the return to the soil of its constituent elements consumed by man in the form of food and clothing, and hence it hinders the operation of the eternal natural conditions for the lasting fertility of the soil. Moreover, all progress in capitalist agriculture is a progress in the art, not only of robbing the workers, but of robbing the soil…" (Capital, I). He added that the separation of town and country, caused by latifundist agriculture and by the concentration of sources of energy in

93

cities, provoked an "irreparable rift" in the process of social metabolism. The result of this was a squandering of the soil, aggravated by trade, undermining the conditions of agricultural production." (Martinez-Alier, 2004):4

"Marx employed the concept of metabolic rift to capture the material estrangement of human beings in capitalist society from the natural conditions of their existence. To argue that large-scale capitalist agriculture created such a metabolic rift between human beings and the soil was to argue that basic conditions of sustainability had been violated."(Foster, 1999):18

The metabolic rift between human production and nature, it is further enhanced by the growing antagonism between country and town, as well as from agricultural production and consumption, creating the bases for the later development of regional and metabolic approach for town planning, as by Ebeenzer Howard, Patrick Geddes (Geddes, 1915) and Raymond Unwin, as well as the approach of Lewis Mumford (Mumford, 1934) on technics and civilization.
This leading to consider the city not as an isolated system but a system which own existence depends from its biological region and their metabolic exchanges, which include positive and negative trade-offs.

It is for this reason that any approach toward sustainable urban development require a regional perspective, aiming to understand and manage a complex metabolic relation, that is includes but it is not limited to material and energy, but ultimately regards the social metabolism of human relations, specifically including consumption patterns and means of production.

It is important to stress that ultimately the social metabolism and the metabolic rift between human activities and nature is having deep and complex cultural and historical reasons, that are also directly dependent by the actions of individuals which in some cases are acting through specific motives and drives that lead them to take decisions that are constrained to a very limited spatial and temporal perspective.

4.1.2 THE RECENT DEVELOPMENT OF URBAN METABOLISM

Urban metabolism is a powerful concept to understand and manage cities in a sustainable manners across spatial scales, if this can go beyond the simplistic material and energy flow approach and lead to a more transdisciplinary understanding of city and its dynamics, namely including also social dynamics and justice in accessibility and redistribution of resources.

Currently there are different approaches to urban metabolism, growing under different theoretical and sub-disciplinary perspectives including, but not limited to: urban ecology, industrial ecology, environmental economics, ecological economics, political economy, political ecology, landscape ecology and ecological engineering.(van den Bergh, 2013, Tagliafierro et al., 2013, Walter, 2002, Shogren et al., 2003, Hastings et al., 2007, Mitsch, 2012, Verhoef et al., 2006, Jensen et al., 2011, Hess, 2010, Nam, 2008, Wachsmuth, 2012)

A recent analysis of emerging research and approaches to urban metabolism reveals six upcoming themes, showing particular potential in integrating industrial ecology, governance and politics (Broto et al., 2012):

- the city as an ecosystem,
- material and energy flows within the city,
- economic–material relations within the city,
- economic drivers of rural–urban relationships,
- the reproduction of urban inequality,
- attempts at re-signifying the city through new visions of socioecological relationships.

There is also growing interest in re-thinking the city as complex interaction between social, technical, ecological and economic forces (Rapoport, 2011), but this still need to be further interconnected with planning practices and the transformation and management of the physical nature of cities themselves, this including both physical infrastructure (means) and social infrastructures (use).

Furthermore this can lead to explore better the use of appropriate technologies and to recover intangible heritage and traditional knowledge regarding more sustainable solution in the management of natural resources and in the relation between human activities and nature, both in terms of time and space.

For developing the concept of urban metabolism for the present work, intended as of spatial integration, it is of particular importance the concept of city as an ecosystem:

"The idea of the city as an ecosystem in the biological sense is applied most literally in the field of urban ecology, which sees the city as both a 'system' and a 'natural' entity. Urban ecology has a particular focus on the implications of applying the metabolism concept to the urban realm, such that the idea that urban areas should emulate the cyclical and efficient nature of natural ecosystems is now employed in normative theories of sustainable urban planning and development. This focus on circularity, balance and order is challenged by urban ecologists studying urban metabolisms from an approach grounded in complex systems theory, who argue that rather than optimising a single set of supposedly ideal" (Broto et al., 2012):852 and (Newman, 1999, Alberti, 1999, Baccini, 1997)

This ultimately leading in developing a co-evolution discourse that is twofold, from one side it consider and re-signify the supposed duality between human activity and nature, and from the other side to restructure the very same social and human relation in the city, recovering platonic understanding of policy as a set of complex social, individual and political relations: a new social deal based on intra and inter-generational justice.

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4.1.3 THE CIRCULAR METABOLIC APPROACH

The co-evolution implication of the urban metabolism approach, particularly with reference to the understanding of the city as an-ecosystems, lead to enter the debate about circularity, apparently in counter position with system theories, but in reality well concealable using the circular economy approach, as outlined here bellow.

The concept of circular economy is not new, it has been defined and used in the last 50 years, this without going back to its original roots that may well be fund in philosophical principle of ancient Greece philosophers. The circular economy has been re-discovered in the last few years at European level thanks to the lobbying work of Ellen MacArthur Foundation (Ellen MacArthur Foundation, 2013a, Ellen MacArthur Foundation, 2013b, Ellen MacArthur Foundation, 2014) that had the ability to have this idea accepted at high level within the European Commission, and in the board of major multinational corporation, as a way to foster economic growth facing the global challenge of resource scarcity and depletion, maintaining, if not increasing, levels of productivity and profit.

The current model developed, describing the technological nutrients and the biological nutrients cycles, is of interest although it has some clear limitations, particularly regarding the very marginal inclusion of consumption patterns and intensity/frequency of substitution, being the model mainly addressing production issues; as well as the forgotten issues of physical scale and physical dimension of production and consumption.

Nevertheless this conceptualization has some potential for its translation at urban level, balancing it with a more prominent focus on consumption and social metabolism, giving the possibility to theorize and structure a circular urban planning practice, following the definition of the circular metabolic approach.

4.1.3.1 THE GENESIS OF CIRCULAR ECONOMY

The loop economy and the service economy

The German architect Stahel theorized in 1976, in a report to the Council of the European Communities, the loop economy to increase job creation and competiveness and to reduce resource use and waste. This seminal ideas where later published in 1981 (Stahel, 1981), theorizing also the concept of product durability, which should be increased, and the selling of services instead of products.

Permaculture

The concept of permaculture was introduce by Mollison and Holmgren in late 70'(Mollison and Holmgren, 1978), with specific reference to human settlement, as social design system based on the observation and

reproduction of natural ecosystems and ecological principles. It includes the concept of just redistribution and use, in respect for humans and nature

Industrial ecology

The concept of industrial ecology has been formulated in the 80' by the physicist R. Frosch, (Frosch and Gallopoulos, 1989) whom analysed the material and energy flows through industrial system, theorizing the possibility to reduce and maximise the use of energy and material input, at the same time reducing the negative externalities of industrial production. Similar concept, referred as industrial symbiosis was already introduced in the 40', and now a days still in use looking at industrial districts and/or industrial cluster, more than a single industry. It also important to recall the concept of industrial metabolism (Ayres, 1989) which is also central in the development of industrial ecology.

Biomimicry

In the late 90' the concept of biomimicry has been introduced by J. Benyus (Benyus, 1997), later used largely in architecture. The biomimicry looks at innovation inspired by nature following three basic principles:

- − Nature as a model: to emulate forms, process and systems
- − Nature as measure: to use evaluation standards based on nature and natural cycles
- − Nature as mentor: to use nature to extract knowledge more than materials

Cradle to cradle

The concept of cradle to cradle has been first used and introduced by W. Stahel, and later trademarked, in the spirit of free circulation of ideas by the architect B. McDonough and the chemist M. Braungart, which have taken very seriously the idea of service economy and created a very profitable business of certification and consultancies for industrial production, including a clever in franchise system.

In McDonough's and Braungart's book (McDonough et al., 2002)it is developed the concept of biological and technical nutrients, which radically change and erase the very understanding of waste, together with the need to use primarily sun generated energy (including sun derived as heolic and tidal).

Clearly there are limits to the cradle to cradle discourse, as there is an issues of durability and substitution rate of products, related to the basic law of thermodynamics and entropy, and the fact that the holy grail of full circularity it is inversely proportional to the material and construction complexity of the product and its production.

It is important to notice that a number of the foundation concepts used in the development of circular economy have been introduced by architects (i.e. Stahel and McDonough) and focusing extensively in architecture and urban design (i.e Biomimicry and Perma-Culture).

The circular economy is based on five leading principles:

- – Design out waste
- – Build resilience through diversity
- – Using Energy from renewable resources
- – Think in systems
- – Think in cascades

These principles can be used, with some modifications, as conceptual base to define a circular metabolic system, to be applied to urban sustainable development, directly including spatial and territorial variable, through the metabolic understanding of cities within their regions.

- **Sustainable consumption and production by design**
  Based in redesign products and means of production of the urban system, reducing input of energy and materials, reducing externalities. At the same use design to reconfigure system of use and consumption of territory and urban systems, also through the intensification of use in time and space and increase life span reducing obsolescence.

- **Build resilience through diversity and knowledge**
  Use knowledge to re-think and transform urban systems. Knowledge intended as awareness of global change dynamics and challenges, but also re-discovering intangible heritage, applied to the planning construction and management of cities and natural resource. This to build dynamically adaptable cities able to reduce and prevent risk but also to fast recover slow and fast on-setting disaster.

- **Thinking in system**
  Understanding system dynamics through the interrelation of the different elements of the system between themselves and with the whole, to give a more complex understanding of urban dynamics, cross temporal and spatial scale, to reduce uncertainty through understanding. Finally being also able to define systemic approaches to evaluation, constantly re-checking the target future, built on social and individual aspirations.

- **Regional integration of cities**
  Understand the city not as isolated but as a complex ecosystems living and relying on material and intangible exchanges with its biological regions, aware of the impacts that extraction of resources and externalities can have at cross spatial scales.

- **Participation at the core of urban planning and management processes**

No radical and sustained change in urban system can occur without the participation of local communities, and more importantly no change toward a more just urban environment, in respects of diversity and using diversity as a value for innovative processes.

4.2 TEMPORAL INTEGRATION: DOUBLE BACKCASTING

The EU Thematic Strategy on Urban Environment 2007 (European Commission, 2006) states clearly the importance of ex-ante evaluation for decision taking and policy making for urban development; under this frame, this article, will try to define the importance of future scenario toward a sustainable urban development, benchmarking the use of forecasting, visioning and backcasting scenarios proposing a further development of the backcasting methodology under sustainable development needs and principles.

Differing from forecasting scenarios, aimed to define future trends and drivers, backcasting scenarios are based on visions of desired future situation and are focused on the support of organizational changes and strategic planning toward these desired situations.
It is particularly important to recognize the key role that backcasting scenarios can have in fostering local milieu innovation and creative destruction value based, supporting urban creativity and sustainable development operational implementation.

Nevertheless backcasting scenarios can lack a vertical integration being mainly problem oriented and limited to the frame of action of the local stakeholders participating in the scenario building process often limited to be a dream book of local communities of few stakeholders not followed by any action and not taking into account present global tendencies and drivers.

For these reason this chapter aims to understand how backcasting methodologies can be integrated with forecasting and visioning ones, under a system dynamic logic, in order to define a structured methodology for the integrated evaluation of sustainable urban development; a methodology that can improve and enhance an active and informed participation to the decision making process, strengthening the linkage between information, knowledge and awareness.

The premise is that sustainable urban development requires to restructure the decision making processes within an integrated and integral sustainable approach and enhancing the innovative and creative potential of the urban milieu, that concentrate not just the biggest threats but also the strongest opportunities to achieve a sustainable development.

In order to renew the decision making process toward sustainability, along the phases of policy making, planning and implementation, it is necessary to define a frame for the integrated evaluation of sustainability, divided in 3 phases:

-        An ex-ante evaluation , based on both desirable futures, that are value based, and tendencies of futures, that are based on trends and drivers.

101

-        A monitoring process which will aid to redefine targets and objectives along the implementation phases.

-        An ex-post evaluation that will assess the reasons for success or failure and will define the follow up through the lesson learned.

Furthermore it is fundamental the strengthening of an informed, open and active participation process in order both to support and legitimate the decision making process and to exploit the innovative and creative potential typical of intense human interrelations.

4.2.1   URBAN FUTURES

The concept of "future" it is structurally part of the same idea of sustainable development, in relation both with the term "development", as a positive dynamic change, and with the definition of "future generations' needs" (United Nations, 1987a). Since the first steps have been moved along the path to define sustainable development concept and principles (Meadows et al., 1972).The analysis and understanding of the future has been a key point, becoming increasingly important to lead the decision making process, on policies, plans and actions, undertaken in the present pointing toward a sustainable development.

The future can be seen under two different perspectives, the first more passive it is limited to the observation analysis of the dynamics through which the present it is unfolding into future and the second more active it is related to gain control and lead this unfolding dynamic. Particularly in relation to urban areas, which are very complex and with physical inertial resistance to change, there is a need to understand both perspectives in which present is unfolding and how it can be controlled, through an ex-ante evaluation of all the possible options and their implications.

Also because urban areas are the centre of human activity, where the consumption of resources and the production of residues and pollutants are more concentrated; but at the same time, cities are also the core of social development and of the economic activity, as well as, they are the milieu with the greatest potential for innovation (Schumpeter, 2009) and creativity (Landry, 2000).

Furthermore the Lisbon Strategy (European Council, 2000, Europan Commission, 2005) and the Sixth Environmental Community Action Programme (European Council, 2002) highlight the importance of innovation and innovative solution toward the challenges for sustainable development, through a multi-policy integration, efficiency and effectiveness principles, participation and involvement based on increased access to quality information.

In 2004 the Lisbon Strategy (Europan Commission, 2005, Kok, 2004) is reviewed under the guidance of Wim Kok in the report called "Facing the Challenge: the Lisbon Strategy for Growth and Employment" followed by the renewed Sustainable Development Strategy, which sets overall objectives, targets and concrete actions organized under seven key priorities, Particularly the importance for integrated policy making, the need for impact assessment, monitoring and follow up, as well as a strong governance process and the understanding of global dynamics, it is stated in the all the previously mentioned European policy documents.

Furthermore the Renewed EU Sustainable Development Strategy sets seven thematic strategies, including the one on Urban Environment , accompanied by an Impact Assessment of the same strategy, which states the importance of ex-ante evaluation for decision and policy making for sustainable development.

103

The Urban Environment Strategy (European Commission, 2006) defines four priority main themes: urban management, sustainable transport, construction and urban design, that should be developed at the local level through the consultation of the stakeholders for a decision making process that should take into account different possible alternatives due to the complexity and the inter-relation of the problems that are affecting the cities.

This complexity, without an integrated strategic management frame work, and a due integrated evaluation of the future scenarios, may bring local authorities to try to solve a problem in a way that can lead to other problems elsewhere or in a long run, where this conflicts should be avoided ex-ante under a long term vision.

Concluding, it is possible to state that both the Lisbon Strategy and the Sustainable Development Strategy, at least agree in recognizing the complexity of urban environments and the scale and time interconnections, stressing the need for risk and uncertainness management and the need to define future scenarios and to integrate evaluation tools supporting urban management through integrated long term strategic action plans.

This imply the need and the urgency, for decision maker, to foster, a radical innovative shift in order to pass from a curative and partial logic to a systemic and preventive one, built on visions, methodologies and tools, that needs to rethink and to manage (Selman, 2000) in a reformed way information and knowledge, through an integrated evaluation methodology for sustainable urban development.

Within this frame will be discussed the contribution that future scenarios, particularly backcasting scenarios, will be able to give to support the decision making process, oriented to a strong public participation, and structured in terms of ex ante evaluation of urban sustainable development.

4.2.2 PATTERNS OF CHANGE

Before describing the different categories of future scenarios it is necessary to introduce briefly the concept of change and to try categorizing the patterns of change, as shown in figure 4-1. This is done in relation to the concept of development that is based on an incremental positive change starting in the present and folding into future.
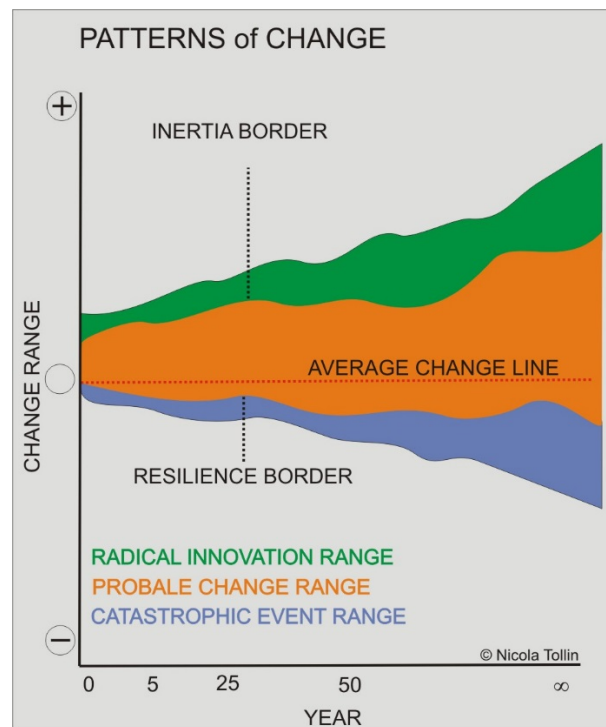
Figure 4-1: Patterns of Change (Source: own graphic)

Human development follows an average change rate, virtually represented with a line, based on incremental innovations leaded by present trend and fostered by present drivers; the average change rate line lies in the middle of a possible change range that includes all the possible futures considering the system stability within its normal fluctuations.

The system possible change range it is limited along its upper part by the system own inertia, that represent the structural system resistance to radical innovations and along the lower part by the system own resilience, that represents the system structural ability to resist traumatic events and to survive to it; thereby the system possible change range can be positively increased by radical scientific and technological innovations, as well as it can be negatively increased by catastrophic events.

105

This abstract change patterns definition can be easily explained using examples of change referred to urban systems, like the invention of power looms that radically influenced and leaded the physical development of British cities along the industrial revolution (Hall and Preston, 1988), or like the invention of computer and internet and the immaterial and physical development of Tokyo, London and New York (Sassen, 1991, Sassen, 2002)

Moreover, on the resilience capacity against natural catastrophe can be used, as positive example, the case of the magnitude 6 earthquake that shacked Tokyo in July 2005 with very contained destruction and casualties, or as negative example can mention the devastating effects of the hurricane Katarina in New Orleans.

The catastrophic events are not just caused by natural events but also by mistaken use of technologic and scientific innovations as in the case of the city of Chernobyl and its 14.000 inhabitants completely devastated for the accident on the near nuclear plant. Furthermore it is to mention the catastrophes related to the terrorist attacks in New York and London that strongly changed the city social life patterns and also the physical environment.

In any case, both radical innovations and catastrophes are uneven events that cannot be foreseen although something can be done to create favourable conditions to reinforce the resilience border and to lose the radical innovation border, always remembering that scientific and technological events can have very negative fall-out (Chernobyl nuclear accident) as well as catastrophes can lead to positive development trends (Tokyo after the 1921 earthquake).

4.2.3   FUTURE SCENARIO METHODOLOGIES

Future scenarios are mainly built and defined through the use of different methodologies and logics that can be divided into three main families: forecasting, visioning and backcasting, each one has a specific use and can contribute to the ex-ante evaluation of urban sustainable development.

4.2.3.1   *FORECASTING*

Forecasting scenarios (Robinson, 1988a, Khakee, 1991, Joshua Klayman, 1993, Armstrong, 2001, Dortmans, 2005, Dyson and Chang, 2005, Chatterjee and Gordon, 2006, Dietzel and Clarke, 2006, Hyndman and Koehler, 2006, Hekkert et al., 2007, Destatte, 2010) define the pattern toward possible medium or medium-long terms alternative futures, starting from the present situation and exploring the change patterns leaded by present trends and drivers, with or without policy effort, having as output a set of different futures each one of them is leaded by the over weighting of a specific driver or a specific policy, as shown in Figure 4-2.
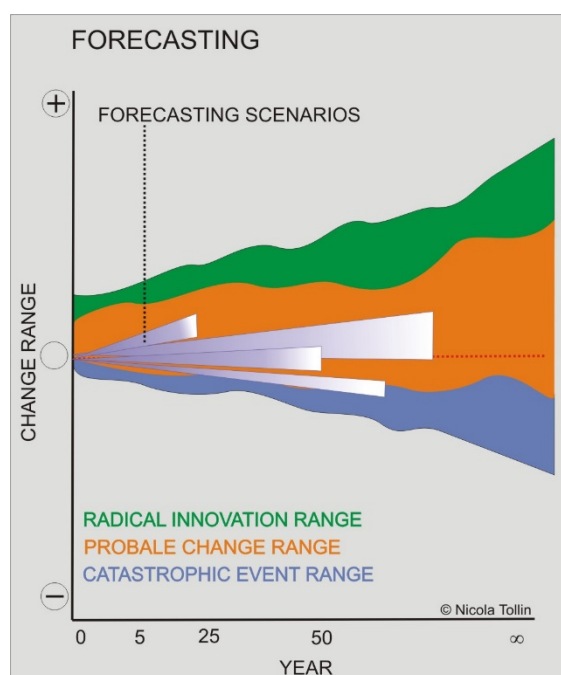
Figure 4-2: Forecasting Scenarios (Source: own graphic)

Forecasting is normally based on expert work and models that require a great amount of data and analysis, also for the fact that it is develop at global, regional or national scale, approaching mainly specific issues, or a conglomerate of specific issues, like: water, energy, transport, environment etc.

Due to its expert based nature, the communication of the results it is normally limited to the final scenario omitting the complete description of the development process and transforming itself in a black box, leading
107

to the difficult to understand completely the out-coming information and to pass to planning and implementation phases.

A further structural weakness of forecasting are related to the difficulties to manage the data in terms of information seeking, fund raising and work. Furthermore another key problem of forecasting scenarios is related to the difficult to foresee inventions and radical innovations (Hall, 1986, Hall and Preston, 1988, Hall, 1999) in fact forecasting scenario are developing in very close proximity to the average change rate line; for this reason forecasting scenario has been mainly used for global prevision of expected futures, in order to understand main trends, but presenting problems in the use of this by decision makers to implement sustainable development policies at local level (Greeuw et al. 2000).

4.2.3.2   VISIONING

Visioning practices and methods (Nicholls, 1988, Hansson, 1990, Stokke et al., 1991, Daniels, 1991, Ziegler, 1991, Ramaprasad and Rai, 1996, Ruppert, 2001, Partidario and Vergragt, 2002, Schwalbe, 2004, Bell, 2005, Kakabadse et al., 2005, Song et al., 2006, Stevenson, 2006, Barbanente et al., 2007, Hagerman, 2007, Vergragt and Brown, 2007, Stock et al., 2007, Nevens et al., 2013)have been used to define long term future scenarios, not strictly following the present trends and drivers tendencies, and for this reason, the future scenarios deriving from this method can be located outside the possible change range, as shown in Figure 4-3.
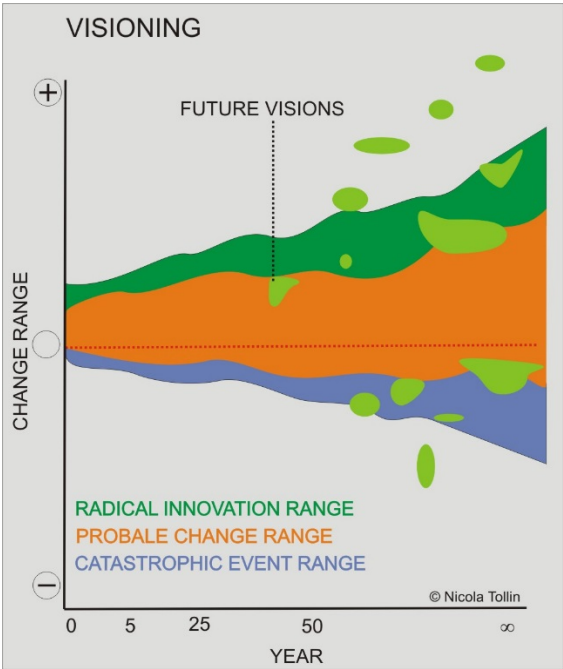
Figure 4-3: Visioning Scenarios (Source: own graphic)

The potential of visioning is strongly related to its capacity to explore the unexpected future in the range of radical innovation or catastrophic events, particularly with a long term perspective, and to use creative/imaginative processes in order to deal with uncertainness.

A strong example of the use of visioning practice, as a way to think out of the box, to foresee the unforeseeable or to predict the unpredictable is given by the SIGMA group, employed by the Homeland Security Department of the USA, to foresee and to give instrument to prevent the next terroristic attacks. The group is formed by science fiction writer, that have been chosen for their ability to develop deviant thinking, and that are going to work closely with expert groups.

Visioning practice can be successfully used at local level, particularly in relation with urban planning, as an instrument of consultation to wider participation without the need of specific knowledge or information, although a direct link between the visions elaborated by the non-expert, and the plan elaborated by the experts might not be directly interrelated.

4.2.3.3   BACKCASTING

Backcasting scenario (Robinson, 1982, Robinson, 1988b, Dreborg, 1996, Hojer, 1998, Kokko et al., 1999, Hojer and Mattsson, 2000, Holmberg and Robert, 2000, Hunhammar, 2001, Anderson, 2001, Robert et al., 2002, Newton et al., 2002, Partidario and Vergragt, 2002, Robinson, 2003, Jansen, 2003, MacIsaac et al., 2004, List, 2004, Dortmans, 2005, Robɛrt, 2005, MacDonald, 2005, Quist and Vergragt, 2006, Manning et al., 2006, Quist et al., 2006, Vergragt and Brown, 2007, Carlsson-Kanyama et al., 2008) method consists in defining medium and long term best desirable future scenarios and to structure backward the process and steps through which these desired futures can be attained, the construction of backcasting future scenarios can be divided in to interlinked phases, as shown in Figure 4-4.

1) The envisioning process: that defines a set of desirable futures from which, after a negotiation process, it is identified the most desirable one. This can be a non-expert exercise not requiring specific knowledge or information.

2) The real backcasting process: that defines a stepwise process starting from the most desirable future scenario back to the present. Also this can be a non-expert exercise.

109
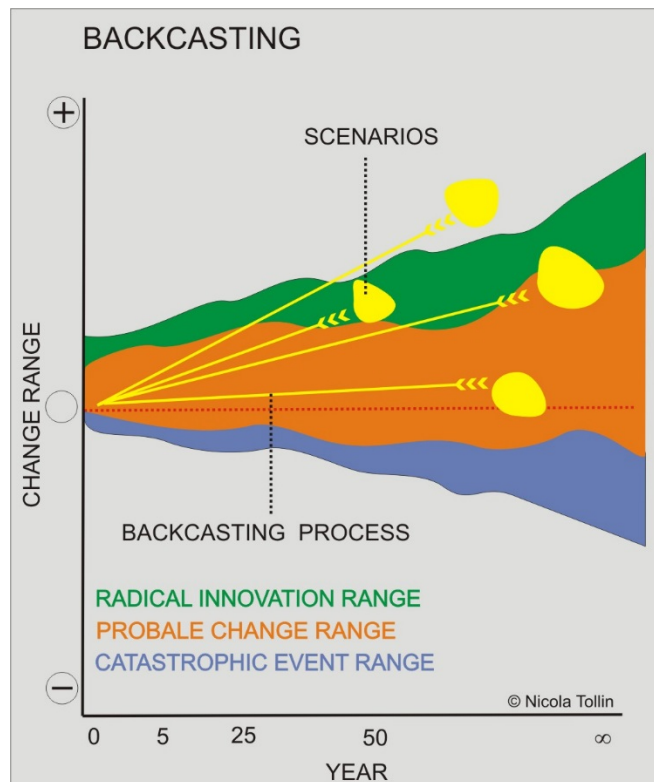
Figure 4-4: Backcasting Scenarios (Source: own graphic)

Backcasting methodology can be very useful in decision making processes with a large public participation, due to the fact it is not required any specific or technical knowledge but it is more based on personal and community value and desires.

For this reason can be recognize the key role that backcasting scenarios can have in fostering local milieu innovation (Aydalot et al., 1986) and creative destruction value based (Weaver et al., 2000), supporting urban creativity (Landry, 2000) and sustainable development operational implementation (Jansen, 2003).

Nevertheless backcasting scenarios can lack a vertical integration being mainly problem oriented and limited to the frame of action of the local stakeholders participating in the scenario building process (Rotmans and van Asselt, 1997) often limited to be a dream book of local communities of few stakeholders not followed by any action and not taking into account present global tendencies and drivers.

4.2.3.4   BENCHMARKING SCENARIOS METHODOLOGIES

At this point some conclusions can be drawn about the potential of the different future scenario method in aiding the decision making and evaluation process toward urban sustainable development. Forecasting can be very useful in defining possible threat and opportunity pathways, but not solutions, in the medium term

110

due to an accurate analysis of present drivers and trends, although in the long term its accuracy will exponentially fade; moreover being an expert based method, that requires a strong input of information and knowledge, it is not very suitable for participative decision making processes.

Visioning it is extremely valuable in terms of creative and imaginative self-learning process that can be used for participative decision making processes, although it does not explore the feasibility and the pathway toward, or away from, the envisioned futures, also because these images of future are normally not framed into a specific timescape; furthermore it is very difficult to bridge the gap between the present situation and the envisioned futures, particularly if these futures lays outside the possible change range.

Backcasting can be very useful in supporting participative decision making process, exploring value and desire based future scenarios that does not strictly require specific information and knowledge, although the backcasting phase, that intrinsically is solution oriented, must be more strongly focused on validating the feasibility of the proposed images and explore all related consequences (Dreborg, 1996); this would require expert knowledge and solid set of information related to trend and drivers in order to maintain the backcasting pathway into the possible change range.

Along the path toward sustainable development it is not possible to define universal solid and static solutions, but there is the need to structure local based operative definitions, through a value based negotiate process that will take into account personal and community aspiration and, at the same time, will considered the due trade off in relation with the pathways leaded by the present trends and drivers.
Furthermore the strength and the weakness of the presented future scenarios methods highlight the need of a more integrated frame for evaluating sustainability (Rotmans et al., 2000).

For these reasons can be stated that for evaluation of sustainable development it is required to develop a backcasting method enhanced with some of the key characteristic of forecasting, in terms of trends and drivers future impact, and of visioning, in terms of alternatives to the business as usual dynamics. Moreover the backcasting method, particularly in relation with urban sustainable development, should be integrated together with the planning processes and the implementation process, under a more systemic logic.

In this way backcasting can be used not just to develop visions of desired future situation but strongly to support organizational changes and strategic planning toward these desired situation (Drebog, 1996), passing from curative logic to preventive ones and in this way defining pathways that are more sustainable, or at least less unsustainable (Holmberg and Robert, 2000).

At this point it is necessary to analyse more in deep in which way the backcasting process can be integrated with planning and integration one.

111

4.2.4 BACKCASTING, PLANNING AND IMPLEMENTATION

Urban sustainable development it is a very complex matter that requires the interrelation of a wide range of specific issues (water, mobility, energy, built environment, society, economy, environment, etc.) with a long term perspective that cannot be reached just through the incremental changes that are strongly leaded by the present trends, that we can consider part of the urban systems unsustainable pathways. It is important to reshape planning mind frame toward long term perspective, going beyond partial sectorial approach and use the intrinsic innovative and creative potential of the urban society through a learning process that will move personal and community values toward more sustainable pathways, increasing the ability to adapt and to manage changes.

Should be clear that our aspirations and desires, as well as the decision that we take, in the present time are having interconnected consequences in the future, thereby there is a need to both define clearly our desires and to explore their consequences in order to be able to plan and act through a real sustainable development process, simply because what might look sustainable in the short term or at the local level can have strong unsustainable consequences in the long term or at the global level.

There is an indubitable need for continuous and integrated evaluation both of our needs/desires and of logic and the measure that we use both to plan its achievement, for this reason it is important to integrate backcasting, planning and implementation along a structured evaluative process focused on urban sustainable development.

These 3 processes cannot be any longer considered as separated, linear and not open to wide public participation and stakeholders involvement, it is then necessary to define method to enhance a continuous feedback loop; moreover evaluation cannot be just considered as quantitative and goal oriented, just limited to monitoring or to the ex-post analysis of the achieved goals, but should take into account all these 3 processes allowing to define possible alternatives and consequences for each phase and to redefine the same desired future also along the implementation phase.

4.2.4.1 BACKCASTING PROCESS.

The backcasting should be as much as possible open to both public participation and stakeholders involvement, and considered as a learning process, that from the definition of future images to their analysis and the exploration of possible pathways, can start a continuous discussion and negotiation process between the value sets, priorities and agendas proposed by the different actors. Furthermore it needs an accurate balance between the given information and the freedom of creative and free thinking, bridging the gap between a visionary state of the future and the present real effort to reach in a given time frame.

112

The backcasting process should be started with framing of the problems, then the future visioning exercise after this the desirable future scenarios should pass through a first generic backcasting phase for validation and analysis, and after this a negotiation between the actors for the identification the best desirable future most desirable, that should also be feasible to reach, and at the end there should be a more complex backcasting phase for based on a more stronger validation and analysis procedure that should identify the different intermediate backcasting stages that will connect backward the desired future with the present, as shown in Figure 4-5..
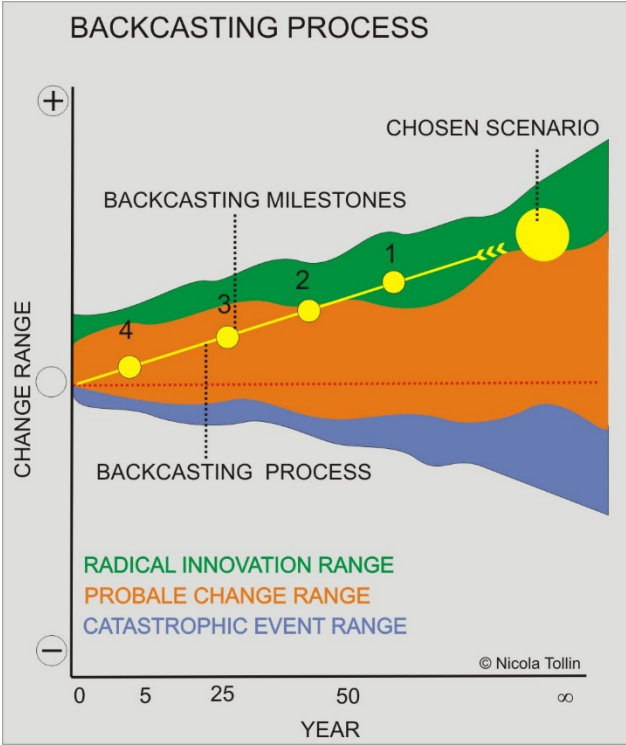
Figure 4-5: Backcasting Process (Source: own graphic)

4.2.4.2 PLANNING PROCESS

Starting from the output given by the backcasting process, in terms of value sets, best desirable future and the intermediate backcasting stages, the planning process should bring together the non-expert and expert actors that will define a plan that will lead from the present situation to the desired future, as shown in Figure 4-6.

This plan should explore and benchmark possible solutions with different time frames, defining intermediate planning stages, which should take into account both the values set expressed by the actors and the intrinsic condition of the urban system, which is characterized by a strong inertia and very complex and dynamic interrelation between its subsystems.

113
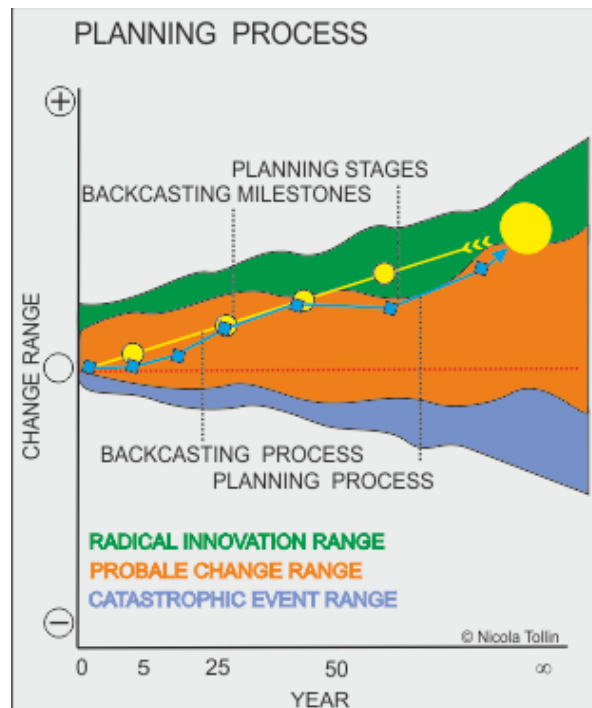
Figure 4-6: Planning Process (Source: own graphic)

Thereby the evaluation of the different possible and desirable alternative, along the planning process, should be very careful and focus on the dynamic understanding of the urban systems as a whole and as summa of parts inter influenced by feedback loops; furthermore it is to be defined in which way the system influences and it is influenced by its vertical connections (local-regional-global).

In some cases the intermediate planning stages might differ from the intermediate backcasting stages due to the fact that the second ones cannot be realistically and operationally achieved, as outside the possible change range, or because they differ to the implemented sustainability criteria within a more systemic and vertically integrated frame.

4.2.4.3 *IMPLEMENTATION PROCESS*

After the planning process, can be started and discussed the implementation process that will define practical stepwise stages understanding the role that each actor can play to support the process and to cooperate for the goals achievement, through continuous information and consensus building mechanisms.

The implementation intermediate stages should be supported with structured monitoring mechanism that should take into account the development of the plan and its effects, both within scale and time projections, in qualitative and quantitative ways.

114

The natural change of the system will lead, in the medium term, a detachment from the planning intermediate phase, as shown in Figure 4-7, that should be considered along a dynamic reassessments of intermediate goals targets and procedures that might need to pass again through the backcasting and the planning processes, thereby the implementation process should be very flexible and rely on the support given by all the actors.
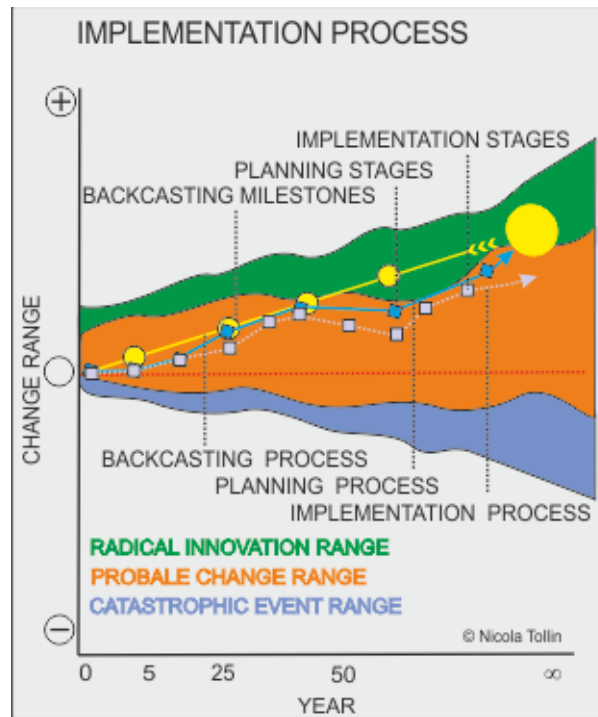
Figure 4-7: Implementation Process (Source: own graphic)

The main point of this chapter is that the exploration and the understanding of future scenarios is vital in order to move toward an urban sustainable development, in order to support the decision making processes with a systemic and integrated evaluation procedure not limited to achieved results but analysing and comparing different alternatives and solution, that are not just based on the incremental change leaded by present trends and driving forces but that will try to shift toward more innovative and creative scenarios based on the local actors aspirations and desires.

The active participation, along the backcasting, planning and implementation processes, will not just define a best desirable future but also its achievement, balancing desires and needs within sustainable development paradigms and complex interrelations, through a dynamic process of information collection and analysis, knowledge construction and awareness raising. This should be considered just a first step that should be improved through further theoretical research and the definition of real practices.

4.3 INTEGRATED EVALUATION OF SUSTAINABILITY

Integrated evaluation of sustainability will make reference directly to the development of it as concept along the discourse on sustainability.

Reference are made also to specific approaches as Life Cycle Assessment (LCA) and multicriteria analysis, as a methodological frame will be used mainly an ecological economics approach.

A division between ex-ante, ex-post, monitoring will also be explained, as well the difference between evaluation and impact assessment.

Specific reference is made to the work developed within EU EASY-ECO project.

4.3.1 SYSTEMS DYNAMICS USE IN EVALUATION FOR SUSTAINABILITY

Systems dynamics model can be an useful tool for supporting decision making, as it has been explained, but there is till to better understand in which way systems dynamics can be used for evaluation of sustainability and moreover sustainable development.

This part it is intended to give some possible visions on the use of systems dynamics for this purpose, and still far from being a strongly articulated theory, particularly because there is not yet a wide range of complete experiences going in this direction.

Nevertheless, before understanding in which way can be methodologically possible to integrate systems dynamics in evaluation studies aimed to sustainable development, it is required to define which is the need and the understanding of this kind of evaluative practices.

4.3.2   SUSTAINABILITY EVALUATION

Global change, imbalance, risk and uncertainness are becoming exponentially treats that humanity has to challenge re starting to think about the paradigms of physical and economic growth. The concern for the future generation, in relation to the limits to the growth, and the inevitable need for a structural change of logic and vision, represents the "environment" where the concept of sustainable development start to be defined and just more recently slowly and weakly implemented. The ability to define the present situation, in all its aspects, and its possible development in the medium and long term needs instruments, tools and capacity for analysis and forecasting.

First of all it is demanded to be able to understand and build models for a world with a systemic structure where the interrelation just between subsystems and the interconnected flows are changing dynamically. Evaluation has to become dynamic and complex, both to detect changes in fast movement and to understand the different dimensions of the system in a multi-comprehensive and integrated way.(Robert et al., 2002, Kraines and Wallace, 2003, Olsson et al., 2004, den Boer et al., 2007, Heidrich et al., 2009, Broto et al., 2012, Venkatesh et al., 2014, Rotmans J and van Asselt M, 2000, Luria and Aspinall, 2003, Brunner and Starkl, 2004, Liposcak et al., 2006, Munda, 2006, Park et al., 2013)

Risk and uncertainness are manageable just through a radical shift in our way of thinking, analysing and foreseeing, in a more multidisciplinary way and within a shift from curative to preventive, through the modification of brain frames and action frames.

This radical shift affects and challenges, both theoretically and practically, a multi dichotomist system of value that has been growing as a set of dual contra oppositions, North-South, reach-poor, developed-developing. In order to restructure this system there is to start to share common values, as a development that will take in consideration equally the present and the future generations, and bridge the gap between these dual contrapositions in terms of equality and accessibility.

This kind of shift it is based on the implementation of criteria and tools that are pluri-disciplinary and more holistic that are going much further then reductionist approaches do, lacking a veritable time dimension, even when aimed by the chimera of the internalization of the externalities; which is based on impracticable "translation" of social and ecological value in economic, chrematistic and accountable quantities.
Right the reductionist vision is one of the major weakness for sustainable development that does not seem able to produce other systems of interaction between its three main dimensions, and that already loose the opportunity to better understand the deeper interconnections.

The well-known holistic principle is something that cannot be stable and crystallisable just using any kind of logic that is not taking in the right account the temporal dimension, and the interrelation of cause effect through scale shift from local to global and vice versa.

The structure and the implementation of sustainable development it is a process, a process that have to be developed taking in account the competitive time of the three pillars, times that are increasing their gaps; the environment is not able to sustain the constants flows of materials and energy needed by the social system and to absorb the impact of the residues flow, as well as the financial and technological time is already too much far from the ability of society to manage and interiorize the change itself.

This increasing time acceleration has produced a strong space compression bringing a never experienced interconnection between global and local dynamics, which needs a new awareness to be handled, restarting through policies and actions at the local level.

For these reason it is every day more important to develop policy and intervention in a GLOCAL prospective, based on a strong participative and supporting structure where every single actor and stakeholder us aware of the impact that its action can have on the global system; at the same time fighting with a growing cinism and impotence diffused felling.

For the sustainable development we need now to implement shared and participatory tools to support widely enlarged decision making processes through the ability to reorganize the knowledge and the learning structure and developing the ability to foreseen and to build scenarios to support policies and actions, for an integrated evaluation of sustainability (Hardi P. and (eds), 1997, Kraines and Wallace, 2003, Brunner and Starkl, 2004, Bill Hopwood, 2005, Liposcak et al., 2006, Hezri and Dovers, 2006, Munda, 2006, den Boer et al., 2007, Yamaguchi et al., 2007, J.O. and M., 2007, Nevens et al., 2013)

4.3.3 SYSTEMIC EVALUATION

During long time the discussion of evaluation debate has concentrated on the division in ex-ante, in-itinere and ex-post, (Loorbach, 2010) but it is opinion in this paper that speaking about evaluation of sustainability this kind of division is artificially moving the discussion from its main core, that should be related to the implementation of integrated methodologies and tools.

The debate on evaluation of sustainability should move forward from this division and accept that an evaluative process, able to effectively support decision making processes for policies and action toward sustainable development, should accept the complete integration and coexistence of this tree phases into the same evaluative process.

Systems dynamics can facilitate this shift in evaluative practice; the models can be built in order to support the decisional process, through which policy and actions will be individuated, and later on can be used as a control tool to assess advancement, efficiency and effectiveness with clear benchmarking procedure.

At the same time the model itself can be modified and changed following the result of this in-itinere partial evaluation; and furthermore a final balance of the results obtained, also in terms of outcomes, can be draw and benchmarked with the forecasted one, giving the opportunity for more radical changes both of the model and the decision process itself.

Furthermore, systems analysis potential for a full integration (vertical, horizontal and temporal) and the relation with context and complex, can give precious elements along the whole participative process, just a pact that the transparency and information accessibility are going to be fully respected, and that the model is flexible enough to be corrected within errors definition.

In order to structure the evaluation of a sustainable development process it is necessary to define clear and accountable twilight targets that can be used to monitor all the process and can give notice of possible deviations.

The same principles of the evaluative process should be integral part of the systems dynamic model, and clearly communicable and transparent, in order to build the necessary informed consensus around the decision making process, that clearly includes the same policies and actions; in fact the decision making it is not a closed process but it is renewing itself along all implementation phases.

The research to define principles, methodologies and tools for evaluation of sustainability it is still long, although that systems dynamic logic and models can give a good support to this process, helping to increase the integration and to verify the different possible alternatives.

As base for further discussion can be stated that systems thinking and system dynamics models to be more effective and understandable, without a too rough simplification of complex and context, should be based on a local perspective but starting from a global narrative; the key elements of this global narrative should structure the logic modelling process and be integrated in the model in terms of drivers "extern" to the main system analysed.

5   THE METHODOLOGICAL FRAMEWORK

5.1   PROCESS DESIGN / TRANSITION MANAGEMENT GENERAL METHODOLOGY

Sustainable development and resilience are complex and dynamic process of transition, aimed to limit and mitigate human activities externalities and at the same time to adapt to global and local changing dynamics. Meanwhile reducing causes and effects of risk, environmental and man-made, and building the system capacity to recover from slow off setting and punctual disasters.

Traditional planning approaches, based on a crystalized plan with a predefined temporal and spatial dimension, which are derived from consumption and production systems, as well as power relations, typical of 19th and 20th century, are unable to address properly complex, cross-scale dynamic changes. Thereby a new planning approach is required, which is self-adapting and dynamically mutating , to better be able to manage the complex transition toward more sustainable and resilient cities.

Marshal McLuhan stated "In a culture like ours, long accustomed to splitting and dividing all things as a means of control, it is sometimes a bit of a shock to be reminded that, in operational and practical fact, the medium is the message. This is merely to say that the personal and social consequences of any medium— that is, of any extension of ourselves— result from the new scale that is introduced into our affairs by each extension of ourselves, or by any new technology." (McLuhan, 1964):15

With reference to planning it is indeed required a re-foundation of planning approached, aimed to design and manage process in an open and participatory way, based on co-created and shared of knowledge to support informed decision making and the implementation of short and long term implementation.

The process design planning approach is grounded also in the theories regarding post-normal science, as well in the definition of our contemporary society as liquid, in a constant largely un-determinable mutation, governed by an high degree of uncertainty; uncertainty which cannot be fully and once for all resolved, as it is an intrinsic characteristic of our society, but can be dynamically managed, through highly adaptive processes, designed and implemented.

It may be reasonably argued that human civilization have been always forced to face high degree of uncertainty, although what differentiate our era is the availability of knowledge , making us more aware about the limit of our knowledge, and an increasing importance at global level of criteria of democracy, justice and participation in decision making processes, as fundamental to face great challenges of humanity as climate change, in a world society with an increasing concern for our collective future, future that extend itself beyond our very own individual existences.

121

One of the key principles governing process design is the change of system through design, design of strategic transformation/transition processes and design o specific intervention/action , including the physical design of space and manufacts, that can better embrace the principles of circular economy of change through design , in order to lead a radical transformation of our way to conceive, plan, construct and manage our cities.

5.1.1 THE PLANNER AS FACILITATOR

The definition of a process design for sustainable urban development and resilient transition requires to re-think radically the role and function of the planner, not any longer a "deus ex machina", a demiurge: only depositary of Gods' will and depository of the only Truth.

The role of planner needs to be radically reformed, to support and facilitate decision making processes that are taken by stakeholders', including local communities, facilitating an informed and knowledge base process of decision, democratic, participatory and inclusive.

At the same time the same urban planning profession require a radical change, to adapt to new system of production and consumption, dematerialized and adopted by a liquid society which interrelation are in constant and dynamic mutation.

The redefinition of planning practice require also to develop planning forms and approaches that are not solely oriented toward the realization and construction of physical manufact, but need to be re-thought as good management of space in time.

At the level of urbanization we are currently experiencing, and due to the consciousness of limits of resources, including territory, it is fundamental to reduce the use of the land and the physical construction in favour of transformation processes which intensify the use of space through time.

Moreover the technical knowledge it is not any longer sufficient by itself, as the issues of justice and democracy require that knowledge is co-constructed taking into account different understanding, different knowledge's and cultures, representing the uniqueness of a location and the diversity of its local inhabitants,

5.2   PROCESS DESIGN METHODOLOGY
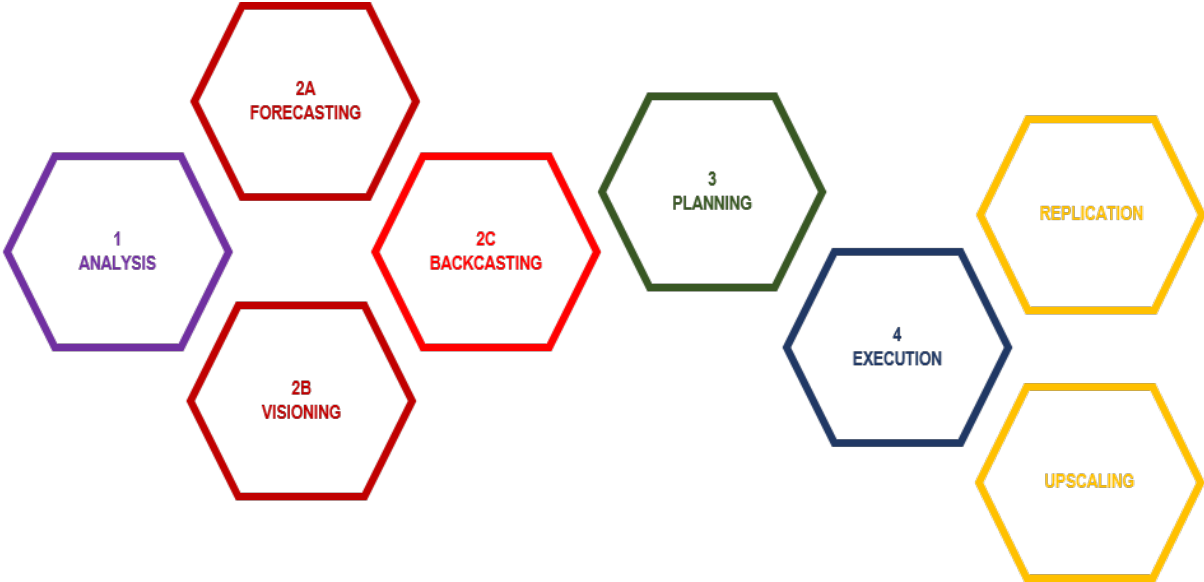
Figure 5-1: Process Design Outlook (Source: own graphic)

5.2.1 INTRODUCTION

The process design methodology is structured in six main phases, as shown in Figures 5-1 and 5.2:

1. Analysis
2. Future Scenarios
3. Planning
4. Implementation
5. Replication/Upscaling
6. Other actions

Beside these key phases a number of additional actions can be undertaken in order to strength the projects and its impact, this may include further analysis, support for fund raising, education/training activities, dissemination and communication, monitoring and evaluation and the deployment of specific appropriate technologies.

The process design methodology is grounded on the following key principles/characteristics:

Multi spatial scale: it can be applied to a number of urban development processes at different spatial scales, from specific projects at local to master/strategic plans at urban and regional level.

Multi temporal scale: it is governing at the same time long terms strategic decision with short terms implementation actions.

Dynamic adaptation: like progressive learning processes, the process design is governed by knowledge base constant process of re-adjustment/re-definition; through the experience of realize activities the overall objectives, strategies and action are constantly adapting.

Governance and participation: the process is governed by all stakeholders, including local communities, participation in an open and collaborative frame, for inclusive and informed decision making processes.

Replication and scaleability: the spatial and temporal cross scale application of the process is aimed to replicate and up or downscale the process design, in order to easily adapt it to other context or more specific and punctual urban development projects and actions.

System thinking approach: the understanding of a system as a complex interrelation of its parts among themselves and within the whole system, in a constant dynamic articulation, it is a fundamental principle for process design.

Justice: justice is a leading principles of the process design methodology, both for the process itself in terms of governance and participation, and in relation to the implementation of actions that should increment and sustain a just accessibility and redistribution of resources.
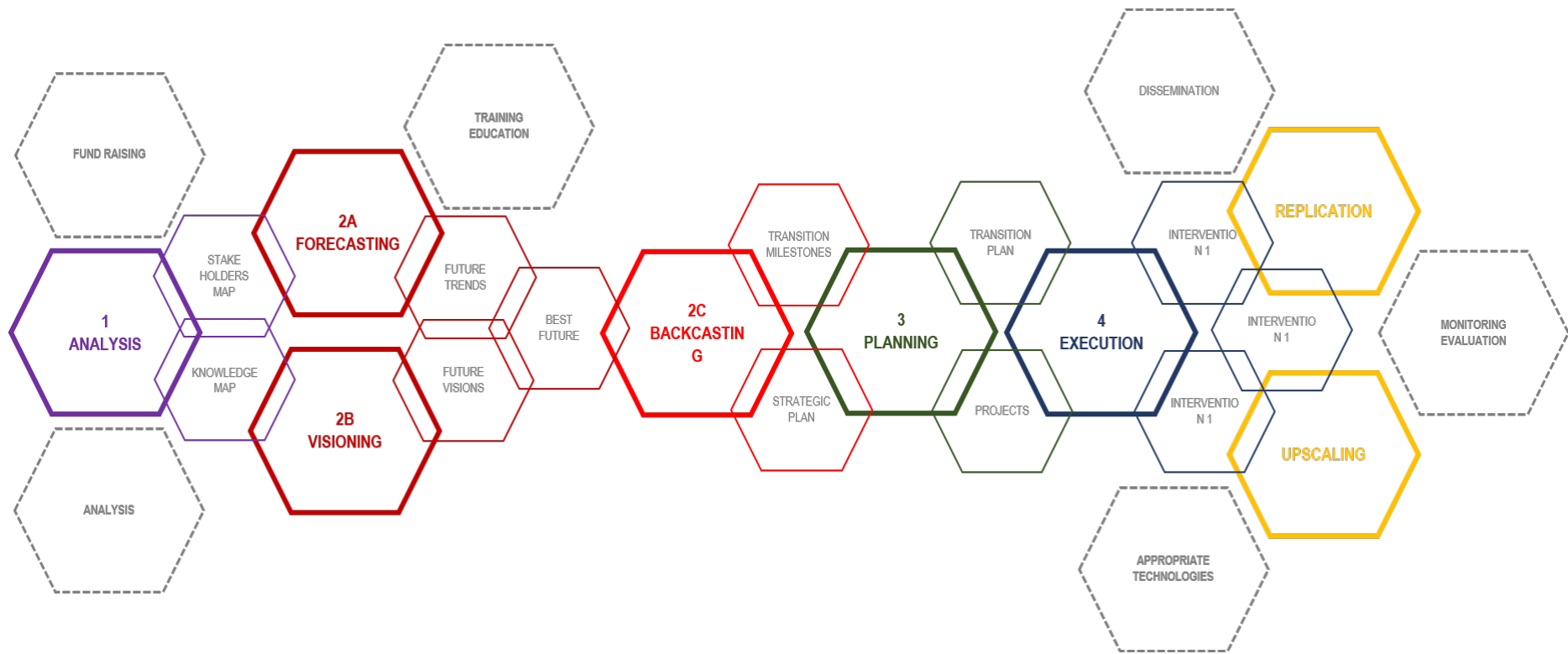
Figure 5-2: Process Design Complete Methodology (Source: own graphic)

5.2.2　PHASE 1: ANALYSIS

This phase is dedicated to a **systemic understanding and mapping the information available and the stakeholders** that are affecting and/or affected by the specific project activities.

It is reasonable to assume that many urban development activities have been developed and/or are under development, having some influence on the specific scope of the specific process and its design. Also different analysis may have been realized in the past, as well as information may have been collected and analysed; this task aims to map all past and ongoing activities in order to better harmonize and integrate it within the process design.

This phase is crucial to understand, with already an active involvement of all stakeholders, which information and data are available and to identify clear knowledge gaps, allowing the definition of specific focused actions to address those gaps.

It is also crucial, for any participatory process, to understand which stakeholders are present and which is the nature of the dynamic relations between them, this is performed by the stakeholder map; which will also enable a continue monitoring of such relations which are clearly having direct influence and impact on the process design itself.

5.2.2.1　PHASE 1.1: STAKEHOLDERS MAP

This sub-phase is twofold, firstly the objective is to realize a first map of stakeholders, through identification and analysis, and secondly to define a process of constant monitoring and updating of the stakeholders map, with specific focus on the changes in their interrelation.

The process is organized as following:

First, preliminary mapping

> Identification of major groups of interest and of specific persons of contact, this will be realized already in collaboration with individuals from the public organization commissioning the work.

Second, analysis

Preparation of a first list, and preliminary mapping exercise, outlying possible interests and interrelations between the different stakeholders and stakeholders groups.

Third, interviews

Semi-structured interviews are undertaken with the stakeholders already identified. During the interview the stakeholders will draw a stakeholder map, from their perspective, highlighting also what they perceive the level and intensity of connection between the different stakeholders, as well as defining the perceived nature of their interest and position.

Fourth, final map and analysis

The maps and comments of the stakeholders are analysed, new stakeholders are included, and interview, and a final map is prepared. This including the relative position of their stakeholders, possible grouping system, and highlighting the intensity of their interrelation as well as the level of their interest and influence.

Fifth, engagement strategy

An engagement strategy is defined, through identifying specific incentives to facilitate the active involvement of all stakeholder, this is of crucial importance for building an open, transparent and effective involvement of stakeholder. The strategy is going to be reviewed periodically taking.

Sixth: Monitoring and update

The stakeholders map is regularly updated and the positon, interest and influence of the stakeholders is monitored. At constant intervals a new series of interviews is undertaken and the map updated; this may entail the possibility to include or exclude some of the stakeholders; in fact some stakeholder may influenced or be influenced by the process only in specific phases.

This phase is performed by both experts and local stakeholders, the expert is having the role to give a structure to the mapping exercise, and facilitate the contribution and input from the local stakeholders. The stakeholder map is not only including local stakeholders but may also be extended to stakeholders that can have some indirect influence on the process. For example it can include national and international authorities, which resolution can affect these specific process.

the stakeholders identified in the mapping exercise, depending from their level of interest and influence, can be involved at different manner and at different stages within the process; for example representative of local communities will need to have a much higher level of involvement, meanwhile national or international authorities may be involved in terms of mutual exchange of information.

The knowledge map is aimed to define the system and its boundaries, analysing all its elements, their interrelation and feedback loops, following a system thinking approach. The knowledge map, can also be developed in a running model based on system dynamics, which can be of use specifically for defining forecasting scenarios, both explorative and normative.

System mapping couples expert and local stakeholders knowledge; experts operates following system thinking methods, and facilitate gathering of information from stakeholders through mental mapping technics, defined also using simplified system thinking.

The process is organized as following:

First, first system map

Experts are drawing a first system map, defining the system boundaries, the system elements, analysing their interrelation and feedback loops. This first mapping will be realized not only analysing the system in its present condition, but also in a future strategic perspective, identifying any potential change in the system and its element, including inclusion /exclusion of some of the elements, and the changes in their interrelation.

Second, mental maps

The stakeholders, with the facilitation of experts, will be drawing individual mental maps of the system. The individuals' maps are then collected by the facilitator that will draw a consensus map, which is discussed and agreed by all stakeholders. The maps will design using a methodology that will allow to weight the degree of interdependence between the different elements. The mental map drawing are accompanied by an oral presentation/description that will be recorded, and will give the possibility to make more clear and explicit the logic beyond the drawing.

Third, final system map

Using the expert map and the consensus mental map, with all supporting information, a complete system map is prepared. This map will be subject to comments and inputs from all stakeholders, which will allow the preparation of a final system map. This map will be of central importance through the whole process, also to monitor its development. The final system map will identify appropriately sub-systems that would be used for the development/implementation of the specific projects that are part of the process design.

Fourth, system modelling

A system dynamic model is developed following the final system map. The entire model, or specific parts of it, can be made fully operational in order to run appropriate simulations, which can be used to analyse, in first instance, the full system interconnection. The running model will be also used to run explorative and normative forecasting, and can also support informed decision making in benchmarking specific alternative pathways for transition.

Fifth, data acquisition strategy

The system dynamic model, in order to be fully operational will need adequate data provision, thereby a strategy for data acquisition will be defined, identifying data required, and appraising the availability and sourcing of it. The strategy will include a step by step acquisition plan, which will be used also to improve the system dynamic model, with reference to data availability and accessibility.

Seventh, monitoring and updating

The final system map, and consequently the system dynamic model, will be subject to periodic updating; that will be conducted by expert in liaison with the stakeholders, also through face to face sessions. This is necessary as the system itself will be subject to change, and changes will be made necessary passing from phase to phase along the process; as well changes within the stakeholder group can clearly affect the system and its understanding, for example in terms of stronger/weaker interrelation between the elements.

5.2.2.3   PHASE 1.3: KNOWLEDGE MAP

The knowledge map is aimed to systematically gather and analyse information and data related to previously realized projects, analysis and studies. This would help to have a more complete understanding of the system and will valuably inform the process design. Furthermore it will prevent unnecessary duplication of effort.

It also of high importance to conduct this knowledge mapping exercise in order to identify specific knowledge gap and to define specific strategies and action plans to cover such gaps.

This exercise will aim also to analyse previously realized development project on the same area, or similar project in other areas, allowing the identification of opportunities and barrier, and to construct, jointly with the stakeholder, a strategic analysis of previously realized development/transition processes.

The process is organized as following:

First, identification of knowledge gaps

Based on the wok realized in phase 1.2 System Map, and on the peculiarity of the specific process to be design and area of intervention it is possible to start identifying knowledge gaps, that would need to be filled to inform the entire process design and specific informed decision and policy making. These knowledge gap includes, at local level, already realized interventions, analysis and studies realized in the specific areas or addressing specific thematic issues of particular relevance for the process design. Moreover it includes, at global level, a revision of current literature and case studies/best practices on urban development projects realized in similar circumstances and or addressing specific thematic priorities.

The identification in conducted jointly by a team of experts and the international local stakeholders, which will be called, through a series of semi-structured interviews, particularly to reconstruct the time line of projects and interventions realized in the past in the area of interest of the process design.

The knowledge gap analysis is a continuous process that will be undertaken and informed by all the following sub-phases.

Second, knowledge acquisition strategy

Once established a preliminary knowledge gap map, specific acquisition strategies for knowledge acquisitions are realized by experts, one at local level and one at global level. This strategy includes the identification of specific knowledge sources, and also specific means to engage stakeholders and access knowledge bases. The strategy will draw a specific action plan and timeline for knowledge acquisition, taking into account knowledge requirements referred to the information needs of the different phases of the process design. In drawing the strategy particular attention will be given to knowledge acquisition in relation to appropriate technologies and traditional knowledge, entailing an analysis of traditional urban development systems with a larger historical perspective.

Third, local knowledge acquisition

The local knowledge acquisition is undertaken in liaison with local stakeholders, and it is subdivided into two parts. The first one is aimed to gather information and documentation on already realized activities (projects, analysis, studies, etc) and will rely mainly on official information repositories, as the ones of local authorities. The second one is aimed to identify critical issues/parameters of success/failure of previous activities, and will be realized through semi-structured interviews with the different local stakeholders, whom will be required to reconstruct first individually and then jointly, through a workshop, the process/development of previous activities. this second phase will be also used to inform and further expand the knowledge gap analysis. Particular importance is given to the gathering
131

and analysis of specific solutions related to appropriate technologies and intangible heritage, that will be systematize and be of fundamental importance to design and implement specific solutions for the project.

Fourth, global knowledge acquisition

The global knowledge acquisition is undertaken in liaison with international stakeholders, and it is subdivided in two parts. The first one, undertaken by experts, will rely primarily on scientific literature and policy document of national and international organizations. The second part, more actively involving stakeholders, will select a number of best practices and experiences with high replication potential for the process design and its specific interventions. The knowledge acquisition will also identify specific appropriate technologies and traditional practices that can potentially be replicated.

The global knowledge acquisition will inform the continuous development of knowledge gap analysis.

Fifth, knowledge analysis and transfer.

The knowledge acquired both at local and global level is analysed in order to apprise specifically in which way it can be replicated and used for the process design. Such analysis is fundamental in order to define different alternative solution and inform the decision making at the different stake of the process design. A fundamental part of this analysis is to translate complex information into more easily accessible and understandable information, targeting the different stakeholders groups. Thereby this sub-phase will define and implement specific action to produce synthesis analyses, and adopting ad-hoc communication strategy, facilitate the knowledge transfer.

Sixth, open knowledge repository

An open depository of knowledge is established, including information relative to previous activities, scientific literature and reports, best practices and synthesis reports produced in the sub-phase knowledge analysis and transfer. The open depository is structured to be accessible and searchable for different stakeholders groups, and easily updatable.

Seventh, update and monitoring

The knowledge map is itself a continuous and dynamic process, which key characteristic is its adaptive capacity, typical of all learning processes that will not just increase the quantity of information but will be able on the base of new knowledge acquisition keep the ability to restrict itself in the most efficient way. Moreover, there will be a continuous update and revision of knowledge transfer strategies and practices, to favour not only the information of the process design, but support the replication of the process design and specific solution themselves..

132

The main outputs of this phase are:

- **D.1.1** Stakeholders map. (list of stakeholders and their relations)
- **D.1.2** System map (system thinking map and mental maps analysed)
- **D1.3** System dynamic model (including sub models)
- **D1.4** Knowledge map (including scientific review, best practices and previous activities)

133

5.2.3   PHASE 2: FUTURE SCENARIOS
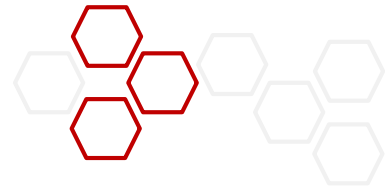
This phase is aimed to define, in a participatory way, best desirable/realizable scenarios, and to backcast such final scenario from the future to the present, defining key milestones and a e a strategic plan for transition. This is performed through three different sub phases:

2A Forecasting: analyse current future trends and drivers, at local and global level, defining possible future scenario. Performed by international and local expert

2B Visioning: defining best desired future at local level. Performed by local stakeholders and local population with the support of international experts.

2C Backcasting: define milestones from the future to the present, starting from the best desirable and realistic future scenario, defined through the mediation between visioning and forecasting,

5.2.3.1   FORECASTING

This sub-phase is aimed to define explorative and normative scenarios at global and local level, in order to inform decision making, defining the space of opportunities and limits of future development.

The forecasting may include also geographical simulations addressing physical and built environment changes, for example related to the dynamics of urban sprawl or extreme meteorological events provoking flooding.

The development of such scenario will help also to define key rends and drivers that may affect or be affected by the development of transition strategies and plans, helping to more accurately define action and transition pathways more aware of possible implications.

Such method have some limitations related to the fact that it would only allow explorations based on the projection of already know key trend and dynamics form the past, but would be less reliable for determining future dynamics, both positive and negative, having a more radical/disruptive nature.

Moreover the reliability of forecasting scenario is inversely proportional to the time perspective of the projection: further in time the projections are less reliable they become. Such reliability issue also applies to geographical scale, and the complexity of the system, larger is the scale and more complex the system is less reliable the forecasting is.

134

For this reason here the forecasting is used primarily to define key trends and drivers and benchmark, at a later stage within the process, future alternatives and pathways.

This is primarily an expert base system that will include the analyses of already realized future simulation at global level, and local forecasting using the system dynamic model previously developed.

Global scenarios

Global scenarios are not going to be developed within the process, due to their complexity, adapt and computing power capacity required; instead already developed future forecasting at global level are going to be used. The information given by these scenarios will be analysed and translated in an appropriate way to appropriately inform the process design regarding global dynamics.

This may include major dynamics as climate change and global environmental change.

Local scenarios

Local scenarios are built using the system dynamic model, specific for the system under consideration, including specific sub-thematic or sub scale models. Moreover forecasting data already developed will be taken into due account. Also in this case, the information given by the local scenario will be analysed and translate in the most appropriate way to inform the process design regarding local dynamics.

This may include major local dynamics as population, urban sprawl, resource availability etc.

Exploratory scenarios

Local and global scenario will be used initially in an exploratory way, better outlying general and specific dynamics and to define key trends and drivers; this to have a better understanding of the system and the way this may be affected by present and future changings.

Normative scenarios

Local and global scenarios, will be used at a later stage to assess the impact of specific policy and decision and to benchmark those within different timelines; this having particular importance to inform decision making at local level.

5.2.3.2   FUTURE TRENDS

The forecasting scenarios will be used to define key trends and drivers at local level, and to understand how global dynamics can influence local transition pathways, and vice versa. The information derived by the forecasting scenario need to be analysed and then translated in a way that the knowledge developed can be made available in a meaningful and understandable way to stakeholders to better inform their decision.

135

This translation process to increase knowledge transferability may include the use of specific graphic representations, specifically dynamic geo-referred maps that can show the impact of key trends and driver at local level.

These representation and maps can be accompanied by more narrative description, which can increase the knowledge communication and transfer, such narrative can be tailor made to fit specific needs/interest of the different stakeholders group, based on the stakeholders mapping interest analysis previously developed.

The forecasting scenarios will also help to re-define the system boundaries and the realistic space of operability of the process design and specific intervention; it is of high importance to be able to understand what is realistic to be achieved through the process design, avoiding to define plans and actions which will aim at achievements beyond the range of reality.

The information gathered through the future scenario will be used to inform the sub-phases on visioning and the one on negotiated future.

5.2.3.3   VISIONING

This sub-phased is aimed to define best desirable futures, for specific stakeholders, stakeholders groups and for the whole community, this exploring and defining which are the key elements and principles that constitute the best desirable future itself.

Visioning is particularly valuable to define disruptive/radical innovation, imagining futures that are outside the normal range of possibilities, giving the opportunity of defining ambitious transition objective and pathways.

Although this freedom in defining future possibilities it constitutes also the biggest restrain of visioning scenarios, as the best desirable futures can be outside the range of possibility and reality, for this reason the process need to be informed by the previously realized forecasting.

Moreover the realization of participatory visioning exercises are bounded within the Plato's cave contradictions: how can we desire and wish something that is unknown to us; for this reason the process wil be facilitated and informed by the knowledge and system map previously developed, including case studies from around the globe. This will give the possibility for the stakeholders to start imaging possible futures outside the normal boundaries of their reality,

This process is led by the stakeholders, through the facilitation of experts, and does not require any expert knowledge, but only a structured definition of best desired future options.

The visioning is going to be realized using a living lab environment during two days facilitate interactive workshop, inviting the stakeholders mapped in the previous phase.

The visioning process is structured through the following sub-phases:

Firstly, individual desired futures

The first part of the living lab will be dedicated to individual stakeholder to define their best desirable futures. They will be asked to define futures goal and pathways and to describe it, also using graphic representations and geographic mapping.

They will try to define specific timeline/horizon to the desired futures to be achieved. This phase, if required can be organized in a more focused way, having small groups working together instead to have individuals by their own.

Secondly, joint analysis and discussion of individual futures

The individual futures are presented, followed by an analysis and discussion, which will be recorded and later used. The discussion is aimed to better define the scope and rational behind the individual scenarios. Common key issues and converging scope of the individual futures will start single out and listed

Thirdly, best practices

On the base of the results of the previous phase analysis and discussion, the expert will select a number of bets practices, at global level, which will be presented and explained. This will allow stakeholders to enlarge their horizon and get inspired to develop more disruptive futures.

Fourthly, common desired futures

The second day of the living lab will focus on defining consensus on a specific set of desirable futures. Each of those will be analysed and described in detail using also means of graphic representation and geographical information.

The definition of such common desired future is the main outcome of this phase, and will be used in the next phase to define common desired and realistic futures, together with the results of the forecasting exercise.

137

Fifthly, updating

The best desirable future will be periodically updated, organizing a short version of the living lab.

5.2.3.4 FUTURE VISIONS

The main outcome of the previous phase, resulting from the living/lab, are a series of best desirable futures, including individual/group ones and a common desired one. These futures are accompanied by a series of supporting narrative, graphic representations and maps/plans, also realized during the living lab. Within the present phase, all these materials will be analysed and better organized, in a coherent and complete form, in order to shape appropriately clear and communicable best desirable future scenarios.

The scenarios and all supporting materials are analysed by the experts/facilitators for defining and understanding better the outlying key principles; this operation will be conducted in liaison with the stakeholders, in an open and transparent way, submitting for comment and addition the preparatory and final documents.

Once agreed the key principles, the best desirable scenario will be analysed to define general and specific objectives of the futures, also understanding the timeline/perspective of such objectives to be achieved; all this process is also undertaken by the experts/facilitators in liaison with the key stakeholders, involving directly and active them along the entire development of this sub-phase.

Finally, once better defined the key principles and objectives of the best desirable futures, the facilitators will prepare complete description of the defined futures, including support narratives, graphic material and maps/plans, in a final format; this to be able to communicate the best desirable future options in more adequate manner. This sub-phase may include also the preparation of more articulated material, like video or spatial simulations that would be representing the future desired and the transition pathway more effectively.

5.2.3.5 NEGOTIATED FUTURES

This phase is aimed to find a final future that is desirable and realistic/achievable, through a negotiating process aimed to balance the results of the forecasting exercise and the ones of the visioning exercise.

This entire phase is realized by stakeholders working directly with experts and facilitators, through a living-lab of the duration of one, or two days, depending the level of detail it is required necessary to better shape the process toward the achievement of its objectives.

138

The negotiating process is structured through the following sub-phases:

Benchmarking visioning and forecasting

The first part of the living labs is aimed to benchmark the results of the visioning and forecasting exercise. First the results of the visioning exercise, specifically the best desirable future for which a consensus has been achieved, will be presented by the stakeholders themselves. Later the expert will present the results of the forecasting scenarios, outlying which are the key trends and drivers at local and global level, and outlying in which way this can affect the transition process.

The best desirable future , through a process of mutual feedback between the results of the forecasting and visioning, will be re-assessed in order to verify if and how the out-coming objectives can be achieved and how.

The entire process is going to be managed as a facilitated discussion, the facilitator will also propose more detailed discussion and benchmarking of specific key issues.

Negotiating a best desirable and achievable future

The second part of the living lab is aimed to identify a final best desirable and achievable future, which will constitute the ultimate objective/goal of the transition process. At this point different stakeholders and stakeholders group will have to negotiate the relative weight that specific issue are having within the scenario and how tackle them. A final agreement shall be reached by the stakeholders for consensus. The facilitator will try to make the stakeholder defining explicitly any item of concern.

Narrative definition of the best desirable future

After the end of the living lab, the facilitators will use the final future, and records of the living lab, in order to prepare a complete and systematic narrative f such future, using also graphic elements when necessary.

The material produced will be used to support the communication of the best desirable and achievable future, and will help this to be a reliable and complete term of reference within the definition and implementation of the transition process.

Spatial definition of the best desirable future

A first spatial representation of the final future is here realized, including plans and maps. This will be realized by experts in liaison with stakeholders. The material produced within this sub-phase will be used to inform, and as first spatial base, within the development of the planning phase. The system dynamic model, geo-referred can be a very useful if developed to give a dynamic representation of the possible development toward the best desirable futures.

139

This phase is aimed to backcast the best desirable and realizable future objective to the present, defining key transition milestones and supporting the definition of a transition plan.

This phase is organized through a living-lab setting, and it is led by the stakeholders through the mediation of a facilitator and the support of experts.

The result for this phase will include the list of milestone and a transition plan, each of these outputs will be fully discussed and defined during this phase; this phase is of central importance within the process design project, it represent the bone structure of the project and will start to translate the general principle and objectives in a clear and actionable strategic plan.

The result of the back casting process, a strategic transition plan, is going to be translated, in a later phase, in specific territorial and physical plans, including design of built environment and space as required.

The backcasting processes in itself it is not particularly difficult or complex, although its main weakness is given by the way in which the future scenario starting point has been identified and described. The present process design methodology is in fact addressing this potentially problematic issue through a more structured and articulated process to define such future in a participatory manner.

Moreover backcasting processes , also participatory ones, are only on a limited manner involving actively actors in the definition of the future used as starting point, most normally the participation is only maintained in defining milestones, meanwhile experts are independently determining the target future.

The backcasting process is structured through the following sub-phases:

Presentation of the best desirable future
The first part of the living lab will be used to present the final future scenarios, result of the previous phase, which will be used as starting point of the backcasting exercise.
This entire phase will be facilitated and at the beginning of the session the rules of the game will be explained to the stakeholders, including a clear outline of specific outputs/results expected.
This sub-phase will include a further discussion, for clarification purposes mainly, regarding the fi nal future target, although the final target future may be subject of changes due to the changes of the system condition typical of any dynamic process of development.

Definition of milestones and description of milestone

The stakeholders will be divided in groups and will be required to first identify milestones, and subsequently to describe it and place it within a defined timeline.

Each group would have a facilitator that will support the group discussion and help to keep it structured and focused.

The groups should also try defining enabling conditions and pre-requisite for the milestone to be achieved, moreover they a system thinking approach is used to understand complex dynamics related to each milestone and the interconnection of one to the other

The milestones and their description are briefly presented by each group, and then discussed in plenary. The plenary will serve to define a common set of milestones, including clearly defined narratives.

Transition plan

The milestones identified and described in the previous stage are used to define a transition plan, the transition plan will specifically define how to make the process of transition from one milestone to another, from a strategic point of view.

The transition plan will be first drafted starting from the target future to the present, using again a backcasting approach, and later verified going form the present to the future.

Also this stage is realized by small working groups, as for the previous sub-phase the focus of the working groups can be general, this meaning that each group will work in parallel to the others, or each group can focus on a specific strategic or thematic issue, and in this case each group will work in convergence with the other. The specific setting of the working groups largely depend by the concrete objective and purpose of the process design itself.

The transition plans elaborated by each group will be presented and discussed during the plenary. Stakeholder will then identify a common transition strategy by consensus.

Living lab postproduction

As for all others living labs, also in this case a significant postproduction effort is required in order to harmonize and better structure the results of the living labs, both the transition milestones and the transition plan. This can also include specific supporting information, as extended narratives and graphic representations, also preliminary spatial representation may be produced, although this phase is having a more strategic purpose.

The post production will be able to finalize the key outcomes of this phase which are briefly described here bellow.

141

5.2.3.7 *TRANSITION MILESTONES*

The transition milestones are specific points in time and space which are of key strategic importance in order to continue a transition/development process. Such points are having also a management structure as control/check points, depending from the level of timely and appropriate achievement of the mails stones, the transition plan can be re-assessed, appraised and eventually modified.

Particularly in line with the key principle of process design, as dynamic transformation process, abd not pre-determined goals, the milestones are having a clear importance in strengthening the adaptive and the dynamic ability of the process itself.

The milestones in order to be functional in the process design, need to be well defined and described, in a systemic way , in order that all possible elements in the system , and their interrelation, are appropriately considered. It would be important also to associate a series of key performance indicators to each of the milestones, using both quantitative and qualitative ones, helping to better assess process progress and coherence of scope and principles.

5.2.3.8 *TRANSITION STRATEGIC PLAN*

Once the milestones are identified and described, the transition plan will primarily focus in understanding how to manage the whole process of transition, as the transition from one milestone to another; this will include the identification of the necessary resources and capacity.

Moreover the transition plan itself need to be dynamically adaptable , as it may need to respond to systemic changes as well as to specific shifting or re-scoping of the milestones itself; this may include also a redefinition of the final future target itself or its position in time and space.

5.2.3.9 *DELIVERABLES*

The main outputs of phase 2 activities are:

- **D.2.1** Future trends and rivers, with forecasting scenarios including future current perspectives. From 2A
- **D.2.2** Future visions, with visioning scenarios including best desirable futures. From 2B
- **D.2.3** Best desirable and realistic future, negotiated on the base of D.2.1 and D.2.2. From 2A and 2B
- **D.2.4** Transition milestones and pathway, from 2C
- **D.2.5** Strategic plan from 2C

142

5.2.4   PHASE 3: PARTICIPATORY PLANNING

This phase is aimed to define a specific spatial plan and projects, following the indication of the transition strategic plan and the transition milestones. This part of planning will see the involvement, though the facilitation of international experts. The plan is NOT going to be designed in isolation by planners, but planner will facilitate, using co-design methods, and with international experts, the drawing of the planning by local stakeholders and population. The plan is then prepared following standard a regulation by the planners.

5.2.4.1   3.1-TRANSITION SPATIAL PLAN

This sub-phase aims to develop a transition spatial plan, based on the outcomes of the backcasting and the strategic transition plan. The spatial plan is co-designed with the stakeholders, with the support of experts, within a series of living labs.

Unlikely traditional spatial plans, which are focusing on a specific physical outcome, the transition spatial plan will focus primarily on the process and its principles, deriving from these a defined spatial configuration.

This can of physical plan, following the overall principle of process design should also be dynamically adaptable and following system thinking principles.

During this phase the transition milestones and strategic plan are reviewed and adapted accordingly with the decision made to define the spatial plan; as well as the target future may be subject to changes in scope and in timing.

One of the key principles governing the dynamic adaptability of the whole process design is the fact that each step/phase is retrofitting the entire process, informing it and allowing it to adapt accordingly with mutating circumstances

The transition spatial plan is structured through the following sub-phases:

3.1.1-Co-design living lab: initial plan

The living lab is based on a co-design process, and will start with a brief on the outcomes of the transition milestone and strategic plan, as well as of a resume of the system mapping. The stakeholders will be divided in groups, either working parallel on the whole plan or individually on specific sub-topics. The work is facilitated by experts, and will then will be presented and discussed in the plenary

143

session. The plenary session will then discuss the working groups' outcomes and draw a first complete initial plan. The working groups will work with the aid of maps and drawing tools.

3.1.2-Post production

The experts will process the initial plan, the minutes and related documents produced within the living lab. A series of outputs for communication purposes are prepared, targeting specific stakeholders'' groups as appropriate, including maps, graphic representations and narratives. The outputs of the post production are used to be discussed with the stakeholders in the second living lab to agree for a finalized plan.

Amendments to the system map, the transition milestones, the transition strategic plan and the target futures may be required, following the outcomes of the living lab discussion, and the expert will implement all due modifications.

3.1.3-Co-design living lab: final plan

The output prepared during the post-production sub-phase are used to inform this session of the living labs, where the overall transition spatial plan principles and objectives are reviewed to realize a final plan. During this phase more detailed definition of specific actions, timeline and required resources are going to be discussed. This sub-phase is also aimed to define a list of specific projects to be implemented. The phase is also lead by stakeholders and facilitated by experts.

3.1.4-Final transition spatial plan

This sub-phase is aimed to process the final plan and list of specific projects, and related minutes and materials, produced during the living lab; this phase is led by the experts.

The processing is consolidating the plan and translating it in a series of technical planning outputs, including maps and detailed description of actions, following planning standards, normative and regulations that can be submitted to the appropriate planning authority to fulfil a formal approval process as due by the current legislation.

The transition spatial plan is also subject to continuous monitoring and adjustments that may be required by the development of the following phases.

5.2.4.2   3.2-PROJECTS

This sub-phase is aimed to co-design specific projects, following the outcomes of the transition strategic plan and spatial plan, and to design executive plan, including g due management procedures and identification of resources as well as schedule and timing for their implementation

144

As for the previous phases this one will be led by the stakeholders with the support and facilitation of experts, which role will be to support the co-design process and translate the design decision of the stakeholders' executive plan/projects, following appropriate design standards.

3.2.1-Living lab: Project co-design

This sub-phase is organized through a living lab, or a series of living labs depending from the number of single projects to be executed. This is led by stakeholders through the facilitation of experts that will resume the results and principles derived from the previous phase and sub-phases.

The stakeholders will be able to draw the projects, divided in small groups, identifying a set of alternative design options, and after discussing it during the plenary meeting. The experts will support this process delivering specific technical information regarding the feasibility of the discussed options. The projects are aimed to have some physical output but would be considered in a systemic way including a series of supporting, non-physical actions.

3.2.2-Post production: Executive plans

The post production sub-phase is led by experts that will process the outcomes of the co-design living lab, and related material, and will proceed to draw specific executive plans and projects for execution. This phase is of high importance as it is essential as the result of stakeholders' c-design, to be rightfully executed will need to comply with a series of normative and regulations, for which the role of experts is indispensable. This sub-phase will produce a series of technical executive projects and plans and also non-technical graphics and narratives that will be used for communicating the projects.

Depending on the complexity of the projects it may be necessary to arrange follow-up living labs, to discuss with the stakeholders any issue may require their attention and decision making.

3.2.3-Identification of resources and time

This sub-phase is aimed to identify due human, technical and financial resources for executing the specific projects, identifying also a precise timeline and schedule for the implementation of the projects. This phase is conducted by the experts that will draw a resource map accompanied by a timeline, and discussed with the stakeholders.

This phase will also identify appropriate technologies to be used in the execution for the project, following the outcome of the previous sub-phase including a map of alternative technologies to be used, that can be fully managed and controlled by local population and through which it would be possible for local stakeholders and communities to co-construct the different projects.

The main outputs of phase 3 activities are:

- D3.1 a series of co-designed projects, including physical projects for the development of the area

- D3.2 a transition plan for the implementation of the projects and the development of the area in the medium and long term, including physical and intangible activities.

5.2.5 PHASE 4: EXECUTION

This phase is aimed to execute the projects co-designed in Phase 3, and start to realize all necessary actions for implementing the transition plan. All the execution is going to be realized following a co-evolution approach, where all stakeholders and local population will collaborate in realizing the projects. This will give the possibility to use directly the intangible knowledge of the local population as well as to strength the ownership of the intervention by the locals. The execution of the project can be used strategically for the continuous education of part of the local population and give them the possibility to start new labour and entrepreneurial activities, that can guarantee significant improvement in their quality of life in the medium term.

5.2.5.1 4.1-EXECUTION OF WORKS

The execution of projects and implementation of works will be done, in the extent it is possible, by the local community itself, with the support of all stakeholders; this will follow a co-construction process, aimed to facilitate and strength the appropriation of the territory by the local inhabitants. The co-construction is very crucial for the entire process as it will give ownership and responsibility for the project and intervention, being this a vital part for the long term viability of the intervention realized, that will not be treated as imposed or alien. The co-construction is going to b e possible through specific capacity building and training course that are aimed to qualify the local communities, and give them alternative options for medium and long term income generating work, also of independent/entrepreneurial nature

4.1.1-Project management

This sub-phase is aimed to define a project management plan, taking into account the resources and timeline developed in the previous sub-phase; on the base of resources needed it will draw also a plan for capacity building, and specific actions for monitoring and controlling the execution of the projects. This sub-phase is led by experts, in liaison with the stakeholders, and will also be used to maintain the due level of transparency of the process and steer their active involvement, particularly of the local community.

The project management will carefully address the issue of integration of the different projects, taking into account the timeline of works and resources needed.

4.1.2-Capacity Building and Training

The capacity building and training will principally focus in providing the necessary technical skills to local population to co-construct the final project and to implement the transition physical plan. Furthermore, depending on availability of finding and timeline, some specific capacity building related to entrepreneurial skill, and support to initiate and manage cooperative of workers, can be provided. This will facilitate the medium and long term viability and impact of the capacity building.

The local communities are going to be supported and guided through specifically design training lead by experts, although in the medium term, some individuals can be specifically trained to become themselves trainers for future capacity building courses; this resulting in further capacitation and ownership of the project.

4.1.3-Co-constructions

The co-construction is going to be realized, as much as feasible, by the same local communities, under the supervision of appropriate technical staff, and following the specifications of the executive project/plans and the project management plan.

Co-construction processes may require more time to be realized, but the positive externalities of involving directly the local communities are of high importance for the entire process.

Through the co-construction the local communities will have also the possibility to have full understanding of the works, this facilitating the future need for maintenance and upgrading of the work.

5.2.5.2   4.2-APPROPRIATE TECHNOLOGIES

An important part of the whole process design is the use of appropriate technologies, which first pre-requisite is to be manageable directly by the local communities and final users directly, without the unnecessary intervention of experts or special equipment/parts. Finally appropriate technologies are appropriate with reference to the context and its use, and manageable by the end-users.

Appropriate technologies rely also on recovery traditional and intangible knowledge particularly with reference to the best possible use and management of local resources, including land.

The recovery of traditional knowledge is a key factor in the use of appropriate technologies, which become instrumental for a systemic revision and collection of alternative traditional solutions, which can be also further upgraded, and ultimately will increase the appropriation of the territory by the local communities.

The main outcome of phase 4 activities are

- D4.1.-D4.x a number of realized projects that will include project of reform of the build environment, as well as project enhancing the overall resilience of the site against negative effects of climate change and socio-economic negative externalities

5.2.6 PHASE 5: UPSCALING AND REPLICATION

This phase is dedicated to replicate and upscale the intermediate and final results of the project. Through the lessons learned on the ground, the projects and activities realized may be replicated in other parts of the cities, or in other cities, as well as up-scaled beyond the limits of the initial project. Such activities upscaling and replication can use the experience of both local population and stakeholders, as well as the one of international partners, that will act as champions, guaranteeing in this way a multiplying effect and a continuous improvement in medium and long term at multiple scale.

5.2.6.1 5.1-UPSCALING

Process design and the related interventions can be used at different spatial scale and for plans and project with different scope, more normally the intervention on a specific city or urban environment would start with a small-medium scale pilot, to verify the appropriateness of the methodology and the measures adopted.

Thereby it is important to foresee, since inception, the possibility for upscaling, passing from a pilot of reduced size to a full project, allowing the full exploitation of a methodology that by itself has been develop to be easily adaptable to different circumstances, projects and plans.

The upscaling can be done both for the process design itself or for the specific projects developed using the process design methodology, or for both.

5.1.1-Process upscaling (or complete upscaling)

The process upscaling is meant to upscale the methodology itself, for example from using it for the development of a specific district to the use for the development of a master plan for the whole city. In the case of upscaling of the methodology there would be very likely a much higher level of complexity of the system, broader scope and larger number of stakeholders, very likely with more distant and strong positions, and a larger number of specific projects to be implemented.

In this case the upscaling will need to be done undertaking a preliminary careful assessment in order to adapt appropriately with the exponential upscaling. The most delicate issue would be to deal appropriately with a significantly increased number of stakeholder, guaranteeing an appropriate level of active participation and involvement. This key issue can be managed defining thematic work lines that, in any case, will be developed in integration and convergence, avoiding to work in silos or parallel isolated systems. This effort for integrating different thematic or spatial working line will require an additional facilitation effort that shall be taken into account in identifying the necessary resources.

150

5.1.2-Project upscaling (or partial upscaling)

The project upscaling is meant to upscale the process, for example passing from the use of the methodology an development of project from a specific neighbourhood to the a whole district. In this case the system and the scope would be relatively similar, and the number of stakeholders also similar, very likely requiring only the inclusion of more representative of the enlarged local community.

For this kind of upscaling it would be possible to simplify the process design using the already developed output to inform the process, to simplify it and to make it more efficient. Moreover the stakeholders that have already been involved can play a very important role, supporting the facilitators and enabling a stronger a more effecting trust relation building with the new stakeholders and local communities.

The definition of transition strategic and spatial plan would be more simple, and also the definition and implementation of specific projects, relaying on the already acquired ability for both co-design and co-construction.

Through a preliminary appraisal and specific re-definition of the specific process design it would be possible to use much less human, time and financial resources to achieve results.

5.2.6.2   5.2-REPLICATION

Replication is a very important feature of the process design, as its high dynamic adaptability would allow its use, including replication of specific outcomes, to other territorial context or to other areas of intervention.

The replicability of the process design itself and specific outcomes, it would be strengthened by working on the replicability potential along the entire process development, within all different phases, being able to clearly systematize clear replic-ability options.

The replication can be realized both at local and global level, and for both the role of both experts and stakeholders, particularly the local communities, is central; replication potential and implementation is going to be enhanced by the dissemination activities, which are outlined below.

5.2.1-Local replication

The local replication is aimed to replicate the process design to other physical and thematic areas within the same city/region; it can be the replication to a different part/district of the city or the thematic replication, for example the process initially used to address energy transition could be used to address transport issues.

Local stakeholders are playing a central role for local replication, and their willingness to support replication is directly related to the level of involvement and satisfaction they experience during the participation within the entire process design.

151

Local communities are playing even a more important role, among the local stakeholders, as they can be called to champion the use of the process design and the results being achieved, in direct dialogue with other local communities in the city.

The local replication can be supported by knowledge brokerage activity, centred in the participation of local stakeholders and local communities, and also through capacity building activities, as later explained in further detail.

5.2.2-Global replication

Global replication is aimed to replicate the process design at global level, in different urban system and cities, with much different characteristics, needs and capacities; this implies that the replication may happen more at strategic level, and not so much for specific solutions and projects realized during the project.

The replication in this case will mainly be related the process itself more than on process results, more then on specific ones, as this kind or replication involves a complete change of system, stakeholders and local circumstances.

Global replication is mainly relying on the action taken by experts and by international stakeholders that may have been involved in the original process design, which would be championing the dissemination activity leading to potential replication.

Also in this case the replication is fostered by the use of knowledge brokerage events and general dissemination activities, which are in large part undertaken by experts, although the involvement of local stakeholders and local communities may be used to support it.

5.2.6.3   5.3-DISSEMINATION

A key factor of success, in the long term, of any project is the level of its dissemination, both local and at international level. The dissemination for project results is vital to guarantee long term local support to the project and attract external resources and support.

The visibility of the project is of high importance for stakeholders, particularly for local administrations supporting the project and needing to show positive outcomes; as well as for local communities for the motivation factor given by showing their success story.

Dissemination action are having a key role in facilitating upscaling and replication, also both at local and global level, for the process design but also for the specific project results.

In order to guarantee a good dissemination and increase its potential impact, a clear dissemination strategy shall be designed at the inception of the process design itself. All dissemination activities will require and rely on the outputs of the different phases and sub-phases, including graphic and narrative outputs.

152

Moreover specific products for dissemination purposes need to be prepared, this including material targeting specific stakeholders groups, as policy makers, scientific community, private sector, other local communities, etc.

Different stakeholders and experts can perform specific dissemination actions, but to increase their impact such actions shall be coordinated and also, in some extent facilitated; moreover the use of knowledge brokerage can also increase the reach of dissemination action, as explained in the next chapter.

The following two dissemination activities will require specific attention and effort:

5.3.1-General public communication actions

The general public communication actions are principally requiring the translation of the process and projects outcomes and results in easily understandable products suitable for general public interest. Communication actions need to be design and lead by an expert communicator in liaison with stakeholders, particularly local communities. This kind type of dissemination activities will include video material and the extended use of social networking.

Such material would be realized in a suitable for that can be used by different mass media in order to exponentially enhance the outreach of the dissemination actions, and may include also translation to a number of different languages, to support upscaling and replication at global level.

5.3.3-Informed policy making actions

A key aspect of dissemination action is to support, both locally and globally, informed policy making, distilling the results achieved through the process and the projects outcomes, in relevant information directly relevant and useable by policy makers.

Preparing relevant policy making products, mainly executive briefs, will require the involvement of policy experts, able to proceed with the operation of distilling relevant information form the different phase of the process and the use of the process itself.

It is normally of particular importance for policy makers to understand in which way specific results and practices are useable and replicable in the frame of their interest and activities, for this reason the activities related to replication and dissemination are strongly interconnected.

Policy making actions and materials shall be developed taking carefully account that policy makers operate within specific policy boundaries, in most cases defined by specific administrative limits, and having distinctive reference to a define scale of action: local, national, international. Furthermore policy makers may operates with specific mandates related to clearly defined thematic issues, for example transport energy, etc.

The main outcome of phase 5 are:

- D5.1 upscale plan and actions of the intervention beyond the initial pilot
- D5.2 replication plan and actions in other parts of the city
- D5.3 replication plan and actions in other cities

5.2.7 PHASE X: CROSS-CUTTING PHASES

5.2.7.1 X.1-EVALUATION AND MONITORING

The continuous monitoring and evaluation of the project is a fundamental key for success. This can be realized through a light structure as an observatory for the project, that can also further strength the potential of replicability and up-scaleability of the project itself.

It is fundamental to define a clear evaluation and monitoring structure, and depending procedures, right at the inception of the process design itself, adapting it to the particular specification of the scope and area of application.

As a general principle monitoring and evaluation shall be transparent and principally meant to inform the process design itself, which is constituted as a self-learning process, which require exactly feedback loops with the evaluation and monitoring process.

The work of evaluation and monitoring is conducted, when possible under the supervision of an external organization/entity, and counting on the full participation of both experts and stakeholders; the evaluation and monitoring may include semi-structure interviews, and will be both quantitative and qualitative.

Establishing since inception a monitoring and evaluation frame will allow to define clear key performance indicators -KPI-, which allow to monitor and assess progress through specifically defined targets.

Structuring the evaluation and monitoring structure it is important to define also key risks and define appropriate counter measures and contingencies plans; this would allow to enhance the same resilience of the process itself, giving the possibility to prevent, in first instance, any risk situation and to respond to it quickly and effectively.

The evaluation process will also be using system thinking approach, taking into account the different part of the system, in this case clearly including the whole operating and management structure of the entire process design; furthermore operating through the different phases from ex-ante to ex-post evaluation and follow up.

The evaluation and monitoring will support the definition and constant update of management and working procedures, monitoring any issue may arise in the development of the process itself or in its management structure; it may as well involve a specific procedures regarding the involvement of stakeholders, particularly local communities, allowing to identify appropriate measures to incentivise and maintain an appropriate degree of satisfaction through the entire process.

The evaluation and monitoring is structured as a three steps process, as following:

X.1.1-Ex-ante evaluation

This sub-phase is aimed to establish general evaluation structure including means and procedures KPIs, risk and contingency plans.

X.1.2-Monitoring

Performing the actions established in the previous phase along the entire duration of the process design and informing the process design itself, allowing all required adjustments timely and appropriately.

X.1.3-Ex-post evaluation and follow-up

This sub-phase is aimed to perform the final ex-post evaluation and to establish a follow-up monitoring activity for assessing medium and long term impact, both direct and systemic.

5.2.7.2   X.2-FUND RAISING

Very often local administrations are unable to finance independently a full urban development project, particularly in developing and transition countries; for this reason to establish mechanism that can facilitate the attraction of match funding at national, regional and international level, is vital for the project and its viability, in the short and the long terms.

A specific strategy for fund raising, for both the entire process design and for specific projects/parts of it shall be developed, involving directly both experts and stakeholders, including local communities; the strategy shall include a map, to be kept up-to-date for the entire duration for the operations, of financial sources including specific programs and donors.

It would be particularly important to finance specific capacity building and development activities, specifically directed to the local communities, including trainings for work capacitation, entrepreneurship; this kind of financial support can be quite easily accessible through international donors or national/regional cooperation for development agencies.

5.2.7.3   X.3-TRAINING AND CAPACITY BUILDING.

Specific training and education activities, tailor made for specific users groups can be designed and implemented, targeting specifically local population, higher education students, professionals. Such activities can be realized using both face-to-face and online delivery methods.

Training and capacity building are a very effective and powerful way to achieve dissemination, beyond general public communication, particularly when targeting specific stakeholders group, both locally and globally.

Training and capacity building will need to be well structured and designed at early stages of the process and further developed during the definition of projects and implementation. The training will cover both training to transfer specifically technical skills to local population for the co-construction phase, and also training in facilitation and process design aimed to enhance replication and up-scaling possibility for the process design methodology

Training and capacity building can be coupled with the knowledge brokerage events, which structure is explained bellow.

5.3   KNOWLEDGE BROKERAGE METHODOLOGY

The knowledge brokerage is use to facilitate the knowledge co-creation and sharing between different stakeholders, including local communities, through both online and onsite activities, information sharing and interaction support. Knowledge brokerage has been developed and used in several EU financed project based on knowledge co-creation and knowledge transfer theories and practices.

Knowledge brokerages are organized in a workshop format, which use facilitated interactive session to broker knowledge between the different participants involved, on a specific topic or in relation to specific development plans. Such methodology has been used increasingly in the past years to address complex urban development and urban transition issues.

The general aim of knowledge brokerage events is dual: from one side it is delivering information to the participants regarding specific development/innovation/research projects and processes, and from the other side it is used to gather information and input from the participants to retrofit the current development of processes and projects.

This section is aimed to define the use of a knowledge brokerage setting to introduce the concept of process design for resilience transition and to start to adapt it, in a short simulated form, to current development process and project on a defined urban environment.

5.3.1 KNOWLEDGE BROKERAGE: INTRODUCING PROCESS DESIGN METHODOLOGY

A knowledge brokerage (KB) methodology has been developed to introduce to stakeholders the structure and use of the process design methodology for urban transition. The methodology consist in two days workshop to be organized with the participation of different stakeholders. The KB is used to simulate the entire process design methodology, in a very simplified and reduced format, to give an idea of the different parts and key aspects of the use of the methodology to key stakeholders.

The KB workshop is used to gather preliminary information from the stakeholders; such information can be later used for constructing the stakeholders' map, the system map and the knowledge map, on a specific project or development area in an urban system.

On the base of past experience, the use of knowledge brokerage session are fundamental in order to give a practical demonstration, though a simplified simulation, of the process design methodology; normally such demonstrations are requested by and organized in liaison with local authorities, and most likely scoped to address a current urban development process already under development.

5.3.1.1 GENERAL STRUCTURE

The KB workshop is structured in four sessions within two days, plus an introduction about the methodology and time line the first day and a final session to draw the conclusion of the workshop and way forward at the end of the second day.

The KB itself is preceded by a preparation phase, and followed by a post-production phase, both are led by the expert organizing and facilitating the KB, these may require further engagement and further support by the stakeholders' involved.

The KB will require the participation of at least two experts, which are explaining the methodology and facilitate the KB events, the number of the expert may be increase depending from the number of participants, a good ration is one expert/facilitator each 7-10 participants.

This is general framework for organizing KB with the purpose to introduce/simulate how process design for urban resilience works, thereby it will need to be adapted to the specific circumstances and agreements made with the local administration co-organizing it, the specific urban development process or set of projects, and the specific stakeholders' interest.

The organization of KB require minimal operational costs for café-breaks and the material used during the different sessions. Normally the venue can be provided by the local co-organizers free of charge. Depending on the location travel and subsistence cost for the experts/facilitators may be required. An agreement should be found to cover the personnel cost of the facilitators for the organization and the postproduction phase, as the latest can results in specific billable outputs as a summary report.

This sub-phase is aimed to define all strategic and logistic details for the KB organization, and it is done by expert in liaison with the local administration co-organizing it; this including the following items:

- **-definition of specific objectives for the KB**

  The KB may have other key objective, a part the introduction to the process design for urban resilience, which may include information gathering from stakeholders, enhance collaboration on current ongoing projects, etc.

- **-definition of a project or urban development process of reference**

  The KB can be better structured if it would make direct reference to a current or foresee specific urban development process or project, thereby the identification of such project/process is of central importance.

- **-identification of participants**

  The central part the organization of the KB is to identify the best suitable participants. These participants should be actors which are effecting and/or affected by a specific project and plan, and that will take final decisions about the adoption of the process design methodology. This sub-phase is conducted in liaison with the local organizers and will list concrete individuals to be invited.

  This sub-phase may include a preliminary sub-division in groups of the participants for the KB.

- **-invitation of participants**

  Invitations to participants should be made directly by the local organizers, though direct contact with each individual; this may include the preparation of preliminary information regarding the KB and a draft schedule of the two days of work.

- **-design of questionnaires**

  A questionnaire is normally used to gather information from the participants regarding the specific urban development process/project target of the KB, a preliminary stakeholder mapping, knowledge mapping and system mapping, with reference to the process design methodology.

  A sample of the questionnaire is presented within the case studies on the knowledge brokerage for Altos de la estancia, which is presented in the last chapter.

- **Preparation of material**

  The material used for the Kb is quite basic, it includes flipcharts, A1 papers sheets, markers and drawing tools of different colours, post-its. For presentation purposed it is required a projector and a laptop; printed questionnaires and writing tools.

  For the post production process a camera to take pictures of the produced outputs and to record the different session may be useful.

- **Preparation of location**

  The location should include seats for all participants and one large table for each group.

- **Opening Session**

    This sub-phase is aimed to give the participant a general introduction about the KB, the process design methodology and the KB dynamics; it is led by the experts in collaboration with the local organizers. It is organized in the form of short presentations to the participants, given by the facilitators and the local organizers.

    The sub-phase includes the following parts:

    – Objectives of the KB (facilitator)

    – Introduction on the specific case of application (local organizer)

    – Introduction of the methodology (facilitator)

    – Introduction of KB dynamic and schedule for both days (facilitator)

- **Session one: stakeholders mapping and knowledge map**

    This sub-phase is aimed to gather information from the participants in relation to the stakeholder's map and the knowledge map; this is done by the participant with the help of the questionnaire.

    The participants will fill the questionnaire with the support, when required, of the facilitators; the facilitators will first explain the questionnaire structure purpose and give a brief explanation about the different sections.

    The questionnaires are treated confidentially and the data will be anonymized during the post-production phase, and used only as aggregate information.

    This phase may include the reconstruction of the key steps and genesis of the urban development process and include the outlying of key factors of success and failure of the process/project and listing of key future actions to be implemented.

    The results of session one will be systematize during the post-production.

- **Session two: system map**

    This sub-phase is aimed to analyse the system, defining its elements, the interrelation and feedback loops between the different elements. The participants are divided in small groups, from 5 to 10 participants, depending on the whole number of participants present for the KB. The group work is preceded by a short introduction ion the bases of system dynamics

    Each group will draw a mental/system map of the process at the core of the KB, and design one speak person to present it at the plenary end session, which will include also an open discussion about the results of the working groups.

    The results of session one will be systematize during the post-production.

- **Closing session**

  This sub-phase is aimed just to summarize and wrap-up the day, outlying the main achievements and to have feedback from the participants about the whole group and working dynamics, in order to be able to make all necessary adjustments for the following day.

  The session is closed and reconvened for the next day.

- **Opening Session**

  This sub-phase is aimed to give the participant an introduction to the day of work and will include preliminary short presentations about global dynamics of urban change and best practices for urban resilience, as much as possible related to the current context and process/projects under development. This sub-phase it is also led by the experts in collaboration with the local organizers; it is organized in the form of short presentations to the participants, given by the facilitators and the local organizers.

  The sub-phase includes the following parts:

  – Objectives for the day (facilitator)
  – Global urban dynamics (facilitator)
  – Best practices (facilitator)
  – Introduction of KB dynamic and schedule for the day (facilitator)

- **Session Three: forecasting and visioning**

  This sub-session is aimed to define the best desirable and realistic future, using the combined forecasting and visioning methodology. The participants are divided in small groups and are asked to perform first a forecasting simulation and after a visioning simulation, through clearly defined timing for both; for this session the role of facilitators for keeping structured and timed the session is particularly important.

  In the first part dedicated to forecasting, the group will outline key trends and drivers relevant to the specific urban development process/project, building on the system map realized in day one and the presentation made by expert on global urban dynamics.

  The result of the forecasting part would be a projection of key trends and drivers at local level, representing the key dynamics of the system, through different timeframes from 5, 10, 20 and 50 years, defining what would be the most likely future change.

  The forecasting part is followed by the visioning one, which is aimed to identify the most desirable futures. The groups, with the help of the facilitators will try to define disruptive innovative futures, not bounded by any specific reality check or limit, but through free imagination. Such envisioned futures would help to define not only best desirable futures but also to understand which are the key principles and characteristic of such futures. For this part in particular the groups are invited to use as much as possible both graphic and narrative descriptions.

At the end of both part, a speak person will be in charge to make a very short presentation of the outcomes to the plenary, that will be followed by a short discussion.

- **Session Four: backcasting**

  The fourth and final session is aimed to define a best desirable and realistic future, which is used as a target for the backcasting exercise, defining milestones from the target future to the present and briefly discuss transition options.

  This first part of this session will define best realistic and desirable futures, drawing on the results of both the visioning and the forecasting process, a negotiation process between the participants divided in small groups, is mediated by the facilitator that will help to keep the discussion focused. Once the best realistic and desirable future is identified, the participants will start describing the key features and characteristic of this future, identifying it within a defined time horizon.

  Once the target future is defined and described the second part on backcasting will start; whit the facilitators giving a brief re-introduction to backcasting principles and explaining its dynamic and the required procedure to define it.

  The participants will then identify milestones from the future to the present, placing this milestone within the timeline and describing the key characteristic and features of each milestones; meanwhile doing the backcasting, the participant may have to amend the position, description and nature of the target future itself.

  Once the transition milestones and alternative pathways have been identified, the groups will identify a spokesperson to make a short presentation on the outcomes of this part during the plenary.

- **Closing session**

  The closing session is aimed to present and discuss the final results of the backcasting and to discuss the whole outcomes of the two days session.

  During the closing session the facilitators will explain about the post-production phase and outline all follow-up actions.

The aim of the post-production phase is to analyse, elaborate and to prepare a synthesis report of the outcomes of the knowledge brokerage; structuring it using the same four partition system used in the organization of the workshop.

The post-production will be execute by the facilitators, in liaison with the local organizers, and potentially involving the stakeholders whom took part in the KB sessions to clarify some specific aspects or to undertake some semi-structured interview to deepen some key aspects of the KB outcomes.

The post-production can be finalized preparing a report, including an executive brief, targeting a specific audience and/or with a specific scope, and a recollection of all material prepared before and during the knowledge brokerage.

The post-production is including the following sections:

- **Introduction to the knowledge brokerage**

This section is including a brief description of the knowledge brokerage in general, and also al details regarding the specific KB session organized in this occasion. Information will include a complete list of participants, schedule for the two day, and clear definition of objectives and scope of the session. Depending on the context and focus of the KB session, some background information regarding the specific urban development process/project at the core of the KB may be included.

- **Introduction to process design for urban resilience transition**

This section is aimed to give a brief outline and explanation of the process design for urban resilience transition, explaining the key phases of the methodology and outlying its potential use.

This section will focus on giving insight about the innovative potential of this approach for delivering high impact results with high potential for upscaling and replication, particularly due to the involvement of stakeholders and local community through a co-evolution process generating a number of systemic co-beenfits.

- **One: stakeholders mapping and knowledge map**

This section is aimed to prepare a preliminary stakeholders map and a knowledge map based on the outcomes of part one of the KB; it is elaborate on the results of the questionnaires, which are typed and analysed, processing and aggregating information, respecting the confidentiality close.

- **Two: system map**

This section is aimed to defining the elements and the boundaries of the systems, the description of its elements and the feedback loops between the different elements; it is elaborated on the results of the working groups during day one.

- **Three; forecasting and visioning**

This section is aimed to report on the results of the working groups' session dedicated to forecasting and backcasting. The material produced by the different working groups, and the record of the short presentation will be processed; particularly importance is given to the reconstitutions of key principles and features of the best desirable futures. For the part on forecasting, this may be enriched by some extra background data, form the initial expert's presentation on global trends and driver.

- **Four: backcasting**

This section is aimed to report on the results of the working groups' session dedicated to backcasting. The material produced by the different working groups, including the record of the short presentation and of the plenary discussion is processed. Particular attention is given to describe the transition milestones and pathways.

- **Conclusions**

This session is aimed to draw some preliminary conclusions on the outcome of the whole KB session, and to outline possible ways for future development/collaboration.

- **Executive summary**

An executive summary is prepared matching the need of a specific target audience and in line with the general scope of the KB and the specific urban development process/project at the core of the KB.

- **Annexes**

This section is including all graphic and photographic product of the knowledge brokerage, and the copy of the questionnaires, anonymised.

6 CASE STUDIES

6.1 MUSICON PLANNING WITHOUT PLAN: PROCESS DESIGN AND PARTICIPATIVE URBAN DEVELOPMENT AT ROSKILDE

This chapter presents and analyses the urban development of the Musicon area in Roskilde (Denmark). Musicon represents a very interesting experiment of planning without the definition of a master plan, using instead a highly participative process design based on the active involvement of key stakeholders and public, and to exploit the creative and innovative potential of the actors involved.

Roskilde is an historical town and, with its 80.000 inhabitants, it is one of the major centres in Zealand, located some 30 km west of Copenhagen; the town is particularly known for hosting one of the largest European music festival that attracts over 100.000 spectators every year, and for hosting one of the major Danish university

Musicon covers an area of 250.000 sq meters located between Roskilde medieval town centre and the area hosting the Roskilde Festival; in 2003 the Municipality of Roskilde acquired the area, formerly used for the production of concrete, deciding to create here a vibrant music district, with around 2.000 workplaces and 500 dwellings, along a development phase of 15-20 years, focusing on culture, education and cultural businesses.

The Municipality decided to avoid the use of a master plan, which is considered to be limited to the definition of the final state for the area, particularly for what concerns its physical dimension, and would represent a major constrain for true participative and innovative processes;

Thereby, in order to keep the development process open and participative, and to avoid immediate and conspicuous economic investments, the municipality opted for planning as less as possible, focusing on activities, small projects and temporary events that should trigger a major colonization process.

For this reason Musicon process design and colonization is based on few key principles, the provision of a minimal physical infrastructure, and the major organizational support given to any actor intentioned to organize temporary events or to settle permanent activities in the area, as long as in accordance with the general concept and principles.

The aim of this article is to use the Musicon case study to better understand the dual relation between a traditional master plan and process design, analysing this experience under a multiple perspective:

- Innovation and creative processes for urban development

- Sustainable urban development, in theory and within similar Scandinavian practices

- Public participation and stakeholders involvement

Furthermore through the analyses are highlighted possible weaknesses within the process design and are suggest possible ways to implement a frame for evaluation and monitoring of the development process.

6.1.1 INTRODUCTION AND METHODOLOGY

A general overview on the social and economic situation of Roskilde Municipality, including present policies, visions and strategies has been conducted because considered of high importance in better understanding the background of the case study analysed and the implicit reason of its development in this very place

The aim is not to explain why the master plans fails but better to define the reasons and the need to a new approach in planning based on the process design, an *in itinere* constant development not focusing solely in a crystallize, somehow utopic, final objective, or better said, object that take the semblance of an urban form, that cannot fully take into account and foresee the constant change and development of the social space and interrelations.

The case study of the Musicon area in Roskilde has been analysed through official documents official present on the web site of Roskilde Municipality, semi-structured interviews with Musicon Secretariat, direct participation to the event a visit of the area. This analysis has been integrated with statistic data from the Ministry of Interior and Social Affairs and the national official statistic data sets. The frame for the analysis and the conclusion are based on extensive research within scientific journals and publications.

6.1.2 FRAMING THE CONTEST

6.1.2.1 ROSKILDE HISTORY

The foundation of the city started in 980 A.D. by the king Herald 1st whom constructed here a church and a royal estate, in XI century the town become a bishopric leading the town to have an increasing growth and importance until XV century. Between the XII and XIII century Roskilde Cathedral has been erected and later designated to be the monarchy burial site, the Cathedral is UNESCO World Heritage site since 1995.

In the 70' Roskilde start to take an important role within the country in relation to culture and education, through the institution of Roskilde University and Roskilde Music festival, as later explained.

6.1.2.2 ROSKILDE AT GLANCE

Roskilde municipality is located in region Zealand, 30 km West of Copenhagen, it covers 212 km2 with a population over 80.000 inhabitants (Ministry of Interior and Ministry of Social Affairs, 2009).

Within the municipality the 30,1%, of inhabitants, between 25 and 64 years, are having an of higher education, 5,6% over the national average, and just 17,7 are without training, 5,6 below the national average (Ministry of Interior and Ministry of Social Affairs, 2007).

This is related to the high expenditure for schools, cultural activities, public libraries, and socio-cultural projects, substantially higher than the national average, reaching 1500 EUR/inh. Circa (Ministry of Interior and Ministry of Social Affairs, 2008). The municipality has developed along the years an important work on public housing that reached 21,7% of the total stock, 2,3% higher than the national average.

The share of medium high employ is very high and over the national average, accounting 3,36% top managers, 16,13 upper level employees and 21,2 medium level employees on the total labour force (Statistics Denmark, 2010b). The labour conditions influence the high average income per inhabitant within the municipality that is 44.500 EUR circa, substantially higher than the national average of 37.000 EUR circa. (Statistics Denmark, 2010a).

These data shows a municipality with a good level of education and income, which invest substantially in schools, education cultural and social activity. This first picture is more substantiated by the analysis of the Municipality vision and policy.
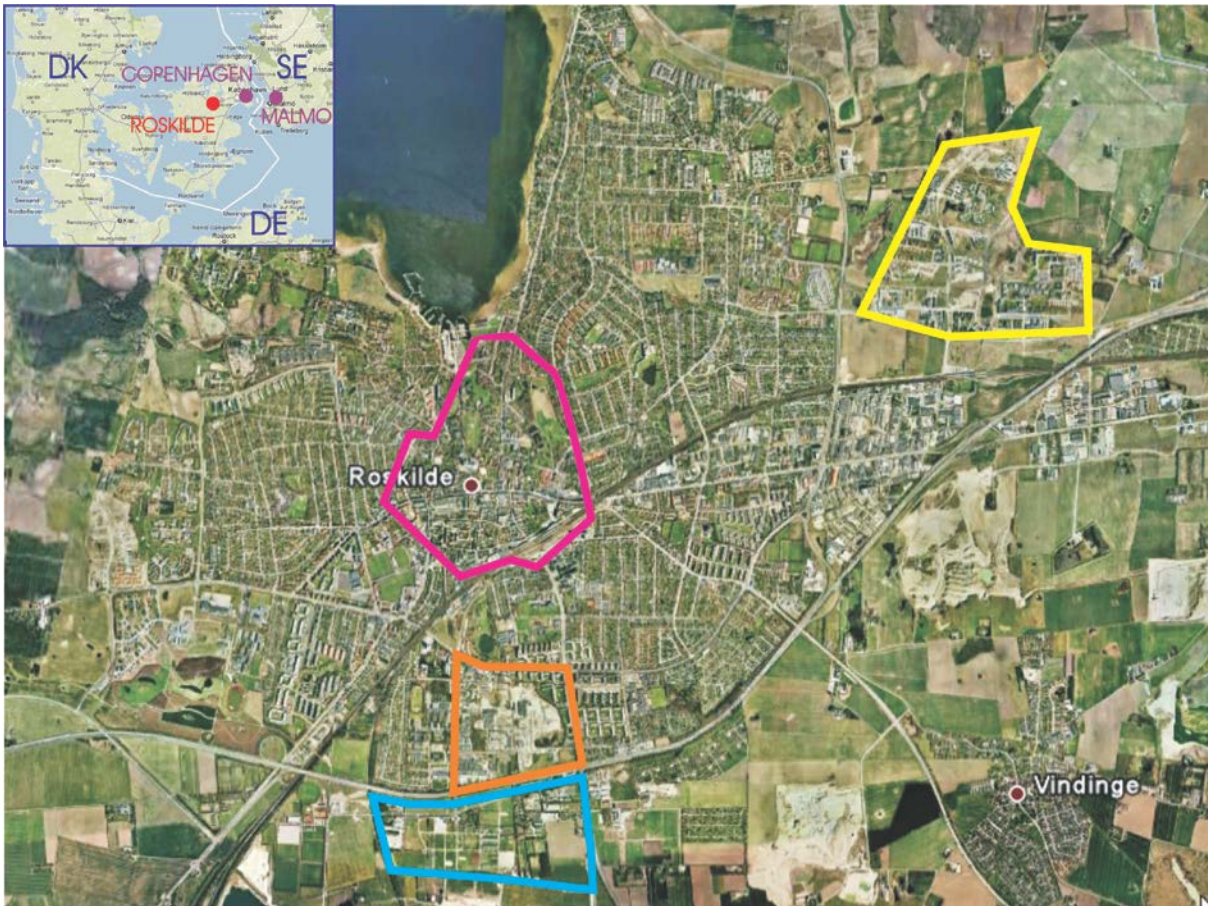
TOWN CENTER   **MUSICON**   **ROSKILDE FESTIVAL**   **UNIVERSITY CAMPUS**

Figure 6-1: Roskilde (Source: own graphic on google map)

6.1.2.3   ROSKILDE UNIVERSITY

Roskilde University is a public university founded in 1972, located in a campus in the outskirt of the town of Roskilde; it hosts 8000 students and 700 lecturers and researchers. The university is dedicated to education and research in the field of humanities, social sciences and natural science.

The university is 6th within the national ranking (Consejo Superior de Investigaciones Científicas, 2009) Roskilde university foundation is linked to the late 1960s student uprisings, that were questioning the traditional university structure and calling for a more democratic and active involvement of students within the academia.

From its foundation Roskilde university dedicated itself to more liberal teaching methods, particularly the teaching is problem solving oriented with a strong interdisciplinary approach, which lead to favour group work, to strength cooperation and exchange in between students, and with a more direct contact and exchange between students and teachers.

173

The Roskilde Festival, created in 1971, is one of the major annual rock music festival in Europe; the festival is managed by the Roskilde foundation, a non-profit organization, oriented to the support to music, culture and humanism. The festival is organized in June every year and gathers over 100.000 participants, along the four days of its duration. It is important to note that the profit of the festival are donated for humanitarian and cultural purposes within national and international aid programs. In 2009 the festival profit, including the collection and donation of refundable plastic bottles and aluminium cans, by itself over 130.000 EUR, was donated to relief the victims of the effects climate change in India and Bangladesh.

Since 1994 the Festival is subject of an environmental survey and defined an environmental policy aimed to reduce the use of resources, to the use of environmentally friendly products, to maximize the recycling, to enhance security and health condition of audience and volunteers.

In more recent years the Roskilde Festival concentrate its efforts toward climate change and reduction of CO2, including a major information and involvement campaign, under the name of Green Footstep, the efforts and the achievements have been very relevant.

The entire audience has been asked to take 10 green foot-steps before the festival, in order to compensate in advance the festival's CO2 emissions, the audience has been advised and put in the condition to use more public transport, the internal transport system start to be upgraded through the use of electric vehicle, the preparation of vegetarian meals has increased, as well the use of local organic and fair trade products, the electricity consumption, from windmills production, has been reduce through the use of LED screens and energy saving bulbs, a stronger organization for recycling has been put in place, including the re-use of sleeping bags. (Roskilde Festival, 2010)

6.1.3 MUNICIPALITY VISIONS AND STRATEGIES

The Municipality visions and strategy for the future development are very simple and, at the same time, very well oriented and structured toward sustainable urban development and public participation, specifically the visions can be resumed in four points (Roskilde Kommune, 2010a)

- **Citizen-centric:**

Putting citizen at the centre of all the activity of the Municipality; delivering high quality and accessible services to the citizens, also through IT infrastructure and dedicated services; taking care of environment and resources for present and future generations, through a LA21 framework; supporting and fostering cultural and associative activities, particularly in relation to music.

- **Business and Education:**

Focusing on a close interaction between education, research and industry, particularly in relation to knowledge based economy and high tech industry, also with the support to public-private partnership, particularly involving Roskilde University, Risø National Laboratory, the Centre for Advanced Technology and the National Environmental Research Institute.

- **Sustainable Communities:**

Assuring and developing local democracy, also exploring new participative forms, and active support to local citizen groups. Furthermore continuing the work within the LA21 framework, as further explained below.

- **Region and Infrastructures:**

Enhancing and expanding both public transport and road network with the aim of accenting the natural potential of Roskilde municipality as an attractor for inhabitants, city users and business.

The development strategy is focusing on developing the society and the economy, which will form the basis for the welfare of future generations; "a society where education, knowledge and experiences will become increasingly vital components" (Roskilde Kommune, 2010b, Roskilde Kommune, 2010a)

In 2007 the Municipality started a work aimed to define the content of a threefold development strategy, involving open to public participation and the direct involvement of key stakeholders; the work developed aimed to define the strategy in a more concrete way and to prioritize the action, in spring 2010 the Municipal Council is discussing and take decision of the overall strategy on the base of the work developed under the three main strategies:

- **Musical Roskilde:**

This is the main strategy for the development of the municipality, and aims to strength the artistic, cultural and historical capital of the town, putting it at the centre of all development efforts.

- **Education and Research:**

This strategy aims to strength the already existing education and research vocation of the city, enhancing the relation between education, research, citizen and enterprises.

- **Health and Sport:**

This strategy aims to improve an healthy and active life through sport activities and the definition of specific dedicated areas. (Roskilde Kommune, 2009)

Each strategies includes a limited number of selected project on which the effort should be concentrated and to which should be granted the highest priority, in order to support their effective and strong development, further projects are also included within the general strategy in form of "bubbles" meaning that their conceptual and operational definition, although already noted and taken into account, should be further developed before being inserted within the three main strategy lines

6.1.3.1   MUSICAL ROSKILDE

The Municipality main strategy for the future development points to strength its cultural, historic and artistic capital; this strategy is particularly centred on the Music, both in form of cultural/artistic activity as well as business opportunity, particularly through the development of an innovative district, which systemic attractive power is fostered by Roskilde Festival and its *filiere*, or supply chain.

This strategy consists three specific sub strategies, the first regards the entire music supply chain and directly related activities, the second defines a physical development area called Musicon that within the related material and immaterial infrastructures is the core of the strategy development ; the third strategy related to some important accessory activities focusing on strengthening the historical and cultural capital of the city that includes the Roskilde Cathedral, Roskilde Museum and the Museum of Contemporary Art. This sub-strategy includes a plan for the refurbishment of the historical building of the centre and the redesign of the central square.

6.1.3.2   EDUCATION AND RESEARCH STRATEGY

The Municipality aims to take a leading role in facilitating virtuous dynamics within the interrelation between the different stakeholders, present on the territory, involved with education, research and development; thereby the Municipality points to strength the role and the potential given by the presence of national and international

176

education and research institute (Roskilde University, Risø National Laboratory, the Centre for Advanced Technology and the National Environmental Research Institute, University College Zealand) particularly creating an open and dynamic milieu that can attract and provide both material and immaterial infrastructure to students and researchers. The Municipality points also to provide suitable housing, an active cultural environment and infrastructures, business opportunity and support for young people; engaging them in a open and innovative decision and policy making process, participating actively, with other stakeholders, to the development of the municipality.

This strategy focuses on recruitment and retention of students and young researcher through specific actions like: guarantee of housing; a self organized culture house; the creation of a science/business park and the development of the Musicon district to attract knowledge and creativity based economic activities; organization of events as the Spirit of Knowledge Festival and the Research Day; supporting the proactive participation and involvement of all young people within the municipality's decisions making process.

6.1.3.3   HEALTH AND SPORT

The Municipality aims to take a leading role in facilitating the sport activities, particularly in relation to an healthy life style, thorough strengthening the already active role of sport associations, promoting and supporting sport events, delivering appropriate information on healthy life style, enhancing the present sport facilities, including a network of path and bike lanes, creating a dedicated area and centre for sport, culture and leisure, supporting citizen driven projects within the sport for all approach.

This very inclusive approach for the diffusion and the empowerment of sport activities and infrastructure is coupled with a strategy more oriented toward the professional sport players and talent development. For this reason, apart the due physical infrastructure, the Municipality has signed a cooperation agreement with professional sport clubs and developed a project of collaboration with the education institutes, in order to provide tailor made education, combined to professional training, to future sport talents. (Roskilde Kommune, 2009)

6.1.4 EXPERIMENT MUSICON

Musicon area development is considered a laboratory to test both innovative ideas in practice and a fully participative method of process design requiring the proactive contribution of public and key stake holders, through the steering and facilitation function played by the Musicon Secretariat.

6.1.4.1 *THE AREA*

The Musicon area, acquired by the Municipality in 2003, covers a total area of 500.000 m2, with a core empty area of 250.000 m2, in great part formerly used for industrial activities for the production of cement and tiles, where old industrial building are going to be refurbished and new buildings will be erected within the next 10-15 years.

The area, located south of Roskilde's city centre, on the north side with the Roskilde's festival area (as shown in Figure 6-3 and 6-4), is surrounded by major road on its four sides, which isolate it physically and although granting a good potential for future accessibility at regional level.

Figure 6-2: Musicon Area (Source: own graphic via google map)

Another key issue of the area is related to its previous industrial use, determining a certain contamination of the superficial land due to waste oil and chemicals, and the presence of two deep gravel extraction holes located in the south part of the core area.

On the entire perimeter of the area are already present a series of buildings, residential on the nor-east corner and along the east side; business and education on the entire west part.
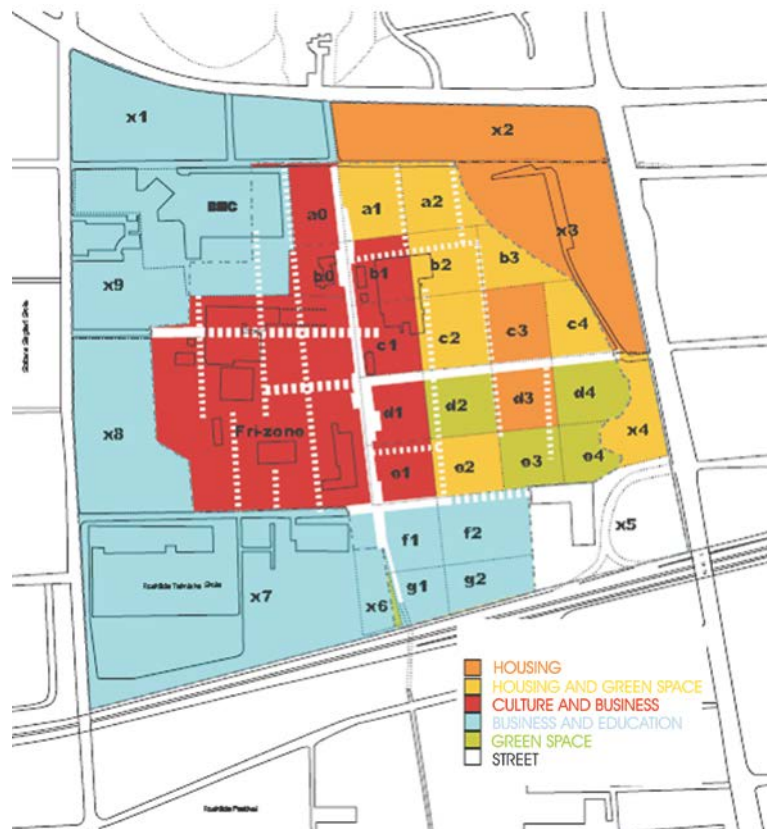
Figure 6-3: Musicon Zoning (Source: Roskilde Kommune, 2010a)

6.1.4.2 THE VISION

"Roskilde Municipality will create a new town with a vibrant urban environment where the *musical* is the overarching theme" (Roskilde Kommune, 2007). Musicon is intended to host a mix of residential, commercial, shops, cultural and leisure activities that can maintain the district alive along the entire day and night.

The district is meant to be the centre pole of a cultural cluster, as the "Rock Museum, Schools, incubators, innovative companies, artist workshops and residences for creative people" (Roskilde Kommune, 2007) able to become an attraction centre at regional level.

179

The vision explicitly state that the development plan of the area is inspired by the experience economy (Pine and Gilmore, 1999) (Roskilde Kommune, 2010b, Roskilde Kommune, 2010a), enhancing the added value of the activities on the area through the "experience" added value, on the base of music related economic and cultural activities, which impact is targeted both at local and global level.

The vision also explicitly state that the development of the area should be structured through new forms of planning, based on the process design instead of the classical master plan, meaning that all the development process will be structured with few key rules and on the base of the direct proposals of key stakeholders and general public, under the facilitating action and support given by the Musicon Secretariat.

In this way the development of the area should be slow, being able to match the different interest and requirements of its own users and inhabitants, along its own development; allowing at the same time an immediate use of the area, without waiting for the accomplishment of a master plan final state, particularly through the organization of temporary activity, proposed by the any actor, through the free use of the space and of the secured former industrial buildings.

For this reason the most representative sentences representing this planning approach is : " We will have life before the city. Citizens & user creates the district before the city is" (Roskilde Kommune, 2010a)

The experimental planning form taken by the Musicon development represents the most interesting aspect, because is further developing the logic used on usual master plans or even strategic plans, coupling the definition of a strong concept with the idea that the citizen themselves should be empowered to take possession and commitment for the development of the area with full support from the local administration.

6.1.4.3   THE TIMELINE

The time line defines, after the review of the original one presented in 2007 (as shown in Figure 6-2), just two main phases the first one from 2008-2010 centred to secure the area and make it increasingly accessible and useable, including the renovation of the old industrial building and structures, occupying 15.000 m2, and the construction of the building that will host temporarily the Musicon Secretariat. This phase is dedicated to the direct organization and to facilitate the organization of spontaneous events under the proposal of interested actors and users, starting also the selling of lots for residence and commercial activities.

The second phase 2010-2025, already prolonged respect the first published time line stopping at 2018 (ROSKILDE KOMMUNE, 2007), is aimed to consolidate activities within the area through the installation of key building as the Danish Rock Museum (opening in 2012) a town all centre, the high school, the technical school (construction beginning in 2010) and the secretariat of Roskilde Festival. Beside this will continue the selling of lots for both residence and commercial activities, particularly oriented toward office spaces for small enterprises and professionals, meanwhile the temporary activity will be continuing within increasingly

stabilized frames always through a direct and active participation of key stakeholders and general public, allowing also the continuous refurbishment of the area and the key industrial buildings.
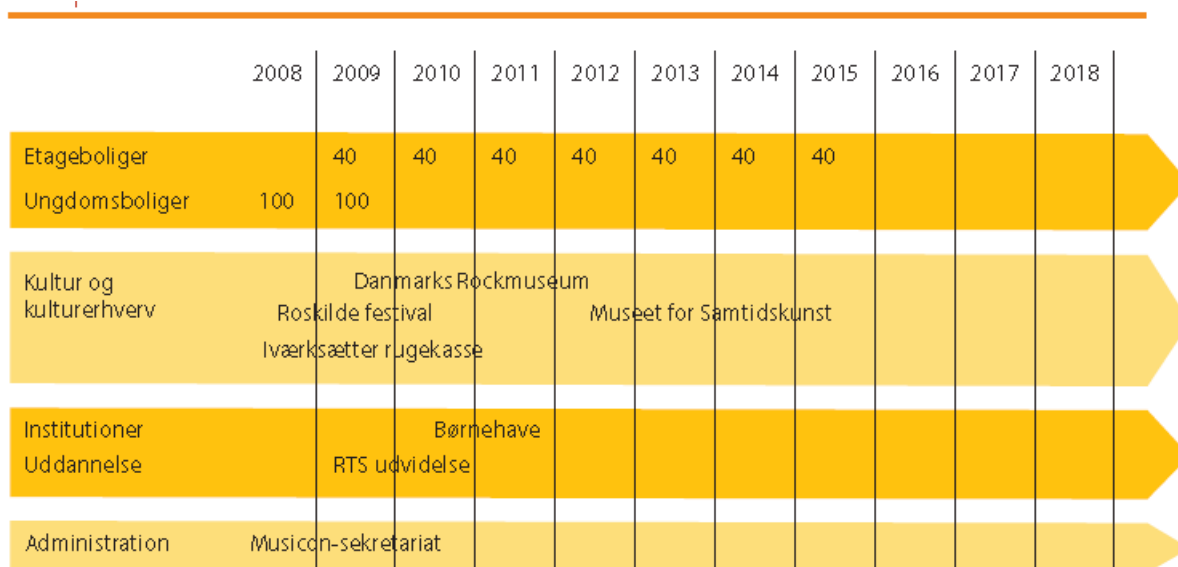
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Etageboliger		40	40	40	40	40	40	40			
Ungdomsboliger	100	100									
Kultur og kulturerhverv		Roskilde festival / Danmarks Rockmuseum / Iværksætter rugekasse				Museet for Samtidskunst					
Institutioner				Børnehave							
Uddannelse		RTS udvidelse									
Administration		Musicon-sekretariat									

Figure 6-4: Musicon Development Timeline (Source: Roskilde Kommune, 2010a)

6.1.4.4   PROCESS DESIGN

1) The idea is to create an urban environment which consists of **many players**. Urban environment should be given **time to evolve** and should **not** be subjected to a **rigorous planning**. There must be scheduled as little as possible and as much as necessary.

2) The **players must build up the district from a vision**, an overall framework and ground rules. Roskilde Municipality hopes that the players themselves develop projects and activities and self-control and maintain it once they put in. It gives ownership to the district who are the **users and citizens** and it will undoubtedly create a **dynamism and diversity** that the municipality itself could create in a traditional urban development process.

3) **”Temporary "is crucial for development**. This means that the **experimental projects** that come in Musicon are not necessarily here to stay. Temporary unit creates momentum and allows you to test options. The players have the opportunity to meet each other and strengthen their **network.** Income from rental of halls and land permits to refurbish the facilities at the site

The key gamerules include the definition of the facilitating function performed by the Musicon Comitee through the Musicon Secretariat; moreover some key rules are defined including:

- The use of no developers, but self-construction instead
- Reduce traffic, specifically motor one

- Buildings/green spaces/open spaces mix
- Temporary events for continous ccupation of space in time

6.1.5   CONCLUSION: WHY PLANNING WITHOUT PLAN

The case of Roskilde does not represent a radical innovation, strictu sensu, but a further incremental innovation on the line of strategic urban planning, the real innovation happens when a specific physical area take the further step and its developed not defining an a priori final design and configuration of the area but it is developed along a process design open to define its "final" state through the natural movement of the process, process that is facilitate by a light administrative role of the Secretariat acting as facilitator of the process, and not as final decision maker, in this case the process is open both in terms of receiving inputs and in terms to define and redefine outputs, in a flexible and fluent way instead of a pre-defined and crystallized final output.

It is important to point out that the strategic plan of Roskilde present some structural differences within a classic strategic planning process, in fact although mentioning strength points for each strategy does not analyse specially the weaknesses, and in a more extended way, referring to a SWOT analysis, just implicitly is able to recognize opportunities but does not mention threats.

Another consideration can be done regarding the strict linkage between strategic planning and urban marketing, as in the case of Barcelona the strategic planning process has been since the end of the 80 coupled with a strong urban marketing strategy, this is a quite problematic issue embedding both strong opportunities (attracting resources and persons) and strong threats, as any marketing strategy there is often a gap between the constructed image advertised and the reality, and a big gap can potentially enhance social tension and reduce effective participation, through the reduction of credibility of the same administration at the eyes of public opinion, also the effect of the marketing strategy sometimes can be overwhelmed, implicitly marketing focus on enhancing the positive aspects of the marketing object, and this "optimistic" perception can implicitly provoke a detachment from the reality and a serious consideration of the weaknesses and detract effort in solving the most critical issues, that is preferred to take out form a more clean and glossy picture.

The choice of the process design is due also by the fact that the strategy focus principally on culture, art/music and knowledge, involving *in primis* young generations, this define the need of more open methodology of the plan try to give support to an innovative process that would be fostered better through more flexible forms of planning, that needs ample degrees of freedom, this including also the definition of a learning by during process.

An evaluation of such a process present some clear difficulties, because it is not defined a final state with whom benchmark the process *iter*, or a clearly defined time scheduling

In this case the process design the strategy and the final goal are merged, the goal is a very ambitious goal to develop the city on what is called knowledge economy that aim to couple economic development with social welfare, and environmental protection particularly through the LA21 over strategy

6.2 ALTOS DE LA ESTANCIA: KNOWLEDGE BROKERAGE TO INFORM THE MASTER PLAN FOR THE RISK PARK

The presented case study is about two knowledge brokerage sessions realized in Bogota 16th and 17th December 2014, with the aim to make a demonstration of the process design system prototype in operational environment at TRL7.

6.2.1 INTRODUCTION

The demonstration occurred in the frame of the general collaboration contract between the UNESCO Chair of Sustainability and the District Agency for Risk Management and Climate Change IDIGER of the city of Bogota for the "development of social and environmental actions to facilitate the recovery and re-appropriation of the Special Risk Protection Park of Altos de la Estancia"; which for this specific sub-set of actions aimed to inform the elaboration of a master plan for integrated risk management and sustainable development of the district of Altos de la Estancia, in Ciudad Bolivar in Bogota.

As previously explained the knowledge brokerage session has been developed to introduce to stakeholders the structure and use of the process design methodology for urban transition. The methodology consists of two days' workshop organized with the participation of different stakeholders. The KB is used to simulate the entire process design methodology, in a very simplified and reduced format, to give an idea of the different parts and key aspects of the use of the methodology to key stakeholders.

Moreover the knowledge brokerage was used to gather preliminary information from the stakeholders to inform the process of definition of Altos de la Estancia Master Plan; this including:

- stakeholders' map,
- the system map and the
- knowledge map,
- forecasting trend and drivers,
- visions for best desirable futures,
- define target futures and backcasted milestones.

The demonstration of the process design methodology in its concise format delivered through the knowledge brokerage session, was the meta-objective, meanwhile the main objective was related to clear contractual specification.

The fact that this demonstration happened in a real life condition it gave particularly valuable insight for the further development of the whole process design methodology and the knowledge brokerage session, although it was, as to be expected, by real life pre-given conditions and constrains, specifically related to the scope and aim instrumental to the delivering of contractual obligations and the specification and requirements for informing the master plan.

The focus of this case study will be the demonstration of the KB methodology as introduction of the process design methodology, thereby the information on the whole programme and projects for altos de la estancia will be limited to some background information.

Moreover it is important to clarify that due to the specific pre-defined frame conditions of the collaboration contract the knowledge brokerage was limited to the simulation of the following phases:

- Phase 1: Analysis (System map, knowledge map and system map)
- Phase 2: Future Scenarios (visioning, forecasting and backcasting)

Thereby the subsequent phases of planning, implementation and up-scale/replication have been excluded.

6.2.2   FRAMING THE CONTEXT

Colombia hosted UNHABITAT World Urban Forum 7 in Medellin in 2014, in recognition of the incredible effort and progress toward sustainable urban development, climate change and risk protection of urban habitats.

At the same time a city like Bogota with over 8 million inhabitants and a very high Human Development Index of 0.965, is facing key challenges as urban sprawl, social segregation, poverty and risk both human and environmental/climate related.

The population, infrastructure and economy of the city is subject to high risk and vulnerable due to the growing urbanization of fragile areas, including watersheds and riverbeds, human activities and industries, the low material and construction quality of dwellings. This vulnerability factors can lead to increase the impact of catastrophic events as earthquakes and flood, as well as internal migratory dynamics related to poverty and conflict.

6.2.2.1   BOGOTA HUMANA

To face these challenges, the city of Bogota has constructed in the past years an integrated strategy and plan for the development of the city called Human Bogota (Bogota Humana), running from 2012 to 2016, with three strategies:

- Human beings at the core for development challenges, reducing segregation and discrimination
- Water centred territorial development facing climate change
- Defending and empowering the public good

These strategy will be used as guideline through all the development of Human Bogota, through the following specific objectives:

- **To contrast the social segregation and to build a city inclusive, just and equitable.**
    Giving opportunities for a worthy work to everybody,
    Not discriminating the poor
    Treating equally for females and young people
    Respecting cultural, racial, sexual diversity
    Giving universal right of health, good education, culture and sport.
    Supporting popular economy.

- **To build a city without plundering the environment and re-vitalized by public spaces and mobility.**

  Water sensitive development

  Protecting from flooding

  Denaturalizing rivers in harmony with the city

  Favouring humans instead of cars

  Strengthening mobility

  Favouring human development

- **To fight corruption and insecurity, strengthening democracy through participation and empowering the citizens.**

  Making public administration and management transparent

  Fostering participation in decision making for investments and strategic expenditures

  Combating corruption, mafia and organized crime

6.2.2.2 THE PROGRAM FOR INTEGRATED RISK MANAGEMENT

As part of the Human Bogota program, following the strategy for Water Centred Territorial Development Facing Climate Change, a specific plan for integrated risk management has been established in 2014, which is articulate through three objectives:

- Reduce territorial vulnerability facing risks and climate change
- Develop resilient population facing risk and climate change
- Strength the District System for Risk management

The first objective refers to generating knowledge for risk management, rehabilitate the areas declared subject to risk, and mitigation and management of high risk areas through an integrated urban-rural approach.

The second objective refers to reduction and management of risk for families located in high risk areas, strengthening social, sectorial and local communities' structures toward an integrated risk management.

The third objective refers to consolidate and optimized the capacity of the District System for Risk Management, and the emergency and disaster response, strengthening the information system for risk management and the response of the Capital District administration

The area of Altos de la Estancia is located in Ciudad Bolivar at the south border of Bogota District, it cover a very large mountain area occupied by an informal settlement, which is subject to phenomena of erosion and massive land slight, with over 5.000 families living under geological and flood risk conditions.

The area started to be occupied in the 90', after the cessation of the mining and excavation activity for earth material, the by persons with low income and internal migrants fleeting from the conflict zones to the capital district.

At the end of 90' and beginning of 2000 the first geological phenomena were noticed and subsequently over 3000 families have been forcefully relocated, due to a land sliding area of over 73 ha, which is considered the major land slight in entire Latin America.

In 2004 a generic area is identified as subject to an high non-mitigable risk , by the resolution 463, under which also gives mandated to start a number of intervention to secure and recuperate the area; in 2010 a specific area of 73.8 ha is finally re-identified, and the general development plan 2012-1026, is decided through the resolution 489 that a new inter-sectorial plan for the recuperation and development of the are should be established, these establishing a series of physical, environmental and social actions.

This plan takes the name of "Integrated Social Innovation Project, for recovering the risk protection area of Altos de la Estancia in Bolivar City" which acts under the auspices of Humane Bogota strategy on "Develop resilient population facing risk and climate change", and directed by the District Institute for Risk management and Climate Change IDIGER.

Figure 6-5-1: Altos de la Estancia (Source: http://www.idiger.gov.co)

The three main objective of the project are to:

- Coordinate actions for the land stabilization, relocation of the families and risk mitigation, ensuring the security of the inhabitants around the area, through preventive actions aimed to not reproduce risk conditions through the habitation and urbanization of the risk area.

- Acknowledge that risk is a social condition, and risk management requires participation for improving quality of life and wellbeing of local population, though reducing impact and losses associated with extreme events cause by either natural or human causes.

- Manage the project through social interventions, beyond the traditional physical mitigation measures and works, characterized by a permanent participation forms of all social and institutional actors, to support social and political processes.

The project for altos de la Estancia won the Risk award assigned by UNISDR during Sendai in 2015, which recognized excellent project realized worldwide having a disaster risk-reduction approach people-centred, innovative and sustainable.

Figure 6-6: Altos de la Estancia geo-environmental works (Source: http://www.idiger.gov.co)

189

During the last to year has been decided to transform the area in a risk park, and to define within the Bogota District over 10 other risk areas to be transformed in Risk Park, replicating the experience of Altos de la estancia.

This follow a specific collaboration activity between IDIGER, the UNESCO Chair of Sustainability, the Botanical Garden of Bogota and the Technological University of Antioquia aimed to implement social and environmental measures though a participatory planning.

Through this initiative five community participatory projects have be established to give the ownership of the risk park back to the local community and its inhabitants, in a way that the new park will be a driver for human development and can become a consolidated public space at the service of the city.

The plan for the development of altos de la Estancia is now continuing through the realization of a master plan of the area, involving different agencies and departments of the public administration, stakeholders and local community. In frame of the realization of this master plan the UNESCO Chair of Sustainability collaborated for exchanging knowledge between stakeholders and gather knowledge and information to inform the realization of the master plan. For this purpose the two days knowledge brokerage workshop has been organized.

Figure 6-7: Altos de la Estancia Informal Settlement (Source: own photograph)

190

6.2.3　METHODOLOGY

The methodology used for realizing the knowledge brokerage was strongly bind by the scope of this activity, meaning the brokerage of knowledge in-between different stakeholders to inform the realization of the Master Plan for Altos de la Estancia.

As typical for any real life experimentation and testing there were some limitations, in this case the major was the impossibility to dedicate a part of the sessions for realizing a complete meta-evaluation of the methodology and structure of the two days itself. Although it was possible to make an assessment of the methodology based on the same results of the KB session against the given scope and through debriefing with participants and organizers at the end of the sessions.

The specific program (as shown in Figure 6-8) and objectives for the day have been developed with the UNESCO Chair of Sustainability (CATUNESCO), and negotiated with high level officers of IDIGER, and with local organizers, including officers from Technological University of Antioquia (TdA) and Botanic Garden of Bogota (BGB). The knowledge brokerage took place at the BGB, officially hosting the event; it involved two expert facilitators (myself and CATUNESCO), a local organizer (TdA), a representative of IDIGER and a person in charge of the venue (BGB).

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1) Prepare KB session including: program, questionnaire, work dynamics, list of invited person, etc
(Duration: 2-4 weeks) (Huma resources: all)

2) Undertake a prelaminar analysis of the development interventions, plans and projects for altos de la Estancia, to be used to structure the dialogue during the KB
(Duration: 2-4 weeks) (Human resources: TdA under CATUNESCO supervision)

3) Realize KB sessions
(Duration: 2 days) (Human resources: all)

4) Analyse of data and information gathered before and during KB sessions
(Duration: 2 weeks) (Human resources: TdA under CATUNESCO supervision)

5) Prepare final report with recommendations and inputs for the master plan, including suggested methodology for its realization
(Duration: 2-3 weeks) (Human resources: TdA under CATUNESCO supervision)

Figure 6-8: Knowledge Brokerage Phases (Source: own table)

The pre-production phase was aimed to define the structure, program, general and specific objective of the KB session, including the list of data to gather, specific method and analysis system of the outcomes.

This phase involved mainly 4 persons, a part myself, each of them representing one of the organizing institutions: CATUNESCO, IDIGER, TdA and BGB.

All task and documents where first prepared by myself, then discussed with the other organizers, and then updated following the remarks made and in line with jointly agreed modifications. All the pre-production phase was realized remotely with regular online meetings among the organizers and email exchanges, with the support of an online project management tool called Wrike.

The first task was to define the key phases from pre-production to post-production, prepare a timeline and assign responsibility for execution among the organizers.

The second task consisted in defining aim, specific objectives and a data analysis system, to be used during the post-production phase, as following:

Aim

To re-construct the planning process adopted and implemented for Altos de la Estancia, and to give recommendations for the future development of the area, including an outline for a process design methodology to be adopted in the definition of a master plan for the area and its implementation.

Specific objectives

1) To collect and analyse general information and data regarding the planning process adopted until now, using documental sources, in order to re-construct the spatial and temporal dynamic of planning and implementation, through its key phases.

2) To collect and analyse general information and data regarding the planning process adopted until now, using semi-structured individual questionnaires, in order to re-construct the spatial and temporal dynamic of planning and implementation, through its key phases.

3) To collect and analyse general information and data regarding the planning process adopted until now, through structured group-work during the workshop, in order to re-construct the spatial and temporal dynamic of planning and implementation, through its key phases.

4) To prepare a synthesis report, based on the objective and subjective, both individual and collective, data collected before and during the workshop, identifying key success and failure factors and key issues arise during the planning and the implementation phases.

5) Give specific recommendations, based on the analysed data, for the future realization of a master plan and its implementations, including methodological suggestions based both on the process undertaken in Altos de la Estancia and on the latest best practices for urban resilience planning and process design.

Data analysis structure

The data analysis structure was defined in order to facilitating the uptake of the knowledge brokerage results, preparing a synthesis report and the recommendations for the master plan for Altos de la Estancia.

The data analysis structure included to:

- Define a detail strategy and methodology for data collection, including specific format and timing, for both the desk and the workshop data collection.

- Define a timeline with key steps in the planning and implementation for Altos de la Estancia, from inception to present.

- Define key positive and negative factors in the planning and implementation phases for Altos de la Estancia.

- Prepare narrative description of the different phases, based on individual (questionnaires) and collective (work groups) reconstructions.

- List key stakeholders involved in the different phases, and their dynamic relations, outlying the level of collaboration dually and collectively.

- List the key results achieved, and key results expected but not achieved, determining the main failure/success factors.

- List and narrative description of key initial objectives, both explicit and implicit, and their change dynamic along the entire development process.

The two days knowledge brokerage sessions' general structure has been established including the following elements:

- General introduction and explanation of the objectives, structure and methodology for both days.

- Presentations of best practices and case studies related to urban transformation/adaptation processes risk and development driven.

- Individual work, through questionnaires and semi-structured interviews.

- Group work with specific assignments, followed by plenary discussion of the results achieved during the group work.

- Conclusions and follow up.

The knowledge brokerage was subdivided in four sessions, within two days:

- The first day was aimed to perform the process mapping (past planning and implementation process), stakeholders mapping, system elements and interrelation among elements mapping.

- The second day was aimed to define use forecasting and visioning future scenarios to determine the best desirable and realistic target futures, and to define key process milestones through a participatory backcasting process.

Following a direct request from IDIGER, the first day sessions should be limited to internal staff members of IDIGER and few external collaborators, whom have performed the role of facilitators of the past development process of the area. Meanwhile the second day should be open also for the participation of other institutional stakeholders, mainly from different departments and agencies of the Bogota District Capital.

The first day a total of 23 persons were invited (90% attendance):

- 13 form IDIGER
- 4 from the Botanical garden
- 6 experts working under contract for the development plan of Altos de la Estancia

The second day a total of 38 persons were invited (75% attendance)

- 23 from IDIGER, Botanical garden and experts(as the first day)
- 15 from different departments/agencies of the local administration

194

The 16th December 2014 the first two session (as shown in Figure 6.9 and 6-10) of the knowledge brokerage took place in the Botanic Garden of Bogota, with the following program:

9.00-10:00	**Welcome address and introduction by the facilitators:**. • General introduction (NT, JM) • Objectives: (i) reconstruction/evaluation of the planning process, (ii) definition of key elements for future planning options (NT, JM) • General introduction on the history and Development of Altos de la Estancia (DL) • Specific objectives related to informing the realization of the master plan (DL) • Specific program and methodology of knowledge brokerage sessions; including individual and group work, in defining system, stakeholders maps and reconstruction of the planning process since inception to nowadays. (NT, JM)
10:00 -10:45	**Best practices of urban transformations in informal settlements** 1) Moravia area, Medellín 2) Montjuic area and Port area, Barcelona
10.45-11:15	**Cafe Break**
11:15 – 12:15	**Individual Questionnaire** • Description and explanation of the questions (NT) • Anonymity and confidentiality (NT) • Filling the questionnaire
12:15 – 13:00	**Planning and development process of Altos de la Estancia** Presentation of the planning process analysis realized during pre-production (AB)
13.00-14.00	Lunch break

Figure 6-9: Knowledge Brokerage Session I (Source: own elaboration)

14.00-15.30	**Group Work** The participants are divided in three groups, they Will reconstruct collectively the planning and development process of Altos de la Estancia The objectives is to define key phases and milestones, identifying key challenges, both positive and negative. This phase will include an outline of critical factor for the future realization and implementation of the master plan for Altos de la Estancia. All the facilitators will follow he group work , keeping track and record it, and facilitating its dynamic when required.
15:30 -16:00	**Introduction on process design methodology** Introduction on the process design methodology for Sustainable and resilient urban transition (NT)
16:00-17:00	**General discussion and preliminary results** One member per each working group will present the results of the group work and outcomes, and the discuss Will be discussed within the plenary
17:00- 17:30	**Conclusions**

Figure 6-10: Knowledge Brokerage Session II (Source: own elaboration)

The 17th December 2014 the first two session (as shown in Figure 6-11) of the knowledge brokerage took place in the Botanic Garden of Bogota, with the following program:

8:00-8:45	**Welcome Address**
	Introduction and objectives (NT, JM, DL)
	Introduction on the structure of the Knowledge brokerage sessions
	Introduction on key objectives:
	I) define key scenarios elements for the future Development of Altos de la Estancia
	II) analyse the collaboration between institutional actors for the Development of the plan and projects
	III)Analyse the involvement of actors and local population in the Development of the area
	IV) introduce the process design methodology for resilient urban transition
8:45 – 9:15	**Presentation on Altos de la Estancia planning process** (DL)
9:15 -10:30	**Short presentation by local authorities** Each department/agencies Will present the official vision for the development of Altos de la Estancia
10:30 -11:00	**Café Break**
11:00 – 11:15	**Presentation of the process design methodology (NT)**
11:15 – 16:30	**Group Work** The participants Will be divided in 3 groups, and will: - define key trends and drivers for the development of Altos de la Estancia (forecasting scenarios)

198	-define best desirable future scenarios for the Development of Altos de la Estancia (visioning scenarios) - Negotiate a best desirable and realistic future for the Development of Altos de la Estancia - Define milestones through a backcasting scenario from future to present
16.30-17.30	**Results presentation and closing remarks** One representative from each group will present theresults achieved during the group work. A plenarry discussion will follow Some closing remarks, outlying the way forward will be delivered (NT, JM, DL)

Figure 6-11: Knowledge Brokerage Session III-IV (Source: own elaboration)

6.2.3.3   POST-PRODUCTION

The post production phase will be realized by an expert working under the collaboration contract established for informing the realization of the Master plan for Altos de la Estancia.

The post-production includes:

- Detailed on the methodologies used for the data collection (desk and KB sessions)

- Timeline and narrative (individual and collective) of the development of plans and projects for the area

- Success and failure key aspects

- List and description of key results achieved and non-achieved

- List of initial objectives, and change in objectives and strategy

- Suggestions of key components for the master plan

- Suggestion of participatory process design and planning methodology to be adopted to realize the mastr plan

6.2.3.4   QUESTIONNAIRE

The questionnaire contained specific personal information, which has been treated following international standards to preserve the anonymity, and the data collected has been used only in aggregated form and with no reference to information that could be re-conducted to specific individuals.

Only three persons had access to the complete information: myself and the two other facilitators. The questionnaire were compiled on paper, and kept by the same person that was in charge of processing the information, for record purposes only. The questionnaires data has been introduced in an excel spreadsheet, as anonymous, in order to be able to analyse it, and to use it to prepare a final report with aggregated data information.

DATOS INDIVIDUALES

- Nombre

- Apellido

- Correo electrónico

- Dirección

- Organización

- Cargo en la organización

- Cargo por Alto de la estancia

RELACIÓN DE SU ORGANIZACIÓN CON EL PROYECTO:

- Responsabilidades

- Tareas específicas

- Inicio participación en el proyecto (fecha mm/aaaa)

- Fin participación en el proyecto (fecha mm/aaaa)

- Personas de la organización involucradas (nombres y cargos)

- Relación con otros actores (Nombre actores, relación)

RELACIÓN INDIVIDUAL CON EL PROYECTO DE ALTOS DE LA ESTANCIA:

- Cargo individual

- Tareas individuales específicas

- Inicio del proprio trabajo (fecha mm/aaaa)

- Fin del proprio trabajo (fecha mm/aaaa)

- Dedicación horaria mensual

- Relación jerárquica relativa al proyecto (nombre, cargo, entidad)

- Colaboración con otros actores (tipo de relación, nombre, cargo, entidad

FASES DEL PROYECTO

- Listado de las fases principales del proyecto

- Breve descripción de las fases principales del proyecto

- Objetivos del proyecto (listado e descripción)

- Objetivos alcanzados (definir se cada objetivo ha sido alcanzado y si lo fue de manera satisfactoria o no)

- Listar y describir los retos majores el proyecto

- Listar y describir los principales elementos de suceso

- Listar y describir los principales elementos de IN-suceso

- Ha sido el método de planificación utilizado útil a alcanzar los objetivos (votación 1 muy mal – 5 muy bien, y describir)

- ¿Cuáles elementos de cambio en el proceso de planificación sugiere?

- ¿Cuáles son los elementos claves por continuar/expandir el proyecto (listado y descripción)?

RELACIÓN ENTRE ACTORES

- Listado de los actores involucrados (describa el rol de cada actor)
- Defina el grado de colaboración con cada actor (1-muy malo 5-muy bueno)
- Evaluación de la performance de cada actor (1-muy malo 5-muy bueno)
- Listado de los actores no involucrados que habrían tenido que ser involucrados (con explicación de las razones)

Figure 6-12: Questionnaire (Source: own graphic and text)

6.2.4 PRELIMINARY RESULTS

Following the interview during the knowledge brokerage session with the participants, and the reception of the synthesis report to inform the creation of a master plan for Altos de la Estancia, the prototype can be considered satisfactorily validated in operational environment.

Some shortcomings has been addressed and a number of correction to improve the methodology were implemented, including:

1) To develop clearer instructions regarding the space and material available

2) To increase the engagement with stakeholders for participation, delivering more detailed information (scope objectives organization)

3) To refine logistic.

4) To establish more direct connection from outcome, analysis of outcome and preparation of outputs.

5) To train the trainers and facilitators for professionalizing them

The recommendations, following the results of the workshop included the use of a structure participative planning methodology, favouring the participation of the different stakeholders, as one of the critical issues is still the difficulties for the same department of the same administration to communicate among them and to not replicate effort and concertation action

7 THE RESULTS AND CONCLUSIONS

7.1 INTRODUCTION

Today over 50% of world population lives in urban areas (75% in EU), and cities account for 60-80% of global energy consumption and the same share of GHG CO2, producing 50% of global waste, consuming 75% of natural resources and producing 80% of global GDP. (UNEP-DTIE, 2013)

"Climate change has the potential to influence almost all components of the urban environment and raises new, complex challenges for quality of urban life, health and urban biodiversity. Some cities will experience droughts and increased temperatures. Others may experience floods. Climate change will affect many aspects of urban living from air quality to consumption patterns. The EU has put in place ambitious policies and initiatives to promoting solutions on the ground. These include initiatives to increase resilience and promote renewable energies and low-carbon technologies." (EC, 2015)

Cities have already started to develop specific mitigation or adaption or risk policies/plans/actions; and a relatively small but growing number of them are now pioneering an integrated approach urban resilience based, facing challenges related uncertainty and unpredictability of the phenomena they are addressing, and ultimately suffering for a lack of knowledge in terms of research, evaluation methods/tools and planning skills. (EU, 2013)

The current state of the art highlight the existence of a series of key knowledge gaps, which this proposal will try to outline and address, this including

The concept of resilience has been first explored and developed in environmental sciences (ecology and biology) since the end of 06'' (Holling, 1973, Folke et al., 1996) and later adopted in phycology, medicine, social sciences, engineering, but only in the last 3-5 years in relation to cities under an transdisciplinary approach (Davoudi et al., 2013).

A number of articles has been exploring the need for undertake research efforts on urban resilience, finally agreeing that there is a need for research development in the filed particularly in understanding the complexity of urban resilience and to develop specific planning theory and practice approaches, and evaluation systems.(Boyd and Juhola, Pickett et al., 2004, Ernstson et al., 2010, Gómez-Baggethun and Barton, 2013, Jabareen, 2013, Cimellaro et al., 2015).

RELEVANCE AND TIMELINESS

The research on urban and regional resilience is very little and uncoordinated, as shown by search in SCOPUS for published journal articles, performed in August 2015 showing the following entries: "resilient cities" 86, "urban resilience" 101, "city resilience" 22, "resilient region" 16, "regional resilience" 62; the majority published from 2012 onward.

At global and at EU level there is a momentum, making urban resilience making not any longer a niche argument but streamlining it, recognising the importance of the cities in giving integrated answers to development, climate and environmental change challenges.

The magnitude and number of initiatives at international, national and local level to dynamically address vulnerabilities of cities, as reducing the impacts of disasters, managing climate risks, and confronting climate change, outlying the need to increase knowledge and building capacities.

2012: UN RIO+20: The Future We Want

The United Nation Conference on Sustainable Development prepared the Future We Want, which mention resilience streamlining the concept of resilience in 11 paragraphs with specific reference to cities, urban mobility, climate change, disasters, social protection and ecosystems. the (United Nations, 2012)

2014: WUF 7 Medellin Collaboration on Urban Resilience

Following the process and outcomes of UNHABITAT WORLD URBAN FORUM 7, the Medellin Collaboration on Urban Resilience has been established and launched, by UNHABITAT, World Bank Group, Inter-American Development Bank, C40, Rockefeller Foundation, UNISDR, ICLEI et al.

This initiative is mobilizing $6 billion in over 2000 urban resilience interventions.

"There is growing understanding of the central role that cities play as contributors to global social, environmental, and economic progress, and the need to move beyond conventional approaches to disaster and climate hazard mitigation and prevention towards a forward-looking, holistic approach to resilience in the context of this new urban era." (UNHABITAT, 2014)

2015 UNISDR Third UN World Conference on Disaster Risk Reduction

In March 2015 the Third UN World Conference on Disaster Risk Reduction (WCDRR), adopted the Sendai Framework for Disaster Risk Reduction 2015-2030, following the Hyogo Framework for Action (HFA) 2005–2015: Building the Resilience of Nations and Communities to Disasters (United Nations, 2005), with a strong new focus on urban resilience, oriented at slow and rapid onset disasters disaster and risk reduction,

"…(HFA) highlighted a number of gaps in addressing the underlying disaster risk factors, in the formulation of goals and priorities for action, in the need to foster disaster resilience at all levels and in ensuring adequate means of implementation. The gaps indicate a need to develop an action-oriented framework that Governments and relevant stakeholders can implement in a supportive and complementary manner, and which helps to identify disaster risks to be managed and guides investment to improve resilience." (United Nations, 2015a)

2015: UNFCCC COP 21

United Nations Framework Convention on Climate Change (UNFCCC), is preparing the Conference of Parties 21 (COP21) aiming to achieve a historical global agreement for climate change.

During the ADP session in Geneva a negotiation text was prepared, later consolidated at the UNFCCC Climate Change Conference in Bonn, introducing the concept of resilience to integrate mitigation and adaptation.

Moreover there is a growing understanding and level of engagement of cities for the key role they will play to implement jointly national adaptation plans and mitigation targets, in an integrated manner. (United Nations, 2011, United Nations, 2015c)

2015: SUSTAINABLE DEVELOPMENT GOALS

The Sustainable Development goals will be adopted in September 2015 at the United Nations High-level Summit, with the aim to coordinate the now coupled development and sustainability agendas at global level.

The SDG have a clear focus on urban resilience, namely Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable, and Goal 9: Build resilient infrastructure,…

"All countries and all stakeholders, acting in collaborative partnership, will implement this people-centred Agenda. We are resolved to free the human race within this generation from the tyranny of poverty and want and to heal and secure our planet for the present and for future generations. We are determined to take the bold and transformative steps which are urgently needed to shift the world onto a sustainable and resilient path". (United Nations, 2015b)

2016 UNHABITAT: HABITAT III and Urban Resilience Institute

The Third United Nation Conference on Housing and Sustainable Urban Development (HABITAT III), is a 20 annual conference to take place in Quito in October 2016; it will result in the adoption of a new Urban Agenda for 2030, focusing on the transformative power of urbanization.

The New Urban Agenda will be built also on the results of the World Urban Forum key message which is referring to the need for stronger means for participation and inclusion through planning and management of the city, in order to respond to key urban challenges and promote sustainable and resilient urban development. (UNHABITAT, 2015)

The process for define the New Urban Agenda is having a leading support by the UNHABITAT newly create City Resilience Profiling Program and the Urban Resilience Institute, established in Barcelona, which goal is to establish a global center for support to local governments to make their cities safe, prosperous and resilient.

2008-2014 EU: ADAPTATION STRATEGY AND MAJORS ADAPT

The European Adaptation Strategy recognize the importance of resilience for European cities facing effects of climate change, as pro-active adaptation con enhance urban resilience. Specifically it is recognized the need

for building capacity, exchanging knowledge / best practices, and raise awareness about the importance of urban adaptation/resilience.

 "Community resilience was identified as an associated umbrella concept that could promote adaptation to climate change and keep it high on the political agenda…. The resilience concept can be applied to infrastructure or communities. … Thus the goal of increasing resilience encourages looking outside a city's boundaries for potential sources of risks and adaptive solutions and promotes working with other local authorities or stakeholders beyond the administrative boundaries" (EU, 2013

EU: H2020

Under the last EU FP7 and H2020 2014 a number of project have been launched addressing directly urban resilience, although their approach is mainly focusing on infrastructure or risk, particularly water and transport related.

As evident by the H2020 programme for 2016-17, the number of calls, and related economic investment, requiring to address resilience, particularly at urban and regional level is increasing significantly, under the Societal Actions primarily the Climate and Secure Societies ones but also Transport, Energy and Health.

7.2 SET AND ACHIEVED OBJECTIVES

The original objective of the thesis, as defined within the approved thesis proposal, was to "contribute to sustainable urban development through the definition of a methodology for the integrated evaluation of sustainability and for the support of participatory decision making processes towards the definition and implementation sustainable urban development policies, programs and action based on the local milieu innovative and creative potential" (Tollin, 2007):27

The aim of the thesis was to establish a methodology to support informed decision making for participatory processes for sustainable urban development; based on system thinking and system dynamic, favouring an integrated evaluative approach of alternative future options.

More in detail the thesis aimed to establish such integrated evaluation methodology for sustainable urban development through the integration of different methodological approaches for future scenarios, namely: visioning, forecasting and backcasting.

The originally set objectives have been achieved and overcome, as during the development of the thesis work, which included not only scientific literature and international policy reviews, but also the participation within cutting edge EU FPs funded project and real urban development projects in EU and Latina America, it become clear that the development of a methodology of integrated evaluation of urban sustainable development was enough to face major global urban challenges.

For this reason the original objective was expanded and broadened to address the very needed request, as proven by both existence of scientific literature and EU/UN policy document, for new forms and methodology of planning addressing urban resilience, as a dynamic process of continuous adaptation of cities balancing between the need to reduce risk and to innovate, ultimately to increase well-being urban citizens, through co-evolution based participatory planning processes.

This objective has also been achieved, developing a process design methodology of resilience planning, including the original system thinking approach and embedded with an integrated evaluation of sustainability system, which has been developed from inception, to a Technology Readiness Level 7-8, finally including the system prototype demonstration in operational environment.

7.3 METHODOLOGY OVERVIEW

Following the EU H2020 Technology Readiness Level scheme it is here possible to reconstruct the full development of the thesis through the methodology used for the full development of the process design and knowledge brokerage system for resilient transition.

- **TRL 1 – basic principles observed**

  Over 300 references, including scientific literature and a systematic policy documents review , mainly from United Nations and European Union, have been analysed. This was realized specifically in relation to: sustainable development, sustainable urban development, system thinking/dynamics, transition theories, resilience and co-evolution, urban metabolism, future scenarios, governance and participation.

- **TRL 2 – technology concept formulated**

  The technology basic concept, including the methodological integration of visioning, forecasting and backcasting, using a system thinking approach to support integrated evaluation and informed decision making, furthermore linking the definition of futures, to the design and implementation of plans and actions, have been developed and dynamically refined.

- **TRL 3 – experimental proof of concept**

  The experimental proof of concept was given by a large number of scientific publication, conferences and papers, and the oral presentations the whole methodology and its parts to scientific symposia. Furthermore the in-deep discussion with peers in the frame of EU funded projects has been particularly valuable to test hypothesis, theories and solutions, namely: EU FP6 STAR CITY: The Green City of the Future, EU FP6 WISE Waste in a Social Environment, EU FP6 HDGEC Human Dimension of Global Environmental Change, EUFP6-7 EASY-Eco Evaluation of Sustainability.

- **TRL 4 – technology validated in lab**

  The validation in lab of the process design methodology was given by the EU funded project ATOM&BITS: Sustainable Urban Development Transition, which proposal was developed including the process design methodology, that later have been adopted for the development of future scenarios and plans for the industrial area of Porto Marghera in Venice. The projects was prepared and delivered by a consortium composed by University IUAV of Venice, Technical University of Denmark, Technical University of Lisbon, Technical University of Delft, Technical University of Sofia and Technical University of Catalunya. The training and research work, undertaken by 30 MSc and PhD researchers competitively selected; ended with a two weeks workshop in Venice where the researchers, together with local stakeholders, developed four scenarios and plans for Venice Porto Marghera area using the process design methodology.

- **TRL 5-6– technology validated-demonstrated in relevant environment**

  The process design methodology has been validated and demonstrated in relevant environment, through high level peer collaboration in developing competitive proposals for EU H2020 and EU COST proposals. Inter alia, a H2020 proposal for mitigation of GHG emissions in European Cities, currently invited for second stage application and awaiting for final evaluation, using the process design methodology to develop integrated urban plans for low carbon transition in three European cities. It also includes an EU COST proposal on Urban and Regional Resilience, under evaluation, with a consortium of 25 organizations from 20 countries, which I am coordinating.

  The validation-demonstration has been realized also through invited/keynotes speeches in the frame of high level conferences as G7's Low Carbon Society Network, UNHABITAT World Urban Forum 7, UNFCCC Climate Change Conference ADP in Bonn.

- **TRL 7 – system prototype demonstration in operational environment**

  The system prototype has been demonstrated in operational environment in Altos de la Estancia, as reported in the homonymous case study.

- **TRL 8 – system complete and qualified now finalized system**

  The finalization of the system consist in the conclusion of the thesis and the presentation of finalized process design methodology

- **TRL 9 – actual system proven in operational environment.**

  This will be achieved in the next 2 years, in the frame of the International Program on Urban Resilience RESURBE, which I have co-initiated and I am currently co-directing. Which count on an international consortium of over 40 organizations including UNHABITAT, UNISDR, UNDP, UCLG, and over 150 individual participants. One of the key outcome of the RESURBE program will be 7 books, part if the book series Resilient Cities: Re-thinking Urban Transformation, by Springer, that I currently co-lead as chief series editor.

7.4 RESULTS (SCIENTIFIC IMPACT)

The thesis resulted in a number of publication, presentation and EU funded projects (see Appendices from page 232) :

- the publication of: 2 JRC papers,

- 7 invited presentations at conferences,

- participation (also as co-ordinator) in 7 EU funded projects,

- 18 conference proceedings,

- the organization of 20 international conferences and side events (as member of the scientific and/or organizing committee),

The thesis will lead to minimum the following output:
- publication of at least 5 JRC journal papers,

- edition of 2 special issues of JRC journals,

- publication of 2 edited books within the Resilient Cities book series by Springer by 2016,

- the publication a monographic book on process design for resilient transition, by Springer by 2016

- the organization of two international conferences on urban resilience

- over 10 oral presentations and publications in conference proceedings

- the award of a major EU H2020 funded project.

7.5   RESULTS (SOCIO-ECONOMIC IMPACT)

The forecasted socio-economic impact of the thesis and the process design methodology for urban resilience transition is of consistent magnitude.

Social impact is mainly derived by the number of people and communities that will beenfit from the adoption of the process design methodology for urban resilience transition. UNISDR and World Bank account that each euro invested in risk/adaptation is equivalent to 4-6€ saved for recovery. For the short term only COST direct investment is accounted, using a factor 4, for the long period all correlated national investment is accounted with a factor 6.

The outcome of the work and the methodology elaborated is currently used for competitive research and innovation proposals, for a total amount of almost 9 million euros, including the usage of the methodology to elaborate urban resilience plans in several European cities.

Moreover the outcomes of the thesis and the methodology itself are at the base of the RESURBE international program on urban resilience, by itself worth over 2 million euros in in-kind contribution, that aims to develop urban resilience development project globally, and will be able to deliver it thanks to the participation within the consortium of UN and Inter-Governmental Organization operating globally.

The direct involvement of local communities, also for capacity building activities, can generate substantial socio-economic beenfits, although not directly quantifiable.
The socio economic impact depends from the level of dissemination of cost action at local level in cities and regions, which will be supported by liaising with key organizations as UCLG, G40 and ICLEI, Medellin Chart signatories inter alia.

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212

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217

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225

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APPENDICES

LIST OF PUBLICATIONS AND PROJECTS

INTERNATIONAL CONFERENCES ARTICLES AND PRESENTATIONS:

1. Wierink M, Tollin N Perception of Resources and Waste from Human Systems Perspective. 18th Annual International Sustainable Development Research Conference University of Hull, 06/2012.

On the role of time in resource and waste management, within sustainable consumption and production.

2. Tollin N. Wierink M., Human and Social Perception of Resources and Waste: material cycles, time and perception, Summer Symposium on Sustainable System, Aalto University 06/2010

On the role of time in resource and waste management, within sustainable consumption and production.

3. Tollin N. Planning without a Plan: Process Design and Participative Planning at Roskilde. University of Prague – Association of European Schools of Planning YA 02/2010

On process design and the case study of Musikon in Roskilde Denmark.

4. Tollin N. The Social and Human Use and Perception of Resources and Waste. Waste in a Social Environment, University of Aachen, EU WISE 11/2009

On integrated resource management and sustainable production and consumption.

5. Tollin N. Helgenberger S., Alvarez J. Future Scenarios Methodologies for Planning Urban Sustainable Development Planning as rear View Mirror or Crystal Ball? AESOP YA and Technical University of Vienna -AT- 02/ 2009

On integrated future scenarios methodology and time perception in sustainable urban development.

6. Heidrich O. Harvey J. Tollin N. Stakeholder Analysis for Industrial Waste Management Systems. Waste Management, Volume 29 Issue 2, 02/2009

On stakeholders analysis and stakeholders mapping.

7. Tollin N., Balslev S., Alvarez J., Future Scenario and Decision Making: the Use of Backcasting in the Evaluation of Urban Sustainable Development, Human Dimension of Global Environmental Change: Participation in Earth Governance, Free University of Berlin, EU MC HDGEC, -DE- 02/ 2008.

On future scenario and backcasting in decision making processes.

8. Tollin N., Alvarez del Castillo J., Book C. System Dynamics as System Thinking in Evaluation of Urban Sustainability Governance by Evaluation University of Vienna, EU MC Easy-Eco, -AT-03/ 2008.

On system thinking and evaluation in sustainable urban development.

9. Tollin N. System Dynamics as a Support Tool for Decision Taking and Policy Making Evaluation as Performance Assessment, Saarland University, EU Easy-Eco, -DE-. 10/ 2006.

On system dynamics in decision making and evaluation of sustainability.

10. Tollin N. De Felipe J. Sureda B. Forecasting Scenarios: Raising Awareness toward Sustainable Development. Future Matters: Future Known, Created and Minded, Cardiff University -UK-. 09/2006.

On future scenarios and learning processes in sustainable development.

11. Tollin N., Evaluation of Urban Sustainable Development Science Technology and Research: the City of the Future, Technical University of Lisbon, EU MC STaR, -PT- 10/ 2008.

On sustainable urbandevelopment evaluation.

12. Tollin N., Karaglou M., Pereira J.P., et al. Building the World Heritage of the Future Integrated Sustainable Systems, University of Duisburg-Essen, EU STaR, Obidos -PT- 04/ 2008

On systemic approach to sustainable urban development.

13. *Tollin N. Waste??? Values and Perceptions of Waste City of the Future: Changing Waste in Resource Management, , University of Sofia, EU STaR, -BL- 11/ 2007.

On resource management and waste management.

14. *Tollin N. Taking a Stand on Urban Sustainable Development City of the Future: Acting in a Sustainable Community, University IUAV of Venice, EU STaR, -IT- 09/ 2007

On participation in sustainable urban development.

15. *Tollin N. Integrated Evaluation of Sustainable Energy Alternatives The Hydrogen Society; University of Duisburg-Essen, EU STaR, -IT-. 04/2007.

On systemic evaluation of resource management.

16. *Tollin N. Harvey J. Tenerelli P. et al. Alderney Small Sustainable Community Development and Planning Small Islands Development, EU MC STaR, Channel Islands -ACI- 10/ 2006.

On systemic and participative planning.

17. *Tollin N. Integrated Approach to Sustainable Urban Development Living in a Sustainable Community;, National Technical University of Athens, Athens, EU STaR, -GR-. 05/2006.

On systemic approach to sustainable urban development.

18. *Tollin N. Re-thinking Waste Management under Sustainable Development Paradigm Waste: Changing Problems into Possibilities; University of Duisburg-Essen, EU STaR, 02/ 2006.

On resource management and sustainable consumption and production.

JOURNAL ARTICLES:

1. Tollin N. Helgenberger S., Balslev S., Alvarez J. Evaluating and Planning Sustainable Urban Development: the Use of Future Scenarios Between Facts and Values, IOP Conference Series: Earth and Environmental Science. Volume 6, Issue 57, 03/2009

On future scenarios for sustainable urban development.

2. Heidrich O. Harvey J. Tollin N. Stakeholder Analysis for Industrial Waste Management Systems. Waste Management, Volume 29 Issue 2, 02/2009

On stakeholders analysis and mapping in resource management.

INVITED PRESENTATIONS:

1. N.Tollin, Planning adaptation in cities: a matter of time and knowledge, TECH4DEV 2012 International Conference: Technologies for Sustainable Development, EPFL, Lausanne, 05/2012

On climate change adaption in cities and regions, including temporal and spatial integration.

2. Tollin N. Evaluation of Sustainability. Pennine Water Group Annual Conference 2012. University of Sheffield UK, 03/2012

On time perspective in evaluation of sustainability.

3. Tollin N. Backcasting Sustainable Urban Development: trends vs aspirations (in Spanish). International Conference recycling cities. Cities and Regions facing Climate Change. Barcelona Tech ES 12/2010

On participative backcasting in cities and regions for climate change adaptation.

4. Tollin N. Time and Social Perception in relation to natural resources and climate change (in Spanish) II International Meeting: Living in the Semi-arid Regions State University of Bahia BR, 12/2011

On timescapes of natural resource management.

5. Tollin N. Managing ecosystem services: toward a resilient society (in Spanish) II International Meeting: Living in the Semi-arid Regions, Federal University of Bahia BR, 12/2011

On resilience of cities and regions toward climate change adaptation.

6. Tollin N. Cities and Climate Change: time for action (in Spanish). International Conference recycling cities. Cities and Regions facing Climate Change. Barcelona Tech ES 11/2010

On climate change adaptation in cities and regions.

7. Tollin N. Future Scenarios for Sustainable Urban Development Department of Planning and Management of Building Processes, Technical University of Denmark -DK- 03/ 2008.

On future scenarios for sustainable urban development transition.

EU PROJECTS:

PI: Principal Investigator, CC: Co-ordinator, RS: Researcher

1. EU FP6 WISE Waste in a Social Environment €0.32M (PI).
   4 organizations, 3 countries.
2. EU FP6 STAR-City Science, Technology, Research: the green city of the future €0.64M (CC).
   5 organizations, 4 countries.
3. EU LLP, ATOMS&BITS (sust. urban and regional dev.in EU and Asia) €0.06M (CC).
   6 organizations, 6 countries.
4. EU FP6 HDGEC Human Dimension of Global Environmental Change €0.38M (RS).
   2 organizations, 2 countries.
5. EU FP6 EASY-ECO Evaluation of Sustainability €0.46M (RS/tutor).
   13 organizations, 10 countries.
6. EU FP7 QUIESST Quietening the Environment for a Sustainable Surface Transport €1.9M(RS).
   13 organizations, 7 countries.
7. EU FP7 PREPARED Climate Change Sustainable Water Management in Urban Areas €6.9M (RS).
   35 organizations, 15 countries.

CONFERENCES:

Scientific and/or organizing committee within international conferences

2015   Bogota Climate Summit, Side Event on Urban Resilience

2015   DCEE4 4th International Workshop on Design in Civil and Environmental Engineering, Taipei TW

2015   RESURBE II. Urban Resilience Transition.(RECNET, UNESCO, UNHABITAT, UNISDR), Bogota CO

2015   United Nations Climate Change Conference, Official side event, Urban Resilience at, Bonn, DE

2014   RESURBE I. Urban Resilience Transition., Barcelona ES

2014   DCEE3 3rd Civil and Environmental Engineering Design International Conference, Lyngby DK

2014   Re-cycling Cities. Official side-event at UNHABITAT 7th World Urban Forum, Medellin CO

2013   Re-cycling Cities Conference, Bahia BR

2012   Planning Adaptation in Cities, Int. Conf. on Technology for Sustainable Development, Lausanne CH.

2011   2nd International Meeting: Living in the Semi-arid Regions. Bahia and Juazeiro BR.

2010   4S Summer Symposium on Sustainable Systems. Sannas FI

2009   ICMMS II Int. Conf. on Measurement, Modelling and Evaluation of Sustainability. Terrassa ES

2009   SET VIII International Conference on Sustainable Energy Technologies Aachen DE

2008   EU STaR The Green City of the Future. Integrated Sustainable Systems. Obidos PT

2008   EU STaR The Green City of the Future. The green City of the Future. Lisbon PT

2007   EU STaR The Green City of the Future. Hydrogen Society. Arona IT

2007   EU STaR The Green City of the Future. Acting in a Sustainable Community. Venice IT

2007   EU STaR The Green City of the Future. Changing Waste in Resource Management. Sofia BL

2006   ICMMS I Int. Conf. on Measurement, Modelling and Evaluation of Sustainability. Terrassa ES

2006   EU STaR The Green City of the Future. Small Islands Development. Alderney ACI

INDEX

236

Planning · 30, 31, 35, 67, 68, 90, 114, 115, 127, 173, 224, 225, 226, 227

R

resilience · 14, 23, 55, 59, 61, 62, 68, 75, 85, 86, 87, 88, 89, 90, 91, 100, 106, 107, 123, 152, 158, 162, 163, 165, 169, 171, 227

risk · 3, 4, 47, 53, 55, 56, 59, 62, 68, 90, 100, 105, 119, 123, 158, 159, 186, 188, 189, 190, 191, 192, 231

S

scenario · 15, 25, 33, 35, 75, 78, 83, 102, 108, 111, 112, 137, 138, 139, 141, 142, 143, 224

Scenarios · 127, 187, 224, 225, 226, 227

stakeholder · 17, 18, 120, 130, 131, 133, 140, 142, 153, 165, 167

sustainable consumption and production · 17, 19, 21, 30, 31, 33, 47, 53, 55, 63, 64, 224, 226

Sustainable Development · 31, 45, 46, 51, 52, 55, 57, 58, 59, 63, 70, 104, 105, 224, 225, 226

sustainable urban development · 16, 17, 18, 19, 20, 21, 23, 25, 26, 28, 29, 30, 33, 34, 35, 43, 57, 60, 64, 66, 67, 68, 69, 81, 92, 93, 95, 102, 105, 178, 188, 224, 225, 226, 227

Systems dynamics · 70, 71, 118, 121

systems thinking · 71

T

transition · 14, 15, 16, 17, 18, 19, 20, 24, 26, 33, 34, 35, 37, 56, 63, 64, 65, 68, 69, 78, 79, 80, 81, 83, 85, 91, 123, 124, 133, 137, 138, 139, 141, 142, 143, 144, 145, 146, 147, 149, 150, 151, 154, 160, 162, 163, 170, 171, 172, 186, 227

U

UNESCO · 1, 31, 70, 175, 186, 200

Urban areas · 13

urban system · 37, 81, 91, 100, 101, 115, 155, 163

V

visioning · 15, 18, 20, 26, 33, 75, 102, 108, 109, 112, 115, 137, 139, 140, 141, 142, 145, 169, 170, 172, 187

ACKNOWLEDGEMENTS