

The logo for URBAN EUROPE features a stylized 'e' symbol in green and white, centered within a series of concentric circles in shades of blue and yellow.

URBAN EUROPE

Joint Programming Initiative

Strategic Research Framework



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ROADMAP JPI URBAN EUROPE

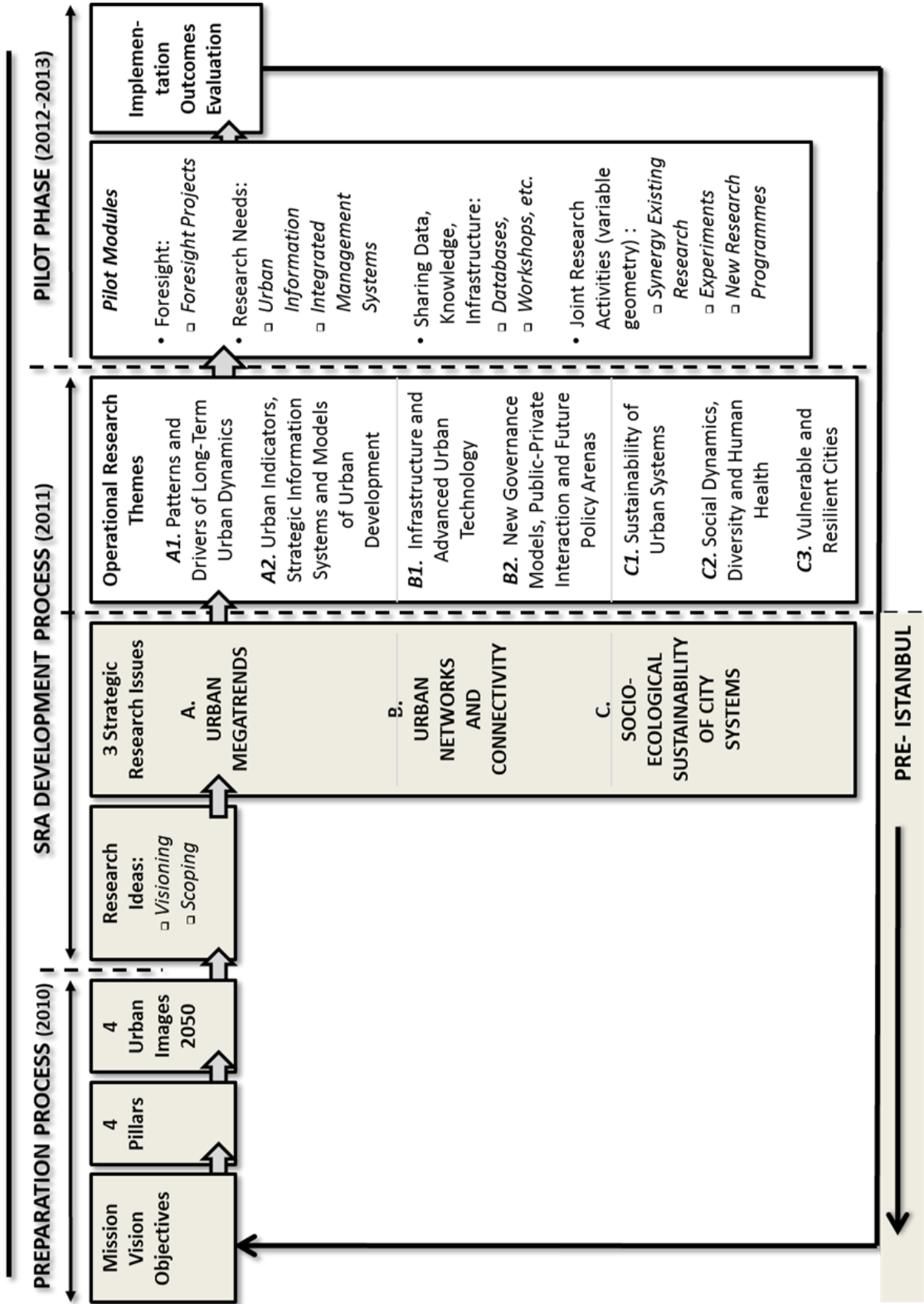


Figure 1: Roadmap JPI URBAN EUROPE

Executive Summary

Modern cities in an open and globalizing economy are powerhouses of creative ideas, innovative technologies, sustainable developments and socioeconomic wealth. They play a pivotal role in the future of an urbanized Europe, but they are also confronted with grand challenges, notably far-reaching *demographic transformations* (in particular, ageing, rapid population rise in many continents, and unprecedented migration flows), *environmental decay and climatological change* (in particular, greenhouse gases, water management), *unequal social participation* (in particular, unemployment and poverty, cultural-ethnic tensions), and *ever-rising mobility trends* (in particular, commuting, long-distance travel, complex urban logistic change). The challenges for urban environments may be turned into new opportunities, in particular in such domains as advanced infrastructure and logistic systems, environmental and climate-neutral facilities, creative and knowledge-intensive strategies for socioeconomic prosperity and well-being. Cities – and in particular, metropolitan areas – may thus act as spearheads of sustainable economic growth for European countries.

The above observations call for appropriate long-range policy strategies for urban areas – and networks of cities – in the highly diversified European space-economy. Such policy actions would need to be supported by solid, multi-disciplinary and evidence-based research on the challenges and opportunities of urban environments in Europe. The research agenda of the JPI URBAN EUROPE is built around four interconnected pillars (cornerstones) that form the focal points of long-term strategic research on urban areas, viz.:

- (1) *Economy & Innovation*: Creative Economic Capital
- (2) *Mobility*: Infrastructural, Logistic, Connectivity and Communication Capital
- (3) *Society*: Social and Cultural Capital
- (4) *Ecology*: Environmental Capital

The value added of URBAN EUROPE initiative rests on strategic and evidence-based research on the interfaces of these cornerstones. Critical research questions are identified by a backcasting experiment based on a long-term horizon for urban future (up to the year 2050).

In view of the strategic orientation of the URBAN EUROPE research calendar, four long-term urban images are identified. These interlinked future appearances of urban environments (in the year 2050) offers stylized pictures of urban agglomerations, with the aim to distillate relevant and operational research issues for the URBAN EUROPE's Strategic Research Framework (SRF). These four urban images and their main orientation are (see Figure 2):

- *Entrepreneurial City 2050*: economic vitality and innovation
- *Connected city 2050*: smart logistics & sustainable mobility
- *Pioneer City 2050*: social participation & social capital
- *Liveable City 2050*: ecological sustainability.

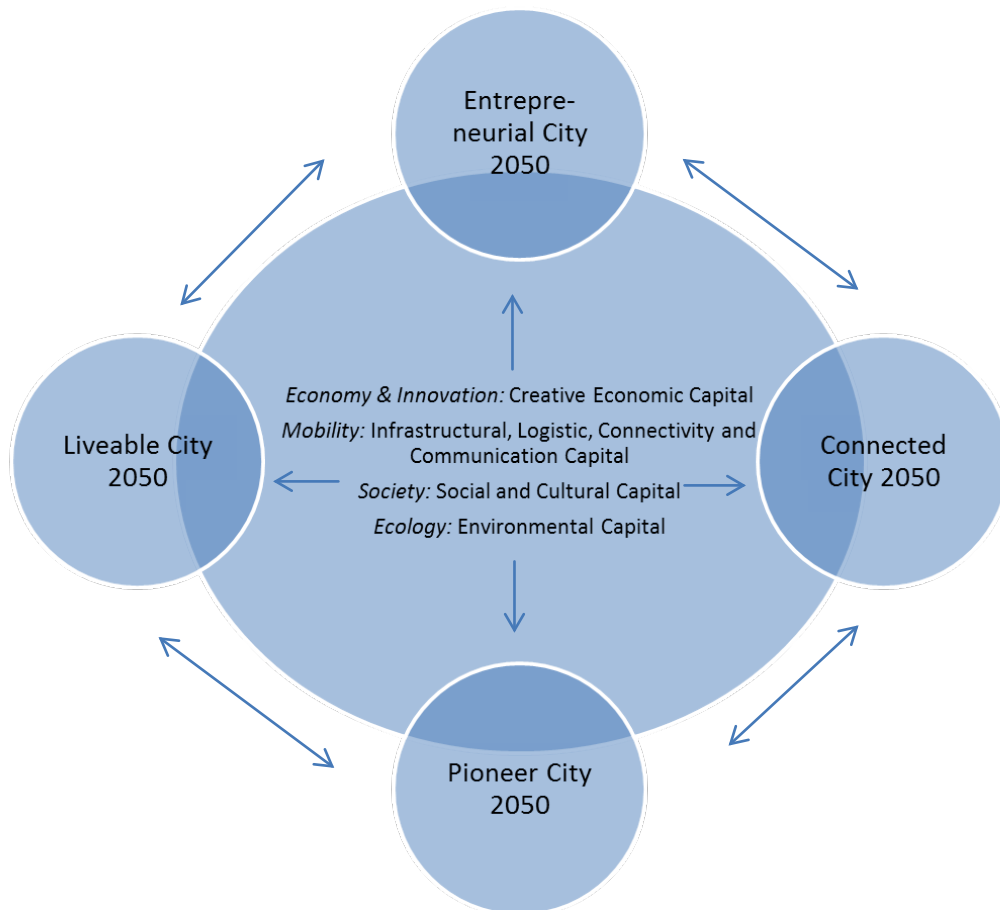


Figure 2: The four urban images 2050 and their interaction

These images may be used as strategic vehicles to identify important research challenges and foundations for an URBAN EUROPE SRF. These interconnected urban images can briefly be described as follows:

- *The Entrepreneurial City 2050*
This image assumes that in the current and future global and local competition, Europe can only survive, if it is able to maximize its innovative and creative potential in order to gain access to emerging markets outside Europe; cities are then spearheads of Europe's globalization policy.
- *The Connected City 2050*
The image of a connected city refers to the fact that in an interlinked (from local to global) world, cities can no longer be economic islands in themselves ('no fortresses'), but have to seek their development opportunities in the development of advanced transportation infrastructures, smart logistic systems and accessible communication systems through which cities become nodes or hubs in polycentric networks (including knowledge and innovation networks).
- *The Pioneer City 2050*
This image refers to cities as attractors for creators and makers as pioneers, offering the general conditions for cutting-edge innovations and developments beyond conventional approaches, and providing innovative environments for the assessment and implementation of new (technological) solutions, through which Europe can become a global pioneer

- *The Liveable City 2050*

The final image addresses the view that cities have to consider all relevant aspects such as health, security and safety in order to provide an attractive environment to live and work for all citizens, and that smart environmental and energy initiatives (e.g., recycling, waste recuperation) shall act as engines for ecologically-benign strategies, so that cities may become climate-neutral agents in a future space-economy.

These four images highlight the strategic dimensions of urban futures in Europe. They lend themselves for systemic approaches to URBAN EUROPE, they all need operational geo-science information and behavioural data to map out or understand uncertain urban futures, and they also reflect the need for strategic thinking on the governance of urban agglomerations in Europe. These four ideal-typical representations of European urban agglomerations in the year 2050 are not to be seen in isolation, but they are interconnected.

A wealth of innovative research ideas has been extracted from a creative envisioning process regarding these four interlinked urban images, on the basis of stakeholder consultation and interactive workshops with experts and policy-makers. To create a systematic and operational research agenda, a process of focusing and filtering has been carried out. This led to the identification of three major research issues to be addressed in the JPI URBAN EUROPE. These can be presented as follows (see also Figure 3):

A. Urban Megatrends

What are the prominent demographic, economic and technological megatrends that are decisive for a promising future of urban systems?

B. Urban Networks and Connectivity

What are new mobility, logistic and land use developments and policies that are needed to create vital and attractive cities – and networks of cities – in the decades to come?

C. Socio-Ecological Sustainability of City Systems

Which ecological and social constellations have to be met and implemented in order to shape sustainable and balanced long-run urban development patterns (including energy systems) in Europe?

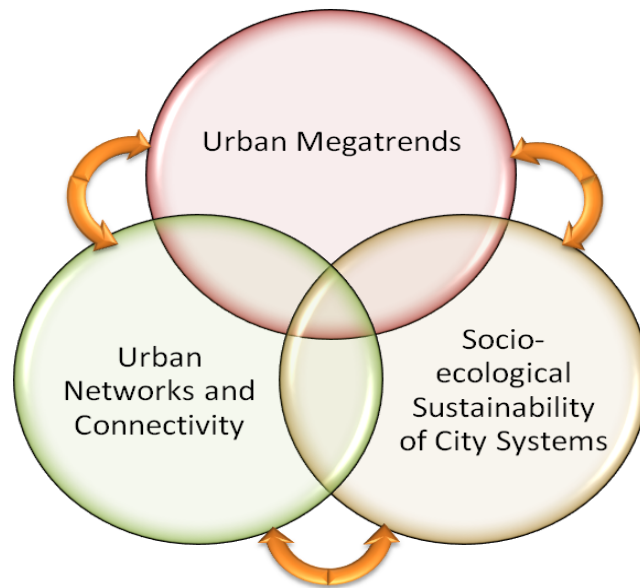


Figure 3: Architecture of the SRF research URBAN EUROPE

These three strategic research issues will now be described successively in more detail.

RESEARCH ISSUE A: URBAN MEGATRENDS

Urban development patterns demonstrate a surprising diversity in many countries. In our urban century, urban networks, regions and cities (including urban agglomerations, supernova cities / megacities and systems of cities) offer strong centripetal and centrifugal forces that will most likely be decisive for the economic geography of our planet. Future urban developments, economic changes and growth challenges call for a long-range research horizon, in which (new) technology, innovation, demography (growth and ageing), climate, culture and socio-economic developments are taken into consideration. There is a need for a systematic analysis and monitoring of the drivers and impacts of both micro- and macro-structural trends regarding urban dynamics. This prompts the formulation of two prominent research themes:

Research Theme A.1. Patterns and Drivers of Long-Term Urban Dynamics

The meaning of this research theme is exemplified by the following list of illustrative – and by no means exhaustive – research questions:

1. Which major *demographic, economic and technological driving forces* are critical for the development of urban systems, in which both growth and shrinking may occur at the same time?
2. How do these *megatrends affect and change the urbanisation patterns* in different types of towns, cities, mega-cities and urban agglomerations in various parts of Europe?
3. How can *space-time patterns of urban processes be systematically analysed* for developing *simulation models of urban development* based on relevant determinants?
4. What types of urban areas in Europe have the *potential for innovative leadership* in the decades to come? In which *economic, technological or social domain* is leadership essential?

5. How can *firms, policymakers and people respond to megatrends in order to shape and handle urban development* with a view to the creation of attractive cities and innovation hubs?
6. Which knowledge (and knowledge networks) are crucial to obtain strategic insight into urban change in Europe and how can this *knowledge be combined in a systematic monitoring system*?
7. What *new policy measures, planning concepts and governance models* are to be envisaged to safeguard urban sustainability in Europe?

Research Theme A.2. Urban Indicators, Strategic Information Systems and Models of Urban Development

Examples of relevant research questions are:

1. Which advanced and evidence-based *foresight tools* are appropriate for exploring the multi-faceted dimension development of urban areas (demographic, geographic, technological, political, economic, environmental, social)?
2. Which modern *data and indicators* can be developed to offer a realistic mapping of the impact of megatrends on urban evolution?
3. How can *strategic information systems* be built and made accessible and suitable for different actors (industry, policymakers, researchers)?
4. Which *conceptual and operational models and tools*, e.g. in relation to geo-science, urban scenario modeling, are needed for shaping the transformation of a city towards desirable urban visions (e.g., living labs, envisioning experiments, complex urban systems models)?
5. How can new *research instruments, concepts and toolkits be sufficiently tested* (proof-of-concept, proof-of-application, proof-of-policy relevance)? What can we learn from existing practices or other initiatives and how can model cities and living labs established as evaluation testbeds?
6. What are the central cornerstones involving different perspectives for *integrated governance models and modelling platforms*?
7. What can Europe learn from *urban developments and planning practise* elsewhere in our world?
8. Which methods and instruments can be used for *comparing the development of cities in Europe and globally* (benchmarking, best practise)?

RESEARCH ISSUE B: URBAN NETWORKS AND CONNECTIVITY

The urban world is highly dynamic and displays a variety of new mobility, logistic and land use developments that are decisive for vital and attractive cities – and networks of cities – in the decades to come. Urban settlements patterns move increasingly towards connected multi-functional urban areas: cities are complex networks, connected cities become higher-order networks, and mega-cities are becoming nodes or hubs of global command and control. Land use and infrastructure offer the material/physical facilities that support the socio-economic

performance of urban systems (e.g., ports, energy grids, rail and road connections, IT systems, aviation networks). Urban agglomeration advantages are critically dependent on land use planning, housing, transportation and logistics, industrial locations and economies of density. A thorough investigation into this complex force field calls for the design and implementation of the following two research themes:

Research Theme B.1. Infrastructure and Advanced Urban Technology

This is a broad research theme on connectivity and accessibility in urban systems which prompt the following illustrative research questions:

1. Which radical innovations have to be designed to ensure *accessibility and connectivity in terms of transportation, logistics and mobility systems* for all urban citizens (the 'equity' motive) in and between cities?
2. How can *different types of urban networks* (transport, energy, logistics, ICT, knowledge) and their *mutual interactions* be designed and shaped for smart solutions for urban networks?
3. How can *new urban land use and planning tools* help to create attractive urban living (urban settlements and housing) and working areas using in an integrated urban design?
4. Which new *analytical and policy tools are needed to cope with rent gaps* in the urban built environment and which value capturing mechanisms for long-term balanced urban land use can be designed?
5. Which *social, institutional and economic conditions* have to be met to *successfully implement new technologies* and ensure *robustness and reliability*? Which *new services and information systems* are needed to make advanced technologies attractive and useable to different target groups?
6. Which *urban financial mechanisms and value added services* can be designed that ensure a *high quality of public transport* for new customer markets?
7. Which methods and technologies have to be developed for *influencing urban lifestyles* and developing *motivators for behavioural changes*?
8. Which *risk assessment strategies* have to be developed for ensuring the development of efficient and successful technologies?

Research Theme B.2. New Governance Models, Public-Private Interaction and Future Policy Arenas

Illustrations of important research questions are:

1. Which changes are to be envisaged in the *administrative competences of policy actors*, if the functional borders of cities are expanding and shifting in our era of globalisation?
2. Which *actor-oriented design principles* are to be developed in order to create pioneer cities and knowledge hubs with a high degree of creativity and resilience in open urban systems?

3. How can patterns and drivers of user behaviour be analysed and used for achieving high *user acceptance* of policy measures and solutions?
4. Which new *models and concepts of governance, management, demand and evaluation* in geographic, political, social and economic science are needed to ensure a matching between functionalities and competences in institutions, among agents and in space?
5. Which are the necessary *information systems* to analyze the matching of manifold demands for urban infrastructure provision and administrative regulatory systems?
6. What could be new forms of *public private interactions and governance* to shape promising urban landscapes (the 'enabling state')?
7. Which *urban amenities for urban actors* have to be provided in order to cope with 'voting by feet' in a civil society?

RESEARCH ISSUE C: SOCIO-ECOLOGICAL SUSTAINABILITY OF CITY SYSTEMS

Cities are seedbeds of innovation and socio-economic progress, but their dynamic evolution changes also the continuity and sustainability. Urban sustainability in terms of ecology, social dynamics and vulnerability of cities calls for a careful management and strategy development, with a view to a balanced future. There are threats by population explosion, but also by large-scale industrialisation and urbanisation. The fast world-wide urbanization leads indeed to the need for a solid research agenda with three components:

Research Theme C.1. Sustainability of Urban Systems

Examples of prominent research questions are:

1. Which operational solutions can be envisaged to realize *ecological sustainability* in cities (e.g. through smart cities or slow cities initiatives)? How can new technologies contribute to a reinforcement of the urban growth potential?
2. How are *ecological quality, climate neutral and zero-waste cities, resource use, and energy consumption* determining the future of cities *related to social sustainability* factors (e.g., high labour force participation, ethnic entrepreneurship etc.)?
3. How can cities become *attractive places for global talents/entrepreneurs and firms to achieve economic sustainability* (location patterns and behaviour, measurement and impact of entrepreneurial activities)?
4. Which new *theoretical concepts and frameworks need to be developed to model sustainable and liveable urban systems* including 'green' or 'blue' urban areas (also with respect to the demands of different target groups)?

Research Theme C.2. Social Dynamics, Diversity and Human Health

A set of illustrative relevant research questions is:

1. What new *social dynamics* (e.g., demographic changes, cultural diversity, social change) will emerge in cities and how can *cities respond to it in term of urban planning, care systems, housing supply, and education*?

2. Which *new health (management) systems* do cities need to develop into urban environments that meet the needs of the people?
3. What new policy conditions would have to be met to allow *cities to become places of social cohesion and diversity* to shape sustainable and balanced urban patterns?

Research Theme C.3. Vulnerable and Resilient Cities

Examples of relevant questions to be addressed are:

1. Which *preventive measures, actions and data systems* (e.g., social support systems, water management) may have to be put in place to ensure that cities located in vulnerable areas (e.g., Delta areas) can withstand the disruptive forces of nature, war, underdevelopment or short-sightedness?
2. How must *cities in less privileged or vulnerable areas* be designed to be attractive for people to remain?
3. Can *resilience theory* help us to identify critical infrastructures and other policy measures for a city to successfully advance in its development?
4. How can *cultural heritage in European cities be managed and developed* so as to reinforce the sustainable and socio-economic profile of urban areas?

The previous research issues, themes and questions are succinctly summarized in Figure 4 which presents the knowledge arena of the URBAN EUROPE SRF.

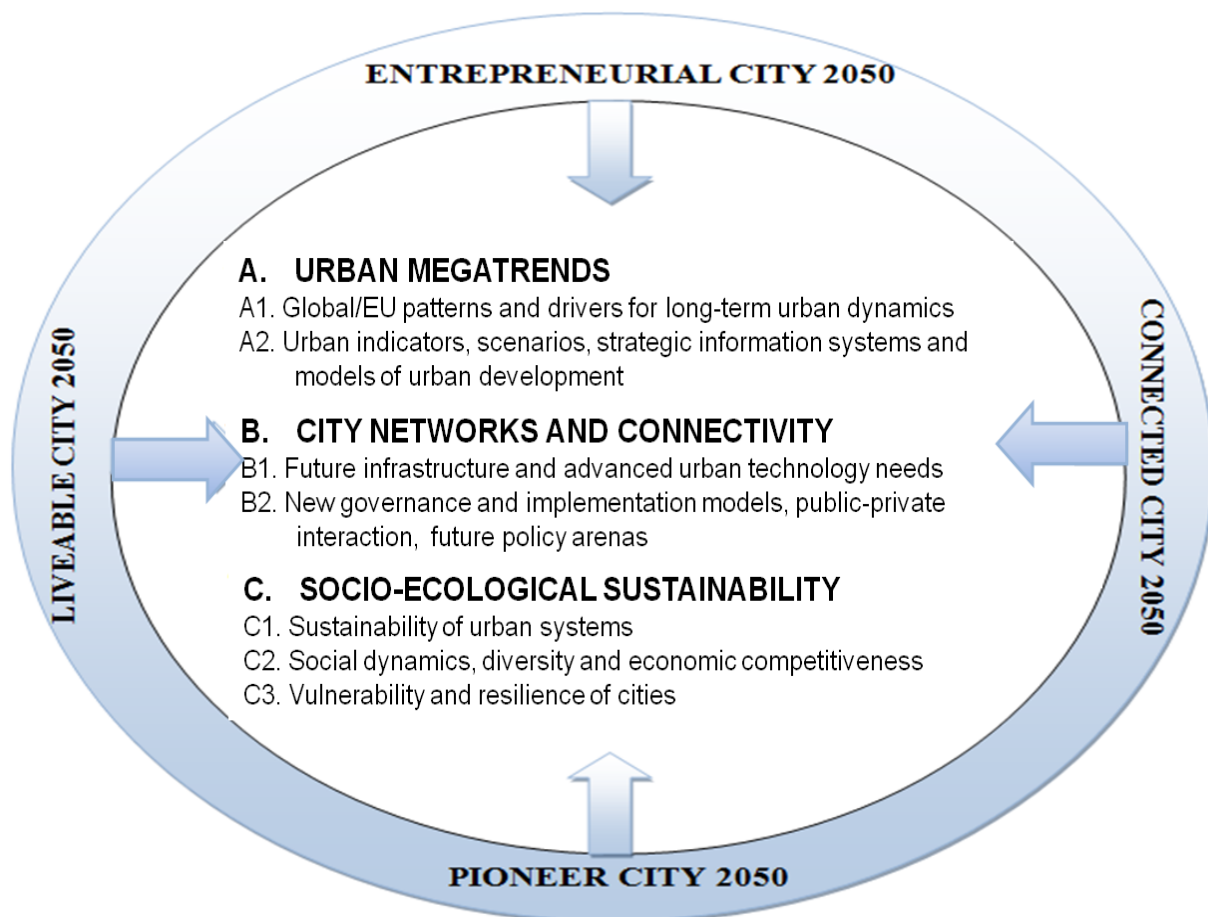


Figure 4: Knowledge Arena of the URBAN EUROPE SRF

The implementation of the JPI URBAN EUROPE is based on a multi-stakeholder, multi-task approach, so that in a stepwise way all ambitions can be realized. This calls for smart instruments – both organizationally and financially - which have to be tested during the pilot phase of URBAN EUROPE to be started in the second part of 2011. It seems reasonable to use whenever appropriate existing instruments. Further information on the details of this pilot phase as well as on the framework conditions (and related instruments) will be included in a follow-up document.

As a result, the JPI URBAN EUROPE aims at producing a variety of research outcomes supporting the establishment of European urban areas as attractive high quality places to live and work and set Europe apart as a global front runner for future urban development. The research activities initiated by URBAN EUROPE are expected to build European common ground by creating a joint knowledge basis for researchers and relevant stakeholders to comprehensively understand urban development processes and related determinants, to significantly advance scientific excellence in urban research by following an integrated, synergetic and human-oriented approach and to strengthen European urban areas and creating attractive and sustainable cities by developing integrated tools, systems and solutions for policy and decision makers.

1 Role and Purpose of the Strategic Research Framework Urban Europe

Europe will gradually but certainly move towards a diversified and urbanized geographical structure. A proper response to such far-reaching challenges calls for strategic research on many aspects of urban dynamics in Europe. This document offers the Strategic Research Framework (SRF) put forward by the Joint Programming Initiative (JPI) URBAN EUROPE to address European research and innovation challenges in the area of future urban systems from a trans-disciplinary, long-range and all-inclusive (i.e., all stakeholders involving) perspective. It sets out the likely directions of technological and organisational changes that need to be converted into concrete research programmes over the coming years. The SRF aims to outline the strategic goals of URBAN EUROPE and to map out viable action plans on research initiatives regarding future urban issues that are shared by a critical mass of stakeholders, while focussing on unique strengths and opportunities of strategic urban policy in Europe. It serves thus to offer the first anchor points for a concrete research programme.

This SRF is based on a great variety of discussions and outputs which have been developed following a series of subsequent venues with a broad participation of scientists and stakeholders to design a first European research programme on urban issues of strategic importance with a time horizon up to the year 2050. The main orientation and idea is to consider future urbanisation patterns in Europe as change vehicles for new opportunities to support and realise smart transport systems and land use, eco-friendly mobility, sustainable energy supply, a high quality of urban life, economic vitality, and broad social participation. Cities – and in a broader sense, metropolitan areas – tend to become – in the age of globalisation – spearheads of global competitiveness, innovation and creativeness, and it is therefore of critical importance to develop new concepts for mobilising local resources and potential opportunities of urban agglomerations in Europe. The purpose of the SRF is to guide and stimulate all those who are interested in and responsible for strategic European urban research themes and action plans, whether from a governmental, academic, industrial, social, funding, policy or regulatory perspective. The SRF does not list and carve in stone detailed research projects or collaborating actors; instead, it paves the way for an emerging and dynamic research programme by establishing a clear set of directions and choice priorities.

The starting point for building up an SRF for URBAN EUROPE is that urban developments in Europe have always been pluriform and heterogeneous, but this diversity in physical appearance, cultural attitude, socio-economic profile and historico-cultural heritage does not mean that there are no common research concerns for the future. Clearly, urban areas in Europe are all affected by globalisation trends, demographic and migration forces, and rapidly evolving new technologies (including ICT). A major task will be to use the rich historical legacy of European cities as a foundation stone for a sustainable future in which the economic strength, the logistic opportunities, the ecological heritage and the socio-economic potential of future urban environments are optimised. The research priorities proposed in the SRF are therefore organised along the four interlinked pillars identified in the framework of URBAN EUROPE: economic vitality and innovation, smart logistics and sustainable mobility, social participation and social capital, and ecological sustainability.

These strategic orientation lines on urban developments are in agreement with the Toledo Declaration (2009) by an informal council of European ministers in charge of urban development, where the following strategic objective was formulated: “to achieve a smarter, more sustainable and socially inclusive urban development”. This policy ambition calls for strategic action based on a solid research agenda. The present agenda makes an important contribution to research efforts addressing local responses to global challenges in the urban century, enabling discussion to begin at European level to reach consensus on the ways and means by which the URBAN EUROPE objectives can be achieved.

2 Development Process of the Strategic Research Framework Urban Europe

URBAN EUROPE is a new research initiative on the future of cities and urban areas in Europe. It is not starting from scratch, but will be solidly rooted in various relevant recent and ongoing initiatives on urban matters and will address and involve a broad range of stakeholders and research leaders (and groups) from a diverse disciplinary background. URBAN EUROPE seeks to provide socio-economic, policy-oriented and innovation-related research of a long-term and strategic nature. Thereby, URBAN EUROPE interlinks European efforts on a transnational level and aims to develop new insights and solutions – through an integrative, multi-disciplinary and multi-stakeholder oriented research perspective – that are not sufficiently or satisfactorily covered by conventional, mono-disciplinary or sectoral-oriented approaches.

In Section 2 of this document the development process of the SRF for the JPI URBAN EUROPE is briefly outlined. The first step implied a concise screening of existing conceptual and empirical approaches focusing on future urban development from different perspectives. With the understanding of urban areas as main driving forces of Europe's future economic, ecological and social development, additional and novel research demands with a strategic focus were identified. This observation has motivated experts and stakeholders in the context of URBAN EUROPE to design a joint ambitious programme on future urban research in Europe. For a further elaboration of the JPI URBAN EUROPE, a series of academic workshops, an extensive literature review and a consultation of stakeholders and experts were instrumental to arrive at the contours and outline of an SRF for URBAN EUROPE. In the following part the different steps and their lessons learnt for the SRF of URBAN EUROPE are presented.

2.1. IDENTIFYING RESEARCH NEEDS FROM A CONCEPTUAL AND EMPIRICAL PERSPECTIVE

2.1.1 Screening of existing conceptual approaches

Various new settlement patterns and spatial urban constellations and their dynamics have extensively been studied in the urban science literature from a variety of different analytical perspectives (see Nijkamp 2010 for a review). These perspectives depend also largely on the appearance of and view on cities in different conceptual frameworks in the literature. Examples are: isolated cities (Von Thünen), hierarchical city patterns (Christaller, Lösch), village cities (de Noronha Vaz), global cities (Sassen), world cities (Friedman), e-cities (Salomon, Cohen), network cities (Castells), city networks (Reggiani), or incredible cities (Kourtit). The most important concepts are outlined in the Scoping Report of the JPI URBAN EUROPE (see Nijkamp and Kourtit 2011). In short they are the following:

Urban Systems Science

The class of urban systems science comprises a wide diversity of different analytical approaches that aims to arrive at a basic understanding of drivers of urban dynamics, against the background of one or more stylised paradigms. They stem from different disciplinary

backgrounds, but have in common that they aim to offer a proper and theoretically founded explanation for the complexity of the urban system. This approach adopts normally a meso-systemic perspective on the development of city systems.

Proximity Externalities

The proximity externalities perspective takes for granted that urban size has no limits, as long as the economies of density overshadow the diseconomies. In particular, our modern age cities offer spatial advantages related to knowledge spillover effects and an abundant availability of knowledge workers in the labour market (Acs et al. 2002). Spatial concentration of activities, involving spatial and social proximity, increases the opportunities for interaction and knowledge transfer, while the resulting spillover effects reduce the cost of obtaining and processing knowledge. It should be added that cities are also faced with negative externalities. Cities have clearly many shadow sides, such as congestion, low-quality environmental conditions, social stress and segregation, high crime rates etc.

Resource Base

Cities are strongly dependent on their resource base. In the past, it was mainly the physical geography that determined the location of cities (riverbanks, seashores, geographically strategic areas in a country, presence of natural resources such as coal or water). In the past decades, industries have become much more footloose, and consequently the meaning of the physical resource base for cities has declined. But in the meantime, cultural and knowledge resources have assumed a more prominent position. The geography of urban systems exhibits a gradual transformation towards more footloose constellations and therefore, towards more volatile settlement patterns, in which virtual and real networks play a prominent role.

Learning, Creativity and Evolution

Since the early 1990s concepts such as learning regions, smart cities, creative cities, science-based regional development, etc. have received an increased attention among regional economists, urban planners, economic geographers and regional policymakers. This development marks the recognition that factors determining economic growth of regions (cities) are increasingly intangible (like institutions and culture), and increasingly mobile (like capital, codified knowledge, and – in part – human capital). The learning regions approach has the advantage over other approaches that it explicitly addresses the quality of policymaking and of other institutional conditions in the local economy and society. It prompts more interest in interactive and participatory ways of decision-making.

The various trends sketched above point at various promising directions in urban economic research: increase in realism, systemic complexity, and spatial networks orientation. However, there seems to be a need for a new wave of analytical efforts that would study cities from an applied equilibrium perspective, with a balance between (i) growth-inducing and growth-hampering factors, (ii) multiple (from micro- to macro-) layers of actors and structures in a city, and (iii) intra-urban and extra-urban force fields and networks. This 'multi-tasking' perspective is also needed to understand the dynamics in modern urban systems from a global perspective, where a rapid rise in urbanisation may be accompanied with both fastly rising and shrinking cities at the same time.

2.1.2 Screening of empirical approaches

Before designing the URBAN EUROPE SRF, an inventory has been made of existing similar research endeavours. Research agendas of existing initiatives on the relevant topics (socio-economic development, mobility, environment, transport, etc.) of the JPI URBAN EUROPE have been collected, coded with numbers and analysed. Thereby, research agendas of Europe-wide research initiatives appear to have focussed on, e.g., research agendas of ERA-nets, European Technology Platforms, Framework Programmes, sector-specific international research associations and multinational enterprises. Although no exhausting list of initiatives exists, the analysed agendas provide quite a comprehensive picture of the research strands relevant for URBAN EUROPE in the future. This screening of research initiatives has in particular focused on the time horizon, the scope and the themes of the different programmes.

Time Horizon of Programmes

Many existing research programmes on urban-related issues are oriented towards *current* actions. However, some programmes focus on future developments (see Figure 5). The medium-term outlook to 2030 is predominantly represented in many research programmes. Only two analysed programmes have an outlook into the far future of 2050. These two programmes focus on transport and energy issues which are only partly related to urban issues. Figure 5 also indicates the programmes with a clear urban perspective (marked in red). It is noteworthy that a strategic programme with a concrete urban and integrated orientation and long-term outlook is missing.

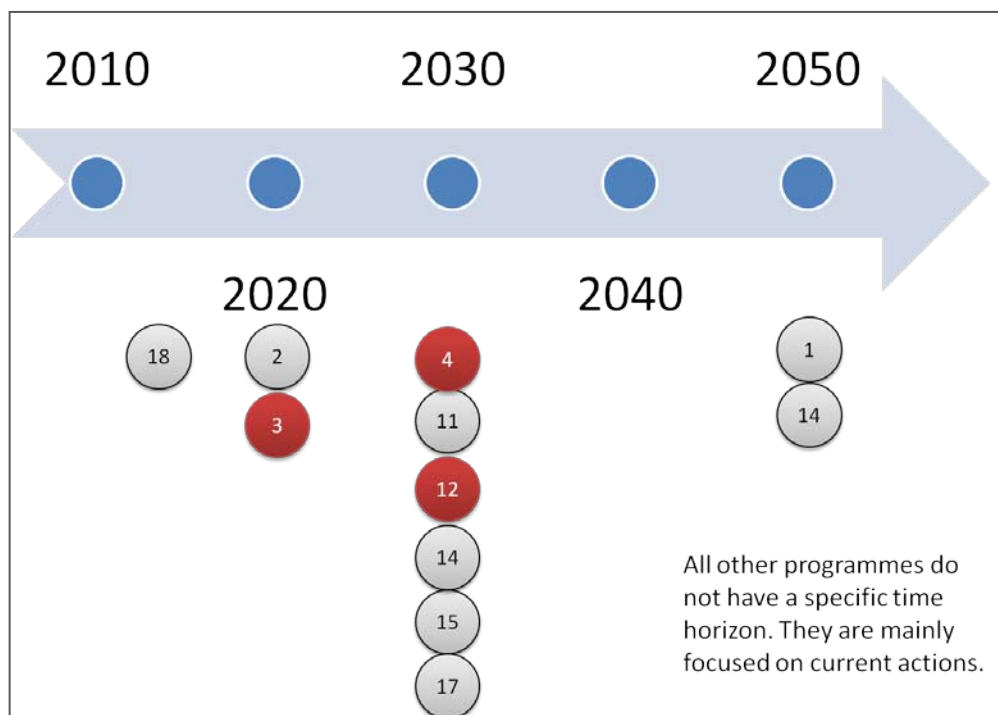


Figure 5: Comparison of programmes regarding their time horizon

Note: Research programmes have been coded, each number indicates a programme in the Annex A

Scope of Programmes

All programmes are primarily research programmes, while in the long run some programmes strongly aim to actively address policymakers and industry, e.g. with a focus on innovation and implementation. The scope of programmes can be divided into four categories:

- Focus on *knowledge generation* to solve problems and reach solutions/targets (researching at first place)
- Focus on *knowledge implementation and diffusion* to public and private firms and organisations (researching and knowledge sharing or cooperating with the applicants)
- Focus on *knowledge implementation and diffusion* to policy makers
- Focus on *knowledge networks* (accumulate knowledge, create networks and synergy effects).

From this classification, it appears that a specific programme can address one or more dimensions. Figure 6 shows that many programmes aim at pooling knowledge as such. Other programmes aim at pooling knowledge in networks to gain synergy effects through knowledge sharing. Only little overlap of circles exists, which indicates that many programmes have a clear focus on one of the issues where overlap exists; research efforts mainly go along with integration and extension of knowledge networks. Moreover, some programmes aim to develop novelties which are ready to be implemented by industries or policy makers. However, industry and policy are hardly addressed in the same programme. For urban research, there seems to be a clear need to closer couple the generation of knowledge with an emphasis on implementation by and diffusion to policy and industry at the same time (Figure 6 und Figure 7). Hence, URBAN EUROPE aims for reinforcing the links in the Triple Helix of governments, private actors and knowledge institutions.

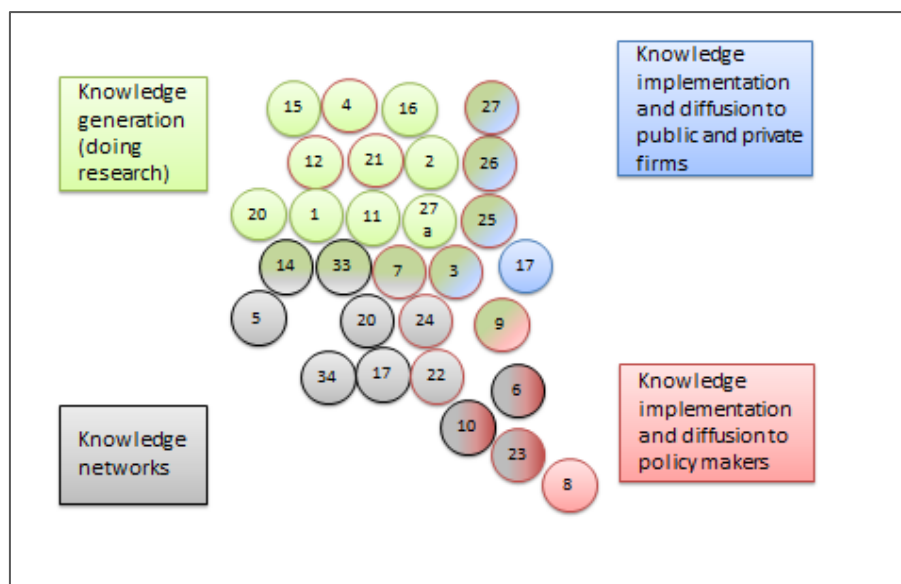


Figure 6: Comparison of programmes regarding their scope and aims

Note: Research programmes have been coded, each number indicates a programme in the Annex A

This is clearly a common task of governments at various levels, research organizations (such as European research and technology organizations), R&D centres, universities, and industry (both large-scale industries and SMEs). Sustainable urban development figures prominently in

the EU's policies on environment, regional development, health and transport. It is a complex, multi-issue area by itself, where issues can be articulated at the strategic, tactical or operational level. At each level different topics play a role which should be investigated, as a separate topic but, more importantly, in coherence with other topics. The urgency for practical solutions in this field differs between issues, topics and levels and is also dependent on the sense of urgency expressed by stakeholders.

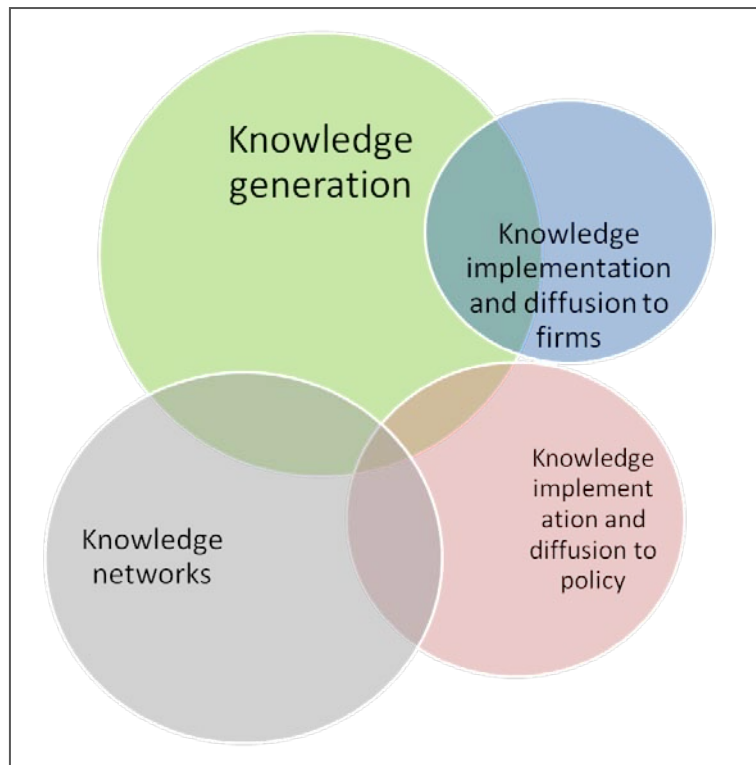


Figure 7: Research programmes and the innovation chain

Themes of Existing Programmes

About one third of the analysed programmes appear to focus exclusively on urban issues, whereas others centring on a specific dedicated issue (e.g. transport), do not have an urban geographical focus, although they touch on urban issues. As expected, mobility, energy and environment themes are very much technology- and infrastructure-oriented, whereas socio-economic themes focus on the development of concepts, models and network building in a behavioural or regulatory context. There is hardly a programme which focuses on covering the entire spectrum from technology- and infrastructure-oriented research combined with the development of appropriate business, governance and policy models taking into account a human centred perspective.

Although currently several (research and implementation) efforts are ongoing, so far no overall concerted and coherent approach has been designed to address future urban development in Europe as a complex network system with intensive interdependencies between the related social, technological and ecological subsystems. This requires substantial research efforts in developing joint views on future urban areas, their functionalities and conditions as well as new instruments, tools and methods for assessing and realising new urban design, governance

and management approaches. Figure 8 presents the research needs identified by the screening of conceptual approaches as well as existing research initiatives. They provide substantial input for the orientation of the SRF URBAN EUROPE.

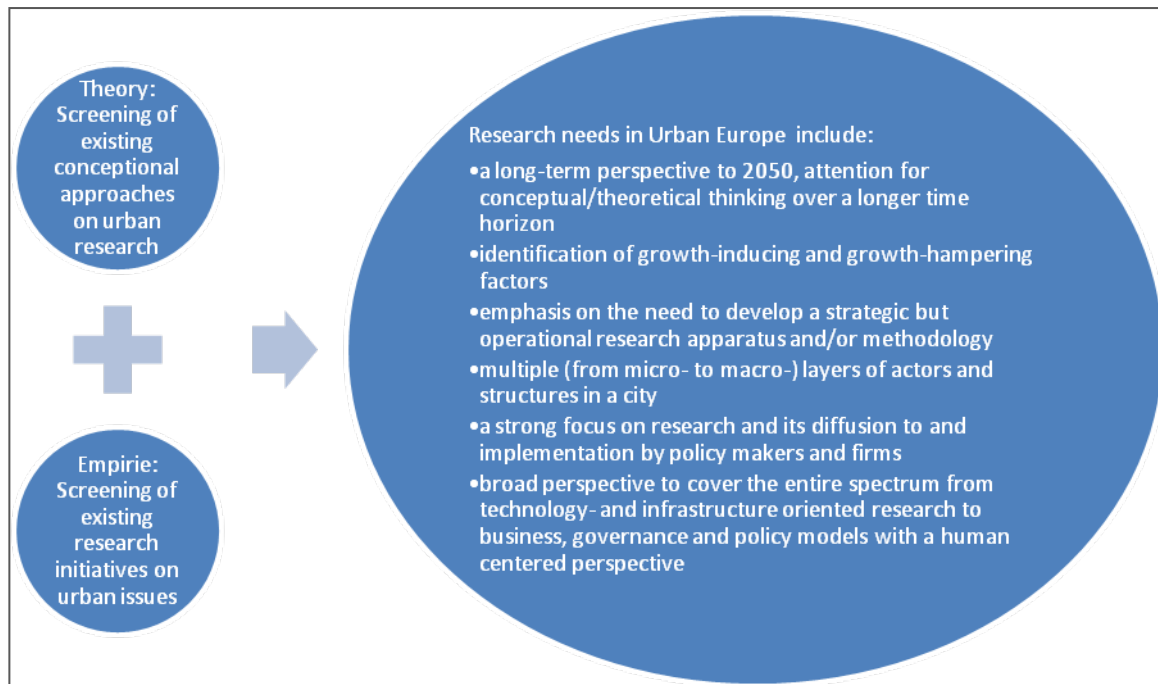


Figure 8: Screening of existing approaches and identification of research needs for the SRF of URBAN EUROPE

2.2. ELABORATING THE INVOLVEMENT OF EXPERTS AND STAKEHOLDERS

To turn the research needs into a research agenda, a series of (scientific) workshops was organised inviting representatives of the supporting EU Member countries, stakeholders from existing initiatives, and a broader group from the urban research community. Experts in urban research played a key role in offering new ideas so as to ensure that identified research issues are in line with the state of the art research. It also turned out that there are a number of initiatives which address different technological dimensions of the challenges urban areas are confronted with. For these initiatives, URBAN EUROPE will provide the tools for developing, assessing and aiding their implementation through supporting test-beds and pilot applications. Figure 9 presents the different workshops with their respective objectives and outcomes regarding the SRF development and involved participants to reach the JPI goals.

For the final research agenda the workshop series will be continued, so as to ensure a flexible and rolling agenda. Joint activities with the URBAN EUROPE Forum, the Scientific Advisory Board and other experts are planned before and after the summer of 2011. Consequently, the URBAN EUROPE SRF will not be crafted in stone, but will have an ongoing evolution, with a long-term strategic perspective.



Figure 9: Steps for an SRF of URBAN EUROPE

3 Strategic Research Framework URBAN EUROPE: Trends, Challenges, Vision

The ‘urban century’ is driven by various megatrends. A prominent one is the demographic development in our world, with a stable population in Europe and an ongoing rise in population numbers in Asia, Africa and Latin America. This has drastic consequences for the future of human settlements; mega-cities of 25 mln people are no longer an exception. Secondly, modern knowledge-intensive technology will have a major impact on urban systems, for instance, regarding energy provision, ICT applications, new building technologies, logistics and mobility (including mass transit systems). And, finally, we observe a high degree of fragmentation in the social ecology of modern cities, with more tensions between inhabitants. Social capital and trust are increasingly becoming scarce and this questions the *raison d’être* of an urban community (or urban ecology).

All these trends prompt a series of serious challenges (see Table 1) which ought to be addressed pro-actively and call for appropriate responses of all urban stakeholders. This is clearly in line with current smart cities initiatives and the “Innovation Union” plans in the EU.

3.1. FUTURE TRENDS AND CHALLENGES

Introduction

It is important to position the role of cities against the background of underlying mega-developments in our world (Table 1). The future of our planet will be characterised by global dynamics and by a great diversity at the local level¹. The Scoping Report on “Global Challenges and Local Responses in the Urban Century” (see Nijkamp and Kourtit 2011) argued that urban agglomerations will play a pivotal role in socio-economic, cultural, technological and political development, in particular, since our world will exhibit a rising orientation towards an urbanised future. In our modern knowledge society and competitive economy, creative strategies, radical new approaches to the governance, planning and management are increasingly required by metropolitan areas, business companies and organisations to become really competitive in a globalised world.

Economy

It goes without saying, that any urban way of life has to be supported by a proper set of values, cultural behaviours and infrastructures which act as determinants of an urban culture, not only for the residents of the city but also for business life. A city forms a complex ramification of many socio-economic forces that shape a seedbed for creative and innovative lifestyles, development of people, skills and capabilities as well as innovation. The relationship between business life and the city system is often underrepresented in urban economics, but deserves

¹ See for a general identification of ‘grand challenges’ also the Lund Declaration (July 2009) on ‘New World – New Solutions’, prepared under the Swedish EU Council Presidency.

full-scale attention. The growth and decline of business firms is critically contingent on urban seedbed and incubator conditions, knowledge production and adoption, creativeness and business potential, and adoption of a modern business lifestyle and culture in a digital economy (see also Acs 2002; Bögenhold et al. 2001; Romein and Albu 2002; Sexton and Smilor 1986).

Table 1: Trend-challenge matrix of URBAN EUROPE

	Trends	Challenges
1.	Structural urbanisation in past centuries: in 2007 50% world population in cities <ul style="list-style-type: none"> • 2050: 83% of the European population – nearly 557 million people – in cities; increase of migrants • double urbanisation: big cities grow into mega-cities (including political power) and medium-sized cities grow even faster into big cities 	Turn mass population movement towards urban agglomerations into new opportunities with great diversity Develop a balanced national (or supra-national) strategy for emerging connected city systems
2	Intra-urban accessibility and inter-urban mobility is under permanent stress Increasing levels of traffic congestion, a considerable number of accidents, and high levels of air pollution will place mounting pressure on cities	Manage sustainable accessibility and mobility of urban systems through new logistic and infrastructural concepts Public transport systems and mobility services require innovative organisational concepts, new sources of funding schemes and social acceptance notions; develop an effective and broad-spectrum urban policy to ensure that the benefits of agglomeration advantages are higher than their social costs through appropriate urban amenities, effective institutions, safety measures and citizens' participation
3	Urban mass concentrations are accompanied by many negative externalities: greenhouse gas emissions in cities and water quality are still worsening	Wide implementation of technical solutions; simultaneously strong emphasis on the acceptance of new technologies by citizens and change of behaviour and attitude
4	Climate change does not only affect coastal settlements, but all cities world-wide (e.g. urban heat islands)	Develop effective measures for monitoring and forecast eco-friendly and climate-neutral metropolitan areas
5.	Structural urbanisation tendencies are directly reflected in drastic land-use and infrastructural changes	Design a spatially-integrated and balanced urban land use strategy that is compatible with ecological sustainability
6.	Urban economies become pivotal vehicles for future economic progress and welfare through their productivity enhancing potential	Manage production and investments to the benefit of sustainable economic development of urban areas; ensure the development of people, skills and capacities for innovative ideas and growth
7.	Socio-economic exclusion and tension in specific districts of urban agglomerations are rising	Need for conflict management and pro-active inclusion strategies for less privileged groups in urban areas
8.	Uncontrolled urbanisation leads to urban sprawl at an unprecedented level and with a high ecological footprint	Design of fit-for-purpose institutional mechanisms and structures in a multi-layer dynamic system of urban areas
9.	Rapid urbanisation leads to drastic changes in the demand for public amenities	Satisfy the socio-economic demand of an increasingly large share of urban population for high-quality urban amenities
10.	Global economic restructuring means that city and city networks compete and collaborate in ways different from the past	Establishment of metropolitan governance and collaborative arrangements between cities; shift from government to governance

ICT

Accessibility and connectivity are of critical importance for urban vitality in an open economy (see also Bertolini 2006; Wegener and Fürst 1999). In recent years, the ICT sector is often

seen as a major complementary initiator of new activities. We have witnessed an upsurge of entrepreneurial initiatives closely connected with the rapid growth of the ICT sector (see, e.g., Cairncross 1997; Cooke and Wills 1999; Ohmae 1999). In the industrial organisation and management literature, much attention has been given to participation in, and access to, formal and informal networks as strategic mechanisms for creating increasing returns in an uncertain dynamic urban business environment (see, e.g., Borgatti and Foster 2003; Hoang and Antoncic 2002; Malecki 1997; Schiller 1990). It is generally recognised that modern dynamic sectors of the economy, in particular the ICT sector, have the potential to generate high returns, though often in a risky business environment. Access to knowledge and information is usually seen as a key factor for success in a risky entrepreneurial context. Clearly, an urban environment offers often a reduction in business risks through a dense (formal and informal) information network.

It is now an important question whether, in our age of advanced telecommunication, contact intensity and business access is best served through physical proximity of people and firms, or whether modern ICT systems create virtual connectivity without the need for geographic proximity (see also Nijkamp et al. 2009). There have been many speculations on the death of distance and on the space-opening character of the advanced ICT sector (for a review, see e.g. Cohen et al. 2004; Van Geenhuizen and Nijkamp 2007). But what are the empirical facts concerning the needs of business firms for geographic juxtaposition in the urban economy? And what are the costs of ICT-instigated urban sprawl (Travisi and Camagni 2005)? Does ICT favour footloose behaviour of firms, or will it reinforce urban agglomeration forces? How does urban infrastructure contribute to a better access or proximity? And what is the role of knowledge networks in proximity?

'Proximity' is a frequently used concept in geography and transportation, but it has different connotations. First, there is physical proximity in terms of a short straight-line distance or a short distance based on using a transport network. In fact, what matters in interaction is the time or efficiency in bridging such a distance. Geographic proximity is either a physical or a time concept, or both. However, in a social space there is also social proximity, i.e., a perceived small psychological distance as a result of impacts from social relationships, common habits and interests etc. (see, e.g., Gertler 2003).

Demographic Change

Structural urbanisation in past centuries results in 50% world population living in cities in 2007. In 2050 83% of the European population – nearly 557 million – are expected to live in urban areas. The challenge is to turn mass population movement towards urban agglomerations into new opportunities with great diversity. Moreover, a double urbanisation takes place: big cities grow into mega-cities (including political power) and medium-sized cities grow even faster into big cities. This calls for the development of a balanced national (or supra-national) strategy for emerging connected city systems. Next to the size of cities, urbanisation in Europe is strongly influenced by an ageing society which prompts the supply of many tailor-made amenities for a large share of the elderly urban population. The public health system needs large restructuring to serve people's needs. It is also clear that the socio-economic future of Europe is co-determined by the demography elsewhere in the world.

Historical Heritage

Most cities in Europe have a long political and cultural history and show fascinating signs from the past, so that an abundant cultural heritage is a landmark of most cities in Europe (which may create developmental constraints but also unprecedented future opportunities). Cultural heritage may become a great source of economic wealth (e.g., through tourism), but also contribute to social stability or place identify. In the Eastern European city the legacy of the communistic era may create special challenges which need adequate response. Europe has a unique urban cultural heritage which is distinct from many other regions and which may pose important developmental challenges.

Migration

Many cities in Europe have over the past decades seen the influx of large flows of migrants, from both within Europe and from outside, and this has induced a dramatic change in both the population composition and the socio-cultural behaviour of distinct population groups in large agglomerations. The attractiveness of cities for talents and the positioning of cities in the brain circulation curve will play a critical role in the future to build capacity. On the other hand, cities are responsible for the integration and education of new citizens to benefit from the diversity of people and avoid poverty and social exclusion. Especially the position of second- and third-generation migrants is important in this context. It is evident that Europe is not an island, but will be faced with the consequences of an open international system.

Environment and Climate Change

European policy-makers are attempting to steer cities towards more sustainable places. In fact, there is currently a new ripple of innovative local action on sustainable development. But despite these efforts, greenhouse gas emissions, water quality and other key indicators of urban sustainability are still problematic – buildings and, in particular, transport being the main polluters. Two-third of the energy consumption takes place in cities, 80% of the greenhouse gas is produced in urban areas. Clearly, original and sophisticated policy instruments are essential for efficient resource management, environmental monitoring and sustainable land-use. Cities' problems are ultimately caused by the everyday behaviour of individual citizens and businesses, and we will only achieve urban sustainability when the impacts of this behaviour change. In many cases, technical solutions already exist, but have not yet been widely implemented (e.g. houses combining photovoltaic with advanced insulation). There is an obvious need to identify barriers in behavioural adjustments of citizens. Therefore, balanced sustainable urban development and planning policies are needed.

Moreover, many cities and urban agglomerations in Europe are located in Delta-areas, for instance, near the seashore, near rivers or lakes; with the anticipation of climate change and sea level rise, these urban areas may become vulnerable areas, so that the need for safety strategies is increasingly imminent. Heat stress, flooding and drought etc. will inevitably present a greater threat to poor and disadvantaged communities, particularly in high-risk areas. Risk assessment and management are critical in preparing urban areas for climate change. Information on spatial and temporal impacts of climate extremes and growing trends will help inform risk management in all spheres of urban planning and governance. Education,

infrastructure and economic development will become increasingly important in maintaining acceptable levels of quality of life and safety with climate change, not only in Europe, but also in the developing world. Urban issues become a global concern.

Transport

Increasing levels of traffic congestion, a considerable number of accidents, and high levels of air pollution will place mounting pressure on the mobility services, particularly in the larger urban areas. The rise in car ownership, combined with the growing separation in traditional cities between employment, shopping, leisure facilities and living areas is increasing the number and length of trips. This in turn intensifies transport problems, thus hampering mobility with increasing costs for the economy. This will give rise to comprehensive, integrated service concepts and business models that complement existing modes. Extensive cooperation between the various actors in the chain will serve to optimise the movement of goods and people to better reflect the actual demand for mobility services (including public transport). More customer-oriented services and tailor-made solutions must be developed for intra- and inter-urban transports. Financial resources are needed, but public funds available are limited and strongly disputed. The shortage of public funds calls for better accountability of public expenditure for public transport and alternative financial resources.

City Networks and Governance

Many cities in Europe have – especially with the intensification of European integration – built up a high degree of physical and virtual connectivity (through road, rail, airline, waterways or communication infrastructure), with the consequence that many urban regions in Europe may be characterised as city networks linking urban areas over quite a distance (e.g., Ruhr area, Øresund area, Randstad Holland etc.). City networks and the distinct position and image of each city will increase in importance in future discussions. Global economic restructuring means that cities and city regions now compete and collaborate in ways that differ markedly from the past. Urban governance of cities and city networks with enhances citizen participation requires organisational innovation to achieve integrated urban management. The shift from ‘government’ to ‘governance’ requires city governments to become more effective in working with other stakeholders.

In addition to a strategic re-profiling of urban areas into integrated network cities, we also observe gradually a new transformation of cities into (regional, national or even global) spatial-economic networks. Urban areas are becoming nodes in global city networks (Taylor 2004) in which regional and national borders will play a less important role. This new development may turn into a new urban revolution in the history of human settlements. This may lead to the emergence of e.g. hierarchical networks or interconnected global networks of urban agglomerations. Clearly, this may prompt new research endeavours on complex network analysis (such as the analysis of black holes, scale-free networks etc.). City networks may become a source of creative and strategic research in the future of metropolitan areas.

In conclusion, URBAN EUROPE brings together creative strands of thoughts to develop future-oriented strategies, initiatives and instruments that can be successfully implemented. In order to make the above vision and strategy concrete and tangible, strategic objectives and long-

range operational research strategies need to be formulated, so that it becomes clear which activities have to be undertaken in order to implement effective future-oriented strategies.

3.2. JPI URBAN EUROPE: RESEARCH ORIENTATION AND APPROACH

3.2.1 Research Orientation

Building Capital for the City of the Future

The exposition offered above demonstrated clearly that urban areas are subject to a great variety of forces that influence their morphology and functioning in a drastic and irreversible way. As a consequence of these mega-trends, urban agglomerations are faced with a broad spectrum of challenges of various kinds, which call for smart and sustainable responses. A rather representative – but by no means exhaustive – overview of such trends and challenges was already offered in Table 1. This diversity in challenges and response calls for a systematic analysis framework through which anchor points for effective action can be identified. To pave the road to a promising urban future, URBAN EUROPE seeks to provide original and new urban policies and design strategies along four action lines by:

- developing urban areas in Europe as hubs of innovation and test beds building on a pool of talents and firms, new functionalities, services, governance modes and communication systems connecting people and knowledge;
- realising eco-friendly and intelligent intra- and inter-urban transport and energy systems, efficient logistics services and facilities for the supply of necessary goods to support the urban (trading) activities;
- ensuring social cohesion and participation by developing new concepts of social care systems, citizen-friendly neighbourhoods and built environments, and social accessibility; and
- reducing the ecological footprint of cities by using smart energy supply and demand solutions, eco-housing (sustainable built-environment solutions), smart mobility and logistics strategies, and renewable resources.

The JPI URBAN EUROPE position document has consequently highlighted four significant goals in creating a strategy for the future. These pillars provide the principles through which URBAN EUROPE stakeholders may manage the increasing concentration of people in Europe in urban agglomerations, with a view to the design and implementation of a liveable, sustainable, accessible and economically viable environment and settlement pattern for European citizens. URBAN EUROPE should build urban capital for the future. “Capital” is characterised here by the resources of a city and the offers it can make to its people and firms. URBAN EUROPE contributes to optimise urban capital that should comprise:

- **Creative Economic Capital:** Cities and city networks as sources of economic vitality, resulting in successful competition in the international knowledge economy through the development of people, skills and capabilities.
- **Infrastructural, Logistic, Connectivity and Communication Capital:** Cities as nodes for smart logistics and sustainable mobility, at both intra-city and inter-city levels, in which technological solutions support the changing needs of citizens

- **Social and Cultural Capital:** Society as a seedbed for a broad socio-economic participation and cultural diversity in an ethnically segmented urban system.
- **Environmental Capital:** Cities as centres for sustainable ecological development and for sustainable energy production and use

These four constituents of urban capital are each of critical importance for the new economic geography of an interconnected Europe. They should be balanced against each other, but are also mutually connected. Thus, linking together these four areas in an interactive chain is an essential task of each urban policy. For example, technology adoption a policy analysis as a focal point of urban strategy should be addressed in all four types of capital. We will now concisely describe these four classes of capital.

Create economic capital deals with factors that can create and maintain an environment (social, technological and educational) to attract a critical mass of talents and innovative entrepreneurs to compete on international markets. Next, *infrastructural, logistic, connectivity and communication Capital* aims to create an innovative system of transport hubs (public transport, ports, inland terminals and transshipment points) as well as communication hubs to interlink the European network of cities and to ensure a time-sensitive flow of information, goods and people, while reducing their ecological footprint, their congestion and accident levels. *Social and cultural capital* requires evidence-based research in order to develop urban areas with social cohesion and integration, to exploit the new advantages of these opportunities through social innovations, and to simultaneously predict and avoid risks of large-scale urbanization. And finally, *environmental capital* seeks to identify strategies by integrating sustainable and environment-friendly energy, buildings, production and transportation systems related to the development and implementation of new transportation and energy concepts characterised by high efficiency, safety and overall a reduced ecological footprint.

JPI URBAN EUROPE: Managing the Interfaces between the Pillars

The four URBAN EUROPE pillars have individually received extensive attention in various distinct disciplines, such as social and economic geography, urban and regional economics, transportation and logistics, urban demography, political science, planning theory, urban ecology, business administration and environmental science. But the interfaces between these pillars have received far less attention, although it is likely that new perspectives and achievements are to be found on these interfaces. Research on the edges of these four URBAN EUROPE pillars is however, difficult, as it needs a clear interdisciplinary orientation that is centred around the future sustainability (ecological, social, economic, logistic) of urban areas. But precisely at these interfaces one may expect breakthrough innovations on the functions of cities in the future (ranging from 2020 to 2050). Scientific research in this area needs long-range strategic foresight experiments, multi-component modelling based on non-linear dynamic (complex) systems analysis, and the use of advanced research tools from different disciplines, based on solid information systems.

It goes without saying that the related policy and research tasks – especially on the edges of these anchor points – are formidable and call for evidence-based scientific underpinnings of

urban development strategies in both a short-term and long-term perspective. Europe has a strong tradition in urban research which often plays a pioneering role in the global research community. Notwithstanding its high-level profile, European urban research is also fragmented and needs more synergy. A more integrative perspective is a *sine qua non* for understanding and shaping a sustainable future for an urbanised Europe. To this end also appropriate and accessible information and research tools for European urban policy have to be developed. And therefore, the creation of a learning urban community of experts and stakeholders is needed, through which an enhancement of strategic research on European urban areas and mega-cities can be realised with view to more efficiency, effectiveness and comprehensiveness of urban policy in Europe.

It should be noted that urban development and urbanisation patterns in Europe exhibit patterns that are often rather different from urban agglomerations elsewhere in the world. A few remarkable differences are:

- urbanization in Europe is strongly influenced by an ageing society which prompts the need for a supply of many tailor-made amenities for a large share of the elderly urban population;
- many cities in Europe have over the past decades seen the influx of large flows of migrants, from both within Europe and from outside, and this has induced a dramatic change in both the population composition and the socio-cultural behaviour of distinct population groups in large agglomerations;
- most cities in Europe have a long political, architectural and cultural history and show fascinating signs from a rich legacy, so that an abundant cultural heritage is a landmark of most cities in Europe (which may create developmental constraints but also unprecedented future opportunities);
- many cities and urban agglomerations in Europe are located in Delta-areas, for instance, near the seashore, near rivers or lakes; with the anticipation of climate change and sea level rise, these urban areas may become vulnerable areas, so that the need for safety strategies is increasingly imminent;
- many cities in Europe have – especially with the intensification of European integration – built up a high degree of physical and virtual connectivity (through road, rail, airline, waterways or communication infrastructure), with the consequence that many urban regions in Europe may be characterised as city networks linking urban areas over quite a distance (e.g., Ruhr area, Øresund area, Randstad Holland etc.).

URBAN EUROPE aims to lay the foundation for an operational, strategic and systemic research programme on future urban issues in Europe, while respecting the great diversity in urban developments in Europe. As outlined above the URBAN EUROPE research programme is based on four interlinked cornerstones, viz. economic vitality, smart logistics & sustainable mobility, social participation & social capital, and ecological sustainability. These four pillars are all encapsulated by the four above-mentioned classes of urban capital.

To extract from these cornerstones novel ideas for a systematic and coherent research programme, it is plausible and consistent to distinguish four related thematic city images on stylised appearances of urban agglomerations in the year 2050, which are connected to the above URBAN EUROPE cornerstones. Thereby, the four different strings are presented and interrelated in each city type. These images are not blueprint realities of urban systems, but

are stylized pictures of imaginary urban futures based on the four abovementioned pillars. Each of these four pillars has a future stylized mapping of the key elements of its appearance. These fictitious images prompt imagination on long-term strategies and trends and serve as backcasting instruments to explore priority key research questions to be urgently addressed, with a view to a vital, innovative, accessible and sustainable urban system (see Figure 10).

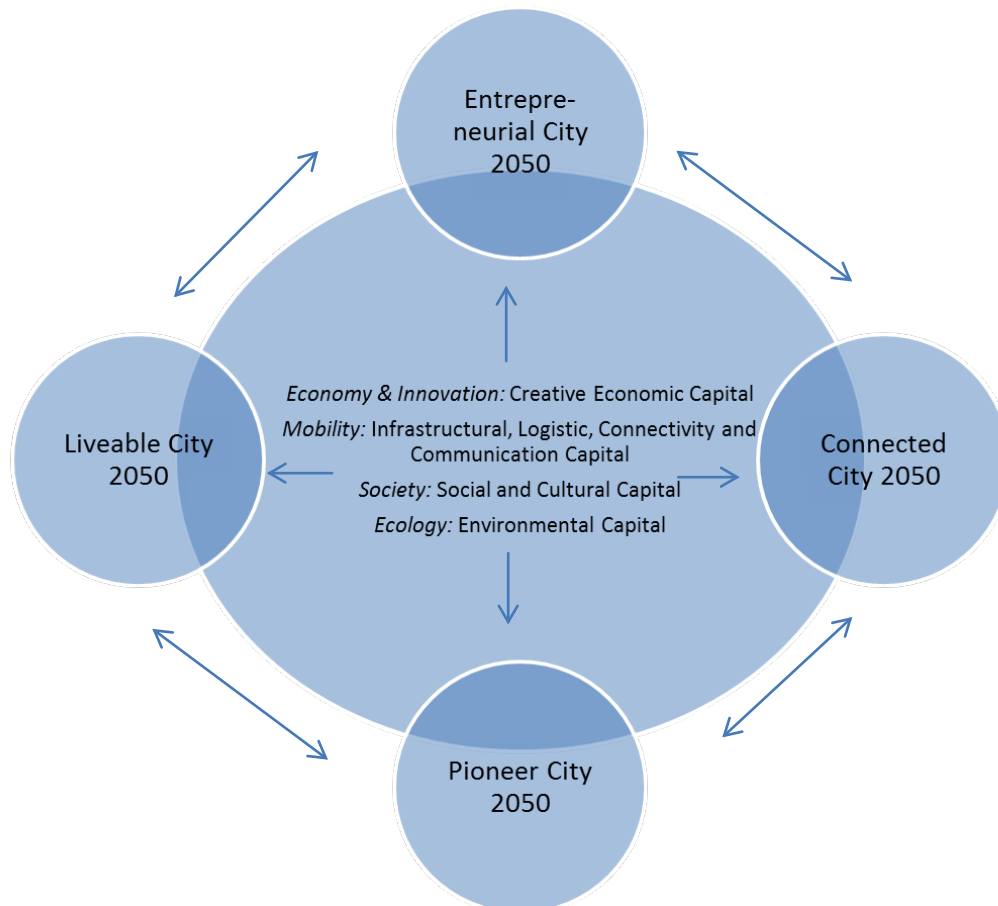


Figure 10: The four urban images 2050 and their interaction

Interaction of the Urban Images 2050

The four images from Figure 6 highlight the strategic dimensions of urban futures in Europe. The above-mentioned four urban images are by no means exhaustive, but they reflect the lenses through which one can look at the various knowledge and policy issues regarding the future of urban systems. They are meant to prompt original long-range research ideas that may lead to an innovative research agenda. They are of course *not* a research agenda in itself. They lend themselves for systemic approaches to URBAN EUROPE, they all need operational geo-science information and behavioural data to map out or understand uncertain urban futures, and they also reflect the need for strategic thinking on the governance of urban agglomerations in Europe.

These four ideal-typical representations of European urban agglomerations in the year 2050 are not to be seen in isolation, but they are interconnected (see Figure 10).

3.2.2 Research Approach

Interdisciplinary Approach

The rationale behind a reflection on the four city types is to produce innovative research ideas, from a scientific point of view, while identifying new perspectives on the interrelation and benefits of urban systems following a human-centred approach. Consequently, research activities need to be based on an integrative and systemic perspective including a broad range of different scientific disciplines and knowledge from relevant stakeholders, *inter alia* social and behavioural sciences, economics, geography, planning, architecture, psychology, and engineering.

Covering the Entire Innovation Cycle

URBAN EUROPE aims at strengthening urban areas and supporting them in their development and transformation to meet the broad set of challenges outlined in Table 1. This requires not only the development of new solutions within the scope of the four city perspectives, but also their evaluation under real-world conditions and finally their implementation. Thereby, feedback loops on different stages of the innovation process and the involvement of potential users of new city developments from the very beginning until the end of the projects should be given special emphasis. For that reason stakeholders and organisations covering the entire innovation cycle – universities, research and technology organisations, companies, public bodies up to cities and their citizens themselves – are invited to participate in the URBAN EUROPE endeavour. Only such an integrative approach ensures that research results in applicable solutions that are tested and relevant under real-life conditions, thus ensuring both ‘proof of concept’ and ‘proof of application’. Special emphasis will therefore be given to the implementation of technological improvements, the investigation of new business models, services or infrastructure, as well as the assessment of the implications of these solutions on human-centred networks and other types of behavioural change. A key element in that context is seen in the concept of living labs allowing for the demonstration, evaluation and customisation of new solutions according to specific city requirements.

Role of Stakeholders

In line with the claim to cover the entire innovation cycle, the various stakeholders have to be actively involved in the research and implementation programme of URBAN EUROPE according to their specific roles. This has already started with the integration of many stakeholder organisations in the development process of URBAN EUROPE and its SRF itself and will continue with their participation in research projects and implementation measures. All four above mentioned city concepts are defined in a way that this involvement is ensured, and stakeholder-specific activities, like policy concepts, business models, technological solutions etc., are seen as an essential outcome. The opportunities of public-private partnerships will be considered in that context, as well as the specific innovation capacity of SMEs and the active involvement of policy makers in order to create solutions that are efficient for and accepted by all different groups of citizens.

Organisational Resources

The integrative approach to research within URBAN EUROPE implies a high level of complexity both in the planning and conduct of development and implementation activities. As a consequence a high amount of organisational capital in all four city perspectives is needed. The successful implementation of research activities will require strong stakeholders at the interface between science, industry and society. In addition to cities and public bodies, research and technology organisations can actively contribute to this task.

Urban Information Systems

Cities and metropolitan areas are complex and dynamic entities shaped by the forces of global competition, but also by the endogenous forces of urban stakeholders, such as the business sector, city administration and citizens. To monitor and understand the forces at hand, transparent and reliable information on the dynamics of urban systems have to be designed. Linkage with existing databases (e.g., ESPON, Urban Audit, Eurostat, EVS, ESS) would then be very fruitful. Clearly, this is a priority task that has to be undertaken as a necessary part of any SRA. In addition, new developments in geoscience technology are noteworthy here.

3.3. THE FOUR URBAN IMAGES 2050

3.3.1 Entrepreneurial City 2050

Introduction

The European city-landscape is changing and European cities are facing major structural changes (demography, economy, culture, etc.) that will require scholars to look into long-term-oriented solutions. Density and diversity are two main urban features; they often result in an intrinsic economic potential advantage for the city, whereby the emergence and facilitation of streams of knowledge and innovation are interwoven with the urban tacit knowledge transferred within the city, such as coordination, confirmation and monitoring.

The objective here is to direct our attention to the city as an incubator and innovation hub of economic activities due to its density and diversity. The research covers two areas:

1. The entrepreneurs themselves, ranging from SMEs to multi-nationals, their socio-economic structure and their motives to engage in entrepreneurial activities as well as their interdependent relations to each other and to the urban economic system as a whole.
2. The specific institutional framework under which urban entrepreneurs have to operate and the governance system including policy instruments used to steer entrepreneurs. Entrepreneurial governance, interpreted both as governments' entrepreneurial choices and as policy towards entrepreneurs, involves identifying and exploiting local circumstances and factors that can spur entrepreneurship. Although closely tied, research in the "urban entrepreneur pillar" differs by identifying entrepreneurial behaviour and its (larger scale) consequences.

Aims of an Entrepreneurial City

The density and diversity of a city result in a potential advantage for the emergence and facilitation of a constant stream of knowledge and innovation: the pool of (specialised) talent and a fertile test-bed for new ideas gives an urban area a considerable edge in the production and diffusion of new knowledge leading to new products, services and processes. Hence, by relying on the entrepreneurial spirit of its population a city may constantly produce new economic activities best suited to the locational endowments of an urban environment at a particular point in time (i.e. technological state of the art). However, these advantages of urban concentration come with a price: there is no such thing as a free lunch. Ultimately the concentration will lead to certain diseconomies of agglomeration: land prices will roar as land becomes ever more scarce, workers will earn more than their more dispersed peers in rural areas, increased population density will lead to traffic congestion and the sheer amount of economic activities will drive up consumption of resources (land, water, energy, etc.) and consecutively pollution. Eventually, these diseconomies of agglomeration will drive out more and more economic activities, especially those which consume relative more of scarce urban resources like land or clean air, a process which many of the core cities of the industrial era had to endure when industrial activities were relocating ('decentralising') to cheaper locations. Urban dynamics may be understood as influenced by these two opposite forces of concentration and decentralisation. Thus, to overcome the fate of agglomeration diseconomies a city has to constantly reinvent itself relying on its superior innovative potential. Given this dialectic dilemma, urban regions are facing following challenges:

- Maintaining a vibrant knowledge production resulting in a constant stream of new ideas principally suited for 'commercial' exploitation
- Balancing the risks and rewards of putting ideas into practice (i.e. establishing a 'culture of success and failure' / 'trial and error')
- Attracting human capital with the potential for knowledge creation as well as knowledge exploitation
- Translating the potential of urban diversity (e.g. ethnic diversity, minorities, subgroups and subcultures) into a creative milieu fostering the innovative output
- Fostering formal and informal networks of the urban business environment ('cooperation culture') while maintaining a competitive environment

Research Approach

Urban systems are characterised by a constant change of their underlying economic structures. Older firms (or even whole industries) relocate outside the boundaries of the urban system (e.g. due to changed competitive arrangements induced for instance by changed input prices like land or labour), while new entrepreneurs or new firms may be generated from within or be attracted from outside. Analysing and modelling these processes and their impact on the urban economic, social and ecological system forms the centrepiece of the research approach.

The research approach will be based on the four pillars highlighted in the JPI URBAN EUROPE approach but will be especially focussed on the economic and social structures and processes within (and between) urban systems. Through the elaboration of measures for the new

requirements for efficiency, effectiveness and reliability of urban agglomeration networks, we will be able to develop pivotal urban diagnostics that can be the vehicles for the cities to advance sustainable production and growth within a broad participation and cultural diversity. The location of people and production also dictates the demands regions have toward the transport system.

Societal and Policy Relevance

If cities are sources of economic vitality, the implication is that society as a whole must participate in, and have access to, the formal and informal networks of the urban business environment. Understanding the role of entrepreneurship for urban development, its impact on various social subgroups and the relevant policies of how to stimulate entrepreneurship (and how to maximise the returns from a welfare-theoretical point of view) does have an obvious relevance for urban policy makers. This understanding will allow for the development of local endowments within an urban sustainability framework, for example, provision of educational infrastructure, utility provisions such as energy, access to the public transportation system etc.

Scientific Novelty

The research questions address issues that are on the interface of disciplines ranging from the humanities (e.g. the sources and the role of creativity and/or the 'sudden' urge of creativity in a certain urban area) to the social sciences like history, sociology, geography and economics and last but not least 'technical' fields like urban planning and architecture. The question of the uneven geography of creativity and entrepreneurship has been receiving increasing attention by scientists (and lately by policy makers as well) and is regarded widely as a crucial explanans to understand the regional variation of economic success.

Explicitly stressing research questions at the cross-roads of these disciplines might provide new insights on entrepreneurship and urban development. For instance, the hypothesis that real estate value fosters entrepreneurship via deposit-backed loans rests both on entrepreneurship theory and urban economics. Such combinations of research approaches at the crossroads of different disciplines/research traditions are still rare if present at all.

The quest for new indicators or new ways of how to measure creativity and entrepreneurship may lead to novel research questions and outputs. For example, a particular novelty envisioned is the use of performance indicators in research in order to verify and compare the urban attractiveness for companies and people. Although less useful in aggregate indicators, it helps the research's transparency and effectiveness if critical success factors (CSFs) and key performance indicators (KPIs) such as FDI inflows, job creation, and technological startups are evaluated and monitored.

Research Objectives and Questions

The metaphor of an Entrepreneurial City creates room for a broad and attractive strategic research area covering a wide, yet interconnected array of different research traditions, methodological approaches and theoretical concepts from various different scientific

disciplines. The main research areas (all of them approachable by different methodological approaches and research paradigms) are as follows:

- ***Measuring entrepreneurial activities over time and space***

A concise understanding of the nature of the various types and forms of entrepreneurship is a necessary prerequisite for any further analysis. We follow a very broad definition of entrepreneurship encompassing a wide range of creative and innovative activities. Developing different measures and indices describing these various forms of entrepreneurial activities we aim for a 'mapping' of these activities both over time (i.e. the dynamics of entrepreneurship over the long run) and space (i.e. the regional differences of entrepreneurship in the European urban system). Thus, it will be possible to derive 'hot spots' of creativity and entrepreneurship in certain times and spaces.

- ***Explaining locational patterns of firms***

This aims to explore the underlying causes of the empirical observable *time-space pattern of entrepreneurship*. Relevant research questions include the following: What are the reasons why some places have an outburst of creativity and entrepreneurship? Why are these dynamic periods often restricted to just a few spaces (i.e. hot-spots)? Why are these dynamic outburst restricted often at limited time periods? What are the common characteristics (if any) of urban regions / cities which are experiencing bustling entrepreneurial activities?

- ***Analysing the impact of entrepreneurial activities on the urban system***

Entrepreneurial activities may impact and influence urban development in various ways. First of all, they may lead to increased economic growth through the development of new firms or even a whole set of new economic sectors. However, in succeeding new firms may also outcompete older incumbents leading to structural changes which eventually may produce 'winners' as well as 'losers' (both in the same city as well as in other, competing regions). The European urban system is characterised by a complex web of a large number of small and medium cities and relatively few very large cities. The role of entrepreneurship for urban development may be somewhat different between cities of different size and economic specialisation. Especially some of the small and medium-sized cities do have a distinct specialisation profile in certain economic activities – often based on the (industrial) history of the city/region.

- ***Policies to stimulate business and innovation***

Entrepreneurship is influenced by a wide array of institutional framework conditions, different policy measures spanning from education to (local) tax policies etc. Some policies might influence entrepreneurial activities explicitly, others may have only an implicit impact. Analysing the role and importance of various policy measures (and institutional settings) is pivotal for a better understanding of how to improve the conditions for entrepreneurship and to foster entrepreneurial activities and their positive influence on urban development. Entrepreneurial policies might even compete with other economic policies. For example established, large firms and industries (incumbents) in large cities are not helped much by entrepreneurial policies. Given this observation, promoting small firm dynamics even if it provides economic opportunities to cities, both in aggregate dynamics and welfare over the long term, it might receive fierce opposition by existing power structures / groups in the short term. Hence, the critical analysis of existing power structures within urban systems

and the power struggles between various sub-groups might provide stimulating new research questions and topics.

3.3.2 Connected City 2050

Introduction

The image of a connected city refers to the fact that in an interlinked world, cities can no longer be economic islands in themselves ('no fortresses'), but they become nodes or hubs in polycentric networks. To establish urban networks for sustainable connectivity will determine the future position and competitiveness in a globalised world. The overarching starting point is that urban networks must be analysed from a multi-dimensional perspective:

1. The nature of urban networks: Networks can be of physical-infrastructure nature, e.g. transport-, logistics-, and energy networks. Next to physical connectivity in city networks, there is also virtual connectivity using advanced ICT. Moreover, social and knowledge networks on a psychological base determine the way data and information are exchanged. New forms of communication create economic externalities that are beneficial to all networks agents and participants involved within and between urban areas.
2. Objects of movement: In a modern world the efficient and effective movement of knowledge/information as well as movement of goods is of high importance. Knowledge and information can be embodied in people, but can also be transferred using intelligent systems. The transfer of knowledge/information and goods can be realised by various networks, whereas networks can be combine or substitute each other.
3. Geographical scale of networks: Movement of objects in networks can be analysed from different spatial angles ranging from global, to national, regional and local.

For sustainable connectivity in its broadest definition (People, Planet, Profit; so encompassing issues of social well-being, environmental sustainability, and economic prosperity and development) each of the three dimensions needs fundamental analysis to understand the structure of networks, the demand of mobility pattern and user acceptance on different spatial scales.

Advanced transportation infrastructures, smart logistic systems and accessible communication systems are facilitators of socio-economic activities and are, at the same time, their consequence. The efficient and effective movement of goods, people and knowledge are basic to a vital society.

Aims of a Connected City

Connected cities are faced with many societal and policy challenges in the future. Examples of such challenges are:

- To foresee future pattern of geographical concentration of people and goods and its relation to high densities of economic activities and new demand for accessibility of places and mobility of people,
- To encounter the consequences of globalisation and changing demography on the structure and functioning intra- and inter-urban networks,

- To analyse the impact of new transport and communication technologies on spatial mobility of people and goods transport,
- To establish appropriate management and governance structure on various geographical levels to ensure efficient and effective connections of places
- To ensure accessibility in urban agglomerations while protecting quality of life and reduce the ecological footprints.

Following a systemic line of thought, also for the exploration of future urban networks for sustainable connectivity a *truly holistic perspective* is needed, which requires an integrated view on movement of information (via social and knowledge networks in combination with ICT networks), on the forward and reverse commodity supply chains (including traffic control, city distribution centres and flow consolidation etc.), on the integration of supply chains with passenger mobility, on an integration of inter- and co-modal transportation (including physical interchanges, real-time information, sophisticated ICT backbones etc.) or advanced freight and services logistics systems in urban areas (e.g., in relation to internet sales), on an integration of land-use policy and planning (and utilisation) of infrastructures, on an integration of policy development, technological development, economic and financial issues as well as issues regarding the behaviour of individuals, companies and governments.

Only an integrative perspective considering the multi-dimensional function of urban networks, actors and their interaction allows exploiting positive network externalities and respond to people's needs and therefore increase diffusion and adaption of newly developed models and concepts for public bodies and companies.

Research Approach

Research on connected cities considers urban connectivity from an urban networks perspective. Sustainable connectivity of cities depends critically on the current and future development and functioning physical and virtual networks (transport-, logistics-, ICT-, energy-, knowledge-, social networks), which themselves are both closely affected by and closely affect spatial development and locational choices of firms and households. These networks have been and will be decisive for determining and defining the opportunities for spatial accessibility and interactions, both physically and in terms of communication and information flows, and therefore have been and will remain crucial for the formation and development of cities. Research on connected city aims to understand how the different networks are interrelated and how the system of networks as such can be optimised under special consideration of people's demand and behaviour on the one hand and integrated policy implications on the other hand. Understanding the functioning of these networks, and formulating strategies and policies on their development and management to maximise their contribution to the city's prosperity and sustainability, requires a deep understanding of their possible role and potential in contemporary and future cities, taking a broad interdisciplinary perspective. Only then can we provide answers to the most pressing questions in this field, which includes themes such as:

- *Examining different types of urban networks*, notably transport, logistics, ICT, energy, knowledge and social networks; and *mutual interactions* between these networks (including complementarily and substitutability) to better prosper from urban networks

- *Understanding the spatially differentiated urban development* due to the existence and dynamics of physical and virtual networks in its broadest sense – both within and between cities, up to the international level, and from a *static as well as longer-run dynamic perspectives*
- *Designing and evaluating governance, management and demand models* for urban networks, e.g. involving questions on institutional set-ups, private versus public provision and control, cooperation versus competition between different governments; efficient and effective utilisation of new technologies, but also a wide array of questions on the role of access pricing and land-use concepts
- Describing the actual functioning and effects of networks, encompassing themes such as *robustness and reliability, quality of service, social interaction and knowledge exchange*, and social inclusion/exclusion; paying ample attention on *behavioural aspects* of network use, taking a *human-centred approach* (including user acceptance of changes in network structures and/or management)
- Understanding the *role, functioning and potential of hubs and gateways* as key focal points in *intra- and inter-urban networks*.

Societal and Policy Relevance

The societal relevance of this programme is immediate from the themes it addresses. The networks mentioned are decisive for the functioning of urban areas, systems of cities, and regions and countries in which cities play central roles. Research will address the determination and enhancement of social benefits derived from these networks, but also issues of accessibility and social inclusion/exclusion. At the individual level, the understanding of behaviour and identification of user demand and acceptability are aspects with a high societal relevance. A deeper insight into the optimisation of the functioning, management and interrelations of networks may bring significant gains to society.

The policy relevance is also immediately clear for those topics that address the organisation and responsibility of the supply and management of these networks. Moreover, the connectivity with and between cities are of high relevance for city managers and furthermore involve the national government due to their overall responsibility of providing the national physical infrastructure. Building sustainable city networks requires the involvement of the different departments of city (planning, infrastructure, economic and social development) on different scales (local, city, national, international). New governance and management structure of cities are needed to ensure an integrated implementation of new connection and supporting changing pattern of people's behaviour.

Scientific Novelty

The scientific innovation centres on the following advances:

- Understanding the interrelation of the different networks in the urban environment (including physical, virtual and social/psychological networks) allowing a determination of the joint influence of different networks in the striving for sustainability

- Establishing methods for determining benefits of sustainable, better connected networks in the future
- Development, evaluation and implementation of governance, management and demand models for urban networks
- Connectivity in and between urban areas as an element of city planning and management (connect actors and institutions)
- Enhancing the focus on human behaviour in the analysis of urban networks (needs, demands, acceptance)
- Consideration of robustness and reliability as well as flexibility and dynamics of networks in time (short-run and long-run dynamics)
- Connection of the network on different geographical level (local, regional, national, international)

Research Objectives and Questions

The Connected City 2050 generates many ingredients for an SRA and research objectives centering around the research theme:

Examining different types of urban networks and mutual their interactions

- new space-time information systems and urban modelling on individual transport moves in a mobile urbanised society in order to change the mobility habits of people and provide a solid basis for evidence-based policies;
- the potential benefits of an all-inclusive urban transport and logistic system, which might lead to effective and sustainable movement of passengers, goods, energy and information (including electric bicycles, electric/non-emission vehicles, mass transit systems, and inter-, co-, and trans-modal freight systems); the increasing growth of internet sales requires a re-assessment of additional distribution concepts, including logistics service points, city distribution centres, etc.
- studying the interrelation of networks, how social and knowledge networks affect the use of ICT and passenger mobility pattern, analysing the behavioural pattern of people and their potential for change

Understanding the spatially differentiated urban development from a static as well as longer-run dynamic perspectives

- standardisation of urban infrastructure technologies to secure interoperability of such technologies and to foster Europe-wide applications
- developing efficient and sustainable methods and concepts to facilitate freight demand and flows related to large logistics and production sites (of supra-regional interest) that are often located near large urban areas and may have a decisive impact on their economic viability
- the advantages of multifunctional land use in urban areas (so as to maximise the economic returns from geographical density) on the basis of co-location of complementary functions in urban neighbourhoods
- understanding how the use of physical, virtual and social networks changes on different geographical levels (local, regional, national, international)

Designing and evaluating governance, management and demand models

- intelligent governance of drastic transformation in infrastructure, logistics, mobility and energy supply patterns in future urban systems
- concepts and models for smarter decisions about maintenance of infrastructures, optimising both direct and societal cost
- policy planning (including price incentives and incentives to stimulate mobility/demand management), and spatial and infrastructural planning in order to reduce peak traffic, strong imbalances in traffic flows (including so-called 'tidal flows') and unnecessary long-distance transport in line with user behavioural models
- positioning of cities in the planning field of urban mobility, in spatial planning the local authorities and the private sector are the main actors; in accessibility issues the national government, the provinces and transport service providers are the main actors
- developing adequate governance structure to handle the increasing scale of the daily urban mobility as well as the energy demand, the scale of governance in regional economic and spatial planning is lagging behind
- developing demand based models on future transport use pattern to ensure implementation and adaptation of new technological and information systems.

Describing the actual functioning of networks, encompassing themes such as robustness and reliability, quality of service, paying ample attention on behavioural aspects of network use, taking a human-centred approach

- realisation of sustainable accessibility of places in cities, robustness and reliability of networks in short and long-term
- developing new models for financing the maintenance and sustainability of future urban networks in sharing responsibility

Understanding the role, functioning and potential of hubs and gateways as key focal points in intra- and inter-urban networks

- developing efficient and sustainable main hubs ('gateways') and hinterland transport infrastructures with special attention to efficient synchro/intermodal transport operations to handle international / intercontinental freight flows between urban regions across the world
- centrality of cities and their function as knowledge hubs and gateway to the hinterland, cities attractiveness due to knowledge networks in combination with excellent physical accessibility.

3.3.3 Pioneer City 2050

Introduction

Urban agglomerations have always been the seedbeds of pioneer thinking and societal innovation. Traditionally, cities have been the ideal market place for the production and exchange of new ideas and knowledge. Generating a constant flow of new knowledge needs the kind of people with appropriate skills and talent. The image of the pioneer city refers to cities as attractors for creators and makers as pioneers, tapping into the diverse skill sets of

migrants and native citizens. Pioneer cities are also hotbeds for the assessment and implementation of new (technological) solutions and provide innovative environments to take utmost advantage of these solutions by constantly implementing adapted or new processes and systems. For a comprehensive understanding of the impact of such new technologies, their user acceptance, the implications for new business scenarios, the changes in the urban innovation system as well as the increasing cultural diversity and fragmentation of lifestyles in European cities have to be considered and integrated into new urban models and governance systems.

The speed of technology uptake and its implementation into real solutions is highly related to the innovativeness of the city and the cooperation of the various stakeholders. The introduction of such new systems and solutions has to be accompanied by a multidisciplinary analysis of social and economic developments to not only reduce and avoid social tensions in urban areas but also to support the creativity and pioneering spirit of all citizens.

Aims of a Pioneer City

Urban areas are facing various challenges and the way a city addresses and tackles these challenges decides on the attractiveness and (economic, ecological, social) success of a city. To improve its ecological footprint and energy efficiency, to guarantee infrastructure accessibility and reliability, to implement new mobility, energy, health or business solutions cities rely to a wide extent on the introduction of new technologies. This furthermore requires not only the availability of new technological solutions but also their customising according to the specific city requirements, their practical evaluation and related risk assessment, as well as the adaption of city planning and governance processes to finally ensure a broad customer acceptance.

Urban areas with pioneer character offer the general conditions for cutting-edge innovations and developments beyond conventional approaches. In this respect, pioneer cities benefit from interactions among companies, universities and research institutes as well as governmental institutions and organisations, as these shape the urban innovation system and highlight their role as centres of excellence.

Pioneer cities provide the ideal environment for the development of new solutions and systems by

- creating and attracting pioneers through appropriate institutions, education, and social environment,
- acting as innovative test beds and living labs for taking the highest advantage of potential new technological solutions and
- interlinking economic growth, networks, diversity and a sustainable framework to create new knowledge and creativity in order to put pioneer cities at the forefront of new and innovative developments.

Pioneer cities aim at taking advantage of currently unused capacities and resources as well as of the heterogeneity of European urban areas in order to create pioneer mindsets and environments through a holistic and integrated perspective. This will prompt great opportunities for smart and creative initiatives in future cities, through which Europe can become a global pioneer.

Research Approach

Research on the prerequisites and conditions for establishing European pioneer cities considers the multi-dimensional character of innovation-building urban agglomerations. The development of new technologies and the investigation of their impacts are essential elements of pioneer cities. To further these developments, creative actors with a variety of backgrounds, cultures, ideas and motivations need to form the appropriate social capital of such cities. Urban areas which aim to become pioneer cities therefore have to provide the necessary drivers for pioneers. According to these urban concepts new requirements for efficient, effective and reliable infrastructures (such as energy, ICT, water, waste treatment and management, etc.) may occur. Since an appropriate infrastructure is essential for cities' attractiveness for companies and people alike and therefore their economic development, emphasis has to be given to the determination of these requirements within the scope of cities as complex systems.

Additionally, the importance of services steadily increases. Such services have to take advantage of the new technological opportunities, be accessible for all citizens, and provide added value for enterprises and people in the context of the overall city challenges, like emission reduction, congestion reduction, safety, resource allocation, and energy security. Such services, their availability and quality, are furthermore related to new business scenarios and the next generation of intelligent cities.

In this respect, the following research themes are of particular relevance in this area:

- Identifying the *attractors* and *motivators* for urban pioneer actors for creating stimulating environments
- Developing new *urban design, management and governance concepts* for facilitating and enabling innovative and creative developments
- Understanding the *key characteristics* of pioneer cities and their impact in order to encourage the generation of globally competitive European innovation areas
- Establishing *model cities and living labs* as evaluation test beds for improving the introduction and efficiency of new technological solutions

Societal and Policy Relevance

Cities have to face a wide range of different challenges, both at the social and the physical level. Pioneer cities must address these issues in order to create stimulating environments for creative minds. Firstly, there is a need to bridge the different social, economic and physical gaps. The goal of integration has to be expanded to different levels in order for a city to become a pioneering organism. Such multi-scalar and cross-thematic approach needs to be used in order to approach the new structural challenges that specific cities undergo. Research on pioneer cities needs to incorporate different adjustment costs and appreciate the winners and losers in order to sustain social stability and equitability.

Another important characteristic of the European urban space is its heterogeneity. European cities are diverse territories with unique characteristics. In that context, research activities do not only need to address this heterogeneous nature, but also to attempt to take advantage by building comparative urban advantages. In regards to migration, it is important to break the *lock-in* servile migrant trajectories and enhance cities' capacities to absorb in-migration flows.

Scientific Novelty

To make use of the opportunities of a globalised economy in order to advance and sustain the specific qualities of European cities a research approach that intrinsically combines a reflective process with the constant shaping and reshaping of the city morphology is called for. Interdisciplinary teams will not merely have to work together, but they must experiment with new approaches that include individual makers, thinkers and entrepreneurs in order to quickly understand and connect individual innovation initiatives with urban institutions. To understand, foster and further develop the interwoven technical, social and market dimensions of pioneer cities is a new scientific approach.

“Embedded research” calls for flexible, hands-on research approaches that demand the development of novel methods for assessing, developing and integrating new solutions by all concerned institutions. Application projects and business models will be quickly integrated into urban political programs and allow for pioneer cities as test-beds for new developments.

The idea of pioneer cities particularly requires the integration of a broad participation basis at all levels including various stakeholders. Research in this area must be driven by a truly holistic approach and must not be limited to academics and policy makers, but should also include NGO's, private firms, civil society, artists, and representatives of specific user groups.

Research Objectives and Questions

The Pioneer City 2050 considers all four interlinked cornerstones the URBAN EUROPE initiative is based upon. The following research objectives are of particular relevance within the research theme:

Identifying the attractors and motivators for urban pioneer actors for creating stimulating environments

- investigating benefits for diversity
- fostering self-organisation influencing urban development by appropriate governing structure
- creating a sense of participation – belonging – identity to sustain creative social capital
- providing environment for creating new pioneers and ensuring accessibility of infrastructure/services/technologies/information
- developing new concepts for efficient, effective and reliable infrastructures (energy, ICT, water, waste treatment and management, etc.)
- building new systems of incentives for user behaviour, entrepreneurship, etc.

Developing new urban design, management and governance concepts for facilitating and enabling innovative and creative developments

- adapting or developing new urban design, management and governance models taking utmost advantage of new technological opportunities for integrating the latest technological developments in mobility, energy and ICT
- understanding the new relationships of the citizens with their city based on the new technologies (e.g. individuals acting as sensors and actuators, crowd sourcing of city

management information & inclusion of marginalised groups, network science of city systems)

- improving our understanding of the urban metabolism related to the various flows of energy, communication and materials is essential for integrated spatio-temporal planning processes
- generating data, tools and methods to consider technological alternatives, assessing their risks and benefits, integrating them into overall urban planning scenarios for deciding on the best option for the given requirements
- developing integrated spatio-temporal planning based upon urban metabolism scenarios
- developing ambient urban intelligence
- establishing new governance structures for supporting self-organisation influencing urban development
- liberating management systems for facilitating pioneer developments

Understanding the key characteristics of pioneer cities and assessing their potential in order to actuate the generation of globally competitive European innovation areas

- evaluating success criteria by learning and gaining experience from existing pioneer cities
- studying the impact of pioneer cities on other cities/areas
- investigating the impact of boundary conditions of pioneer cities on European traditions and systems
- understanding the concept of pioneer cities as an innovative approach of its own (competitiveness, incentives)
- considering different scale levels and spatial contexts of pioneer cities
- using social and urban diversity for enabling and enhancing innovation and creativity (risk as opportunity)
- investigating capacities for absorbing in-migrating flows and using their potential

Establishing model cities and living labs as evaluation test beds for improving the introduction and efficiency of new technological solutions

- evaluating test activities and developing new evaluation methods and benchmarking for pilots
- developing new models and concepts for determining the (technological) potential of innovations
- acquiring new data and developing integrated city models for a more complex analysis of cities
- investigating relevant conditions and success criteria of living labs and innovative urban environments (e.g. social diversity, human and infrastructure resources, customer integration, connectivity, economy of scale) for improving the introduction and efficiency of new technological solutions
- understanding and utilisation of living labs including the standardisation of data acquisition and modelling for comparative analysis
- accompanying research to demo and research city projects in terms of best practice innovation, development and establishing of foresight stakeholder processes

Among the above described research topics, several case studies can be considered as pilot projects. A potential but not exhaustive list includes:

- Immigrants as entrepreneurs
- Use of technology for influencing urban lifestyles
- Building a framework for pioneer cities
- Self-organisation at the neighbourhood level
- Added value of the collaboration between designer and researcher

3.3.4 Liveable City 2050

Introduction

The image of the liveable city addresses the view that cities are not only energy consumers (and hence environmental polluters), but may – through smart environmental and energy initiatives (e.g., recycling, waste recuperation) – act as engines for ecologically-benign strategies, so that cities may become climate-neutral agents in a future space-economy; cities in Europe are then attractive places to live and work.

Sustainability as a general concept is of essential importance in this respect. It requires the reconciliation of environmental, social and economic demands alike and is based on a symbiosis between various, sometimes conflicting objectives. A sustainable city is more than an environmentally-benign city; it should also fulfil economic goals and act as a home for man. It has been extensively argued that a city - through its potential for agglomeration advantages - has far more opportunities for sustainable development than dispersed ways of living and working. Examples are environmental benefits from public transport instead of private modes, or energy efficiency for concentration of households. Clearly, there are also bottlenecks as a result of massive densities of people or economic activities.

Liveability itself denotes an integrating concept which emphasises the necessity of combining different perspectives. Particularly the interdependencies between technological and social developments are to be seen as mutually reinforcing. Potential risks have to be systematically assessed and new potentials and opportunities can be identified and used. Social issues are put at the forefront in order to take best advantage of technological developments and innovations for improving the quality of live and all related aspects and making cities more liveable and attractive.

Aims of a Liveable City

The aim of a liveable city predominantly lies in creating a “city for all” encompassing all relevant aspects such as health, security and safety in order to provide an attractive environment to live and work in for all citizens. Therefore, social issues play an essential role in this concept and need to be considered from an integrative perspective. New developments and innovative approaches tackling current challenges of modern cities need to be especially examined with respect to their impact on the city’s role as a pleasurable, attractive and safe place to live.

Environmental issues have to be particularly considered, as developments and growth in multiple areas such as economy, mobility, energy, and society are constrained by

environmental limits. It should therefore be recognised that the efficiency of the city in achieving sustainability goals is partly due to the ecological footprint of the city: a significant share of the environmental burden caused by activities taking place in the urban territory is exported to other areas. General goals as e.g. the carbon neutral city 2050 are therefore defined by the necessity to achieve climate change adaptation and mitigation with respect to demographic trends and resilience concepts.

Technology (especially ICT) and infrastructures are viewed as enabling functionalities for achieving the goals of liveable cities. Liveable cities should use their potential in reinforcing efficient processes. Developments in this field particularly call for new or adapted governance and management systems to serve as leading process, which is strongly supported by education. Urban planning and design has to understand and consider these potentials and integrate them in future urban concepts. This requires appropriate models, tools and concepts that allow for a fast evaluation of potential solutions and their efficient and sustainable integration into existing infrastructure and concepts.

Research Approach

Research on liveable cities must be based on a human-centred perspective and has to include all aspects for creating sustainable, attractive and safe, i.e. liveable urban environments. In particular, this predominantly demands a thorough understanding of what makes a city “liveable”, how it can be measured and what can be done in order to achieve an environment which is attractive for all groups of citizens. Technologies and systems need to be developed for analysing the characteristics and determinants of sustainable and attractive urban environments on the one hand, and on the other hand using that knowledge for building efficient management and planning tools in order to improve urban systems as for example mobility and logistics solutions, energy supply, or water and waste management. Research topics must contribute to the long-term goal of an ecologically sustainable and socially balanced city with prosperous economy and dynamic interconnections to other regions.

The most relevant research questions in this field refer to themes such as:

- Understanding the main *characteristics and determinants* of liveable cities with respect to the demands of different target groups
- Determining significant *indicators* for assessing the quality of life in a city
- Identifying main determinants and examining *interdependencies* of determinants in order to understand the impacts of particular factors
- Assessing major *challenges and opportunities* for achieving liveable cities
- Designing and evaluating *governance, management and planning models* for implementing sustainable and human-centred systems and solutions.

Societal and Policy Relevance

The urban environment is a multi-faceted phenomenon ranging from “hard” pollution indicators to “soft” quality-of-life indicators. In addition, it is the playing ground of many conflicting interests, institutionally, sectorally and geographically, so that the concept of the sustainable

city is an interesting test case for the notion of “civitas” or civil society. Therefore, a broad perspective on urban sustainability as a living lab is to be adopted.

The idea of a liveable city means different things to different (groups of) people as regards to participation, accessibility, health care, mobility, safety and security etc. The needs of these (groups of) people have to be investigated in order to set the basis for the creation of a shared solution of the “city for all”. Therefore, measures need to be developed and designed in order to ensure the inclusion of all groups and stimulate interactions between these groups. This requires the development of methods for addressing all target groups in an integrative way and creating implementation paths for new technologies. This also means including evaluation on how (the combination of) policy measures and management in general work, what effect they have and what the outcomes are. Within this context the component of psychology of the individual needs to expressly be taken on board (i.e. behaviour and related determinants).

Scientific Novelty

The scientific novelty lies particularly in the clear emphasis on an integrative human-centred approach. Social issues are set central while using technology to achieve the described goals. Technology development is not to be driven by “what is technologically possible” but rather by “what is required from a human centred perspective” in order to improve the quality of life in future cities and considering all potential side-effects influencing the quality of a city as a attractive and liveable place. This means not only looking at targets and groups but also looking into impact vulnerability and uncertainty. Putting social issues central to making a liveable city means that there are many added-value potential areas of research necessary and possible: for example, research into behavioural change and values, the psychology of individual decision making processes or the role of education.

An evident major problem in urban sustainability analysis is the definition and operationalisation of proper indicators, e.g., on density, green areas, pollution emission, waste water, energy consumption, noise etc. Many indicators are used and collected on an ad hoc basis and lack a clear policy and methodological foundation. In various planning evaluation studies, such indicators form the input for a multicriteria analysis. The creation of a liveable city incorporating all relevant aspects calls for a more rigorous and thorough basis for sustainability indicators, which has to be based on a network and systemic approach.

The integrative approach also embraces innovation as a spiral from the interactive activities of the involved parties: university, NGOs, business & industry, government and public bodies (extended Triple helix approach). The involvement of multiple stakeholders enables the improvement of services by combining different services (e.g. having energy and health care supply using the same system of communication) or by adding value by incorporating the so-called eco-system services into planning processes.

Research Objectives and Questions

The Liveable City 2050 should be a place for all: attractive, healthy, carbon-neutral, safe, smart and democratic. Research objectives related to this goal are:

Understanding the main characters of liveable cities with respect to the demands of different target groups

- what is the role of nature (active/passive) in cities
- what is the contribution of cultural heritage to the quality of cities
- how are globalisation, population changes and changing living patterns influencing the quality of urban environments
- how do different groups perceive the qualities of an urban environment; which group-specific preferences and priorities are existing

Determining significant indicators for assessing the quality of life in a city

- what are the indicators of sustainable, vital and dynamic environments for citizens and companies
- how can we measure safety and security (especially subjective safety and security)
- which behavioural changes indicate improvement or deterioration of the quality of life

Identifying main determinants and examining interdependencies of determinants in order to understand the impacts of particular factors

- how can transport planning fit in with the future working patterns
- how can re-using energy, waste, etc. influence city structures
- to what extent and in what way are the internal and external accessibility of cities affected by climate change and the energy transition
- what is the impact of new and sustainable logistics concepts and freight transport systems on mobility behaviour (e.g. increase of home delivery systems)
- how can emissions and noise be reduced while maintaining a high level of traffic and external safety
- which effect is created by incentives to stimulate sustainable behaviour (policy planning).

Assessing major challenges and opportunities for achieving liveable cities

- what is the role of urban size with respect to environmental decay (smart growth and new urbanism)
- how can we rethink the resilience (water issues, urban heat, impact on health) of cities
- how to realise sustainable accessibility of cities in the long term
- how to deal with social segregation and uneven distribution of high quality infrastructure.

Designing and evaluating governance, management and planning models for implementing sustainable and human-centred systems and solutions

- how to introduce participatory democracy this at the very beginning of the planning processes and at what level (district, city, etc.)
- which models and tools have to be developed for creating sustainable, vital and dynamic environments for citizens and companies; how can cities promote beneficial change
- what are the available (and new) mechanisms to allocate scarce urban land.

4 Strategic Research Issues and Operational Research Themes for Urban Europe

4.1. THREE RESEARCH ISSUES

The four urban images introduced in Section 3.3 were not meant to be the object of research in the JPI URBAN EUROPE, but were introduced as cross-cutting long-term pictures of possible appearances of urban systems which stimulated a process of envisioning and creative thinking on strategic research needs for future urban agglomerations. These four images may not be seen as four desired urban futures, but they offer a future panorama through which one may extract and identify important research concerns, in the form of a backcasting approach. Through these virtual constructs ('metaphors') – consistent with the four URBAN EUROPE cornerstones and the interfaces between the four cornerstones – it was possible, on the basis of an intensive interaction with stakeholders, to extract a variety of fascinating researchable long-range research issues from a topical perspective. The main task is thus to identify a limited set of systematic research issues under the URBAN EUROPE umbrella, which are coherent and map out the main research directions and issues to be analyzed. Such a scoping and filtering process is a prerequisite for an operational research programme based on a clear demand articulation.

A further analysis of all ideas and proposals put forward in Section 3.3 highlights the existence of a limited set of cross-sectional and recurrent issues on the future of urban agglomerations that make up a consistent picture for an integrated research programme of URBAN EUROPE. It appears that – in a direct or indirect way – three major research issues were mentioned in the different documents and meetings of URBAN EUROPE. These three interconnected axes of research issues to be addressed in URBAN EUROPE (see also Figure 11) are:

A: Urban Megatrends

- What are the prominent demographic, economic and technological megatrends that are decisive for a promising future of urban systems?

B: Urban Networks and Connectivity

- What are new mobility, logistic and land use developments and policies that are needed to create vital and attractive cities – and networks of cities – in the decades to come?

C: Socio-ecological Sustainability of City Systems

- Which ecological and social constellations have to be met and implemented in order to shape sustainable and balanced long-run urban development patterns (including energy systems) in Europe?

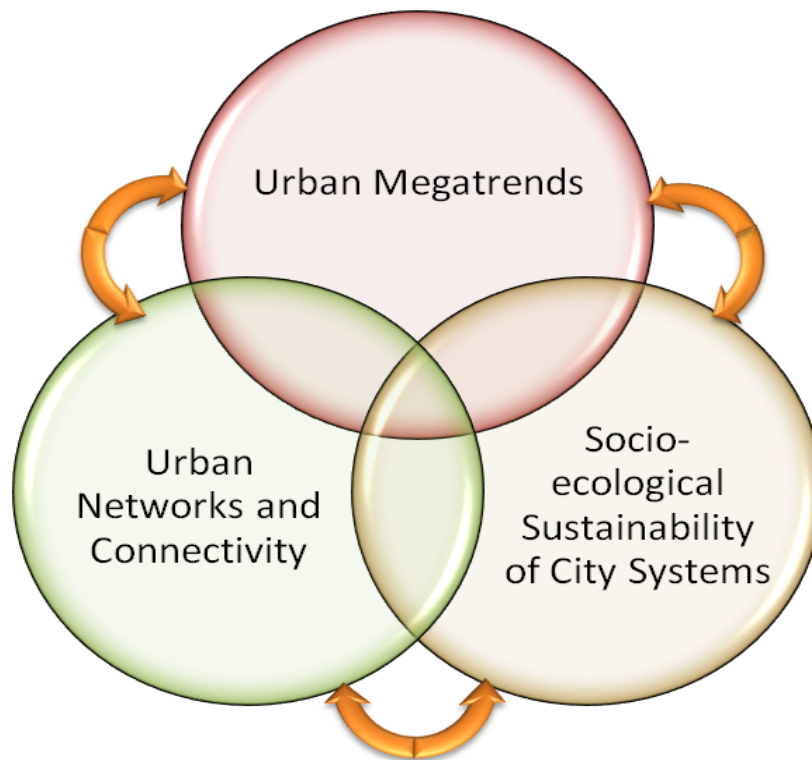


Figure 11: Architecture of the SRF URBAN EUROPE

The contents of the three research issues outlined above is a logical and systematic follow-up of the four urban images described before; they prompted a whole range of challenging research ideas, needs and concerns on URBAN EUROPE. This approach is schematically depicted in Figure 12 which offers a Research Landscape Matrix linking the above-mentioned four Urban Images 2050.

Each of the items in the Research Landscape Matrix of Figure 12 describes a research idea (either on the demand or on the supply side) which is consistent with the intersection of a given urban image with one of the three corresponding research issues. An important task was of course to integrate the various research ideas into a transparent and systematic framework that would lead to clear thematic research choices. The approach adopted here is based on a systematic scanning of all research ideas put forward in the process of envisioning, scoping and exploring the research agenda for URBAN EUROPE. All these ideas, concepts or proposals – put forward in alpha-numerical format in the discussion on urban images – could next consistently be allocated to one of the three research issues (see Annex B). A digital content analysis was employed to identify and extract the words with the highest frequency and relevance to confirm the findings of the systematic scanning and visualise them (see Annex C). The main building blocks for the URBAN EUROPE research agenda could systematically be identified and linked to the architecture of an URBAN EUROPE SRF.

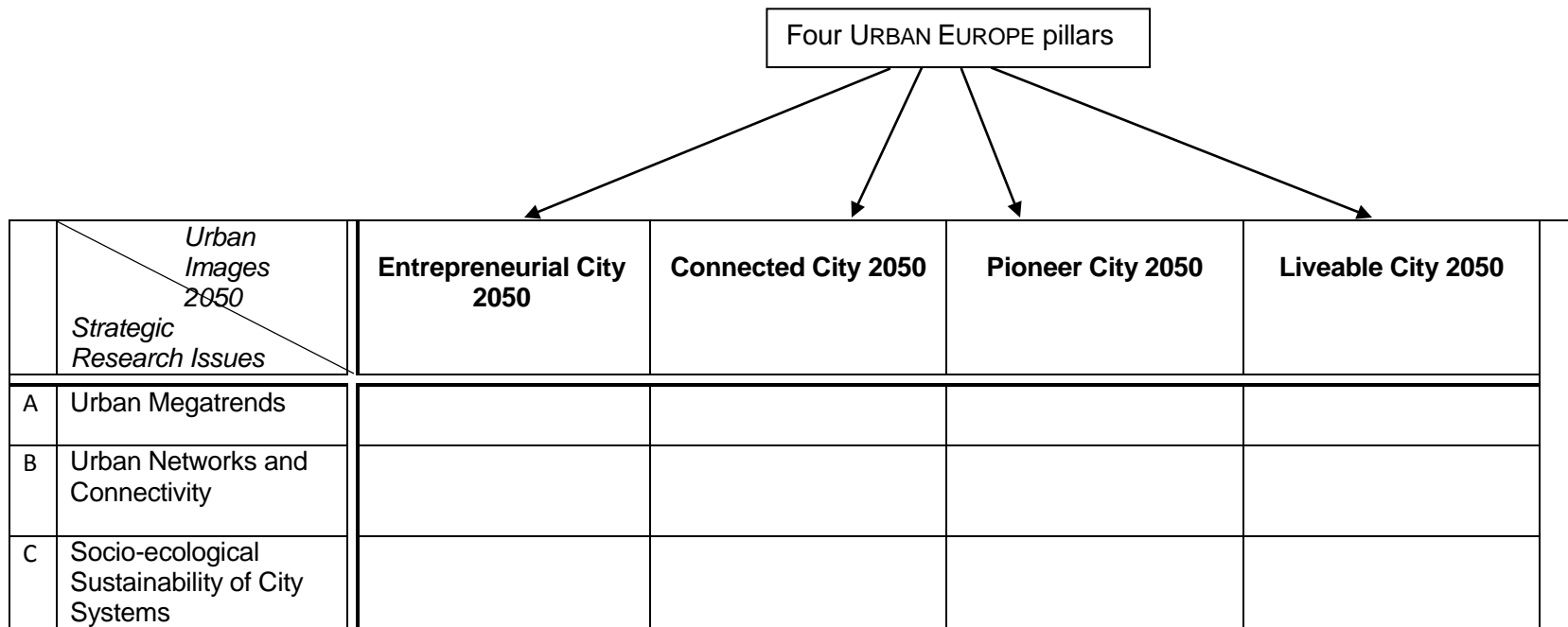


Figure 12: Research Landscape Matrix for the JPI URBAN EUROPE SRF

Legend: Entries in this Research Landscape Matrix refer to research ideas or research questions (see Annex B)

As highlighted above, the research ingredients of each of the four Urban Images 2050 should not be addressed in isolation, but should be integrated by looking at the interfaces among the various images. Thus, the main task for building an SRF is to combine in a consistent way various building blocks from the four columns of Figure 8, so that for each of the three rows (i.e., the research issues) a systematic and novel research agenda can be designed (see also Figure 9). A provisional formulation of this research agenda – systematically categorized according to three main research issues, prominent research themes and corresponding research questions – will be offered in Sections 4.2-4.4.

4.2. RESEARCH ISSUE A: URBAN MEGATRENDS

Urban development patterns demonstrate a surprising diversity in many countries. In our urban century, urban networks, regions and cities (including urban agglomerations, supernova cities / megacities and systems of cities) offer strong centripetal and centrifugal forces that will most likely be decisive for the economic geography of our planet. Future urban developments, economic changes and growth challenges call for a long-range research horizon, in which (new) technology, innovation, demography (growth and ageing), climate, culture and socio-economic developments are taken into consideration. There is a need for a systematic analysis and monitoring of the drivers and impacts of both micro- and macro-structural trends regarding urban dynamics. This prompts the formulation of two prominent research themes:

Research Theme A.1. Patterns and Drivers of Long-Term Urban Dynamics

The meaning of this research theme is exemplified by the following list of illustrative – and by no means exhaustive – research questions:

1. Which major *demographic, economic and technological driving forces* are critical for the development of urban systems, in which both growth and shrinking may occur at the same time?
2. How do these *megatrends affect and change the urbanisation patterns* in different types of towns, cities, mega-cities and urban agglomerations in various parts of Europe?
3. How can *space-time patterns of urban processes be systematically analysed* for developing *simulation models of urban development* based on relevant determinants?
4. What types of urban areas in Europe have the *potential for innovative leadership* in the decades to come? In which *economic, technological or social domain* is leadership essential?
5. How can *firms, policymakers and people respond to megatrends in order to shape and handle urban development* with a view to the creation of attractive cities and innovation hubs?
6. Which knowledge (and knowledge networks) are crucial to obtain strategic insight into urban change in Europe and how can this *knowledge be combined in a systematic monitoring system*?
7. What *new policy measures, planning concepts and governance models* are to be envisaged to safeguard urban sustainability in Europe?

Research Theme A.2. Urban Indicators, Strategic Information Systems and Models of Urban Development

Examples of relevant research questions are:

1. Which advanced and evidence-based *foresight tools* are appropriate for exploring the multi-faceted dimension development of urban areas (demographic, geographic, technological, political, economic, environmental, social)?
2. Which modern *data and indicators* can be developed to offer a realistic mapping of the impact of megatrends on urban evolution?
3. How can *strategic information systems* be built and made accessible and suitable for different actors (industry, policymakers, researchers)?
4. Which *conceptual and operational models and tools*, e.g. in relation to geo-science, urban scenario modeling, are needed for shaping the transformation of a city towards desirable urban visions (e.g., living labs, envisioning experiments, complex urban systems models)?
5. How can new *research instruments, concepts and toolkits* be sufficiently tested (proof-of-concept, proof-of-application, proof-of-policy relevance)? What can we learn from existing practices or other initiatives and how can model cities and living labs established as evaluation testbeds?
6. What are the central cornerstones involving different perspectives for *integrated governance models and modelling platforms*?
7. What can Europe learn from *urban developments and planning practise* elsewhere in our world?
8. Which methods and instruments can be used for *comparing the development of cities in Europe and globally* (benchmarking, best practise)?

4.3. RESEARCH ISSUE B: URBAN NETWORKS AND CONNECTIVITY

The urban world is highly dynamic and displays a variety of new mobility, logistic and land use developments that are decisive for vital and attractive cities – and networks of cities – in the decades to come. Urban settlements patterns move increasingly towards connected multi-functional urban areas: cities are complex networks, connected cities become higher-order networks, and mega-cities are becoming nodes or hubs of global command and control. Land use and infrastructure offer the material/physical facilities that support the socio-economic performance of urban systems (e.g., ports, energy grids, rail and road connections, IT systems, aviation networks). Urban agglomeration advantages are critically dependent on land use planning, housing, transportation and logistics, industrial locations and economies of density. A thorough investigation into this complex force field calls for the design and implementation of the following two research themes:

Research Theme B.1. Infrastructure and Advanced Urban Technology

This is a broad research theme on connectivity and accessibility in urban systems which prompt the following illustrative research questions:

1. Which radical innovations have to be designed to ensure *accessibility and connectivity in terms of transportation, logistics and mobility systems* for all urban citizens (the 'equity' motive) in and between cities?
2. How can *different types of urban networks* (transport, energy, logistics, ICT, knowledge) and their *mutual interactions* be designed and shaped for smart solutions for urban networks?
3. How can *new urban land use and planning tools* help to create attractive urban living (urban settlements and housing) and working areas using in an integrated urban design?
4. Which *new analytical and policy tools are needed to cope with rent gaps* in the urban built environment and which value capturing mechanisms for long-term balanced urban land use can be designed?
5. Which *social, institutional and economic conditions* have to be met to *successfully implement new technologies* and ensure *robustness and reliability*? Which *new services* and *information systems* are needed to make advanced technologies attractive and useable to different target groups?
6. Which *urban financial mechanisms and value added services* can be designed that ensure a *high quality of public transport* for new customer markets?
7. Which methods and technologies have to be developed for *influencing urban lifestyles* and developing *motivators for behavioural changes*?
8. Which *risk assessment strategies* have to be developed for ensuring the development of efficient and successful technologies?

Research Theme B.2. New Governance Models, Public-Private Interaction and Future Policy Arenas

Illustrations of important research questions are:

1. Which changes are to be envisaged in the *administrative competences of policy actors*, if the functional borders of cities (including urban sprawl and urban corridors) are expanding and shifting in our era of globalisation?
2. Which *actor-oriented design principles* are to be developed in order to create pioneer cities and knowledge hubs with a high degree of creativity and resilience in open urban systems?
3. How can patterns and drivers of user behaviour (in particular spatial mobility) be analysed and used for achieving high *user acceptance* of policy measures and solutions?
4. Which new *models and concepts of governance, management, demand and evaluation* in geographic, political, social and economic science are needed to ensure a matching between functionalities and competences in institutions, among agents and in space?
5. Which are the necessary *information and logistics systems* to analyze the matching of manifold demands for urban infrastructure provision and administrative regulatory systems?
6. What could be new forms of *public private interactions and governance* to shape promising urban landscapes at the interface of connected and liveable cities (the 'enabling state')?
7. Which *urban amenities for urban actors* have to be provided in order to cope with 'voting by feet' in a mobile and open civil society?

4.4. RESEARCH ISSUE C: SOCIO-ECOLOGICAL SUSTAINABILITY OF CITY SYSTEMS

Cities are seedbeds of innovation and socio-economic progress, but their dynamic evolution changes also the continuity and sustainability. Urban sustainability in terms of ecology, social dynamics and vulnerability of cities calls for a careful management and strategy development, with a view to a balanced future. There are threats by population explosion, but also by large-scale industrialisation and urbanisation. The fast world-wide urbanization leads indeed to the need for a solid research agenda with three components:

Research Theme C.1. Sustainability of Urban Systems

Examples of prominent research questions are:

1. Which operational solutions can be envisaged to realize *ecological sustainability* in cities (e.g. through smart cities or slow cities initiatives)? How can new technologies contribute to a reinforcement of the urban growth potential?
2. How are *ecological quality, climate neutral and zero-waste cities, resource use, and energy consumption* determining the future of cities *related to social sustainability* factors (e.g., high labour force participation, ethnic entrepreneurship etc.)?
3. How can cities become *attractive places for global talents/entrepreneurs and firms to achieve economic sustainability* (location patterns and behaviour, measurement and impact of entrepreneurial activities)?
4. Which new *theoretical concepts and frameworks need to be developed to model sustainable and liveable urban systems* including 'green' or 'blue' urban areas (also with respect to the demands of different target groups)?

Research Theme C.2. Social Dynamics, Diversity and Human Health

A set of illustrative relevant research questions is:

1. What new social dynamics (e.g., demographic changes, cultural diversity, social change) will emerge in cities and how can cities respond to it in term of urban planning, care systems, housing supply, and education?
2. Which new health (management) systems do cities need to develop into urban environments that meet the needs of the people?
3. What new policy conditions would have to be met to allow cities to become places of social cohesion and diversity to shape sustainable and balanced urban patterns?

Research Theme C.3. Vulnerable and Resilient Cities

Examples of relevant questions to be addressed are:

1. Which *preventive measures, actions and data systems* (e.g., social support systems, water management) may have to be put in place to ensure that cities located in vulnerable areas (e.g., Delta areas) can withstand the disruptive forces or nature, war, underdevelopment or short-sightedness?

2. How must *cities in less privileged or vulnerable areas* be designed to be attractive for people to remain?
3. Can *resilience theory* help us to identify critical infrastructures and other policy measures for a city to successfully advance in its development?
4. How can *cultural heritage in European cities* be managed and developed so as to reinforce the sustainable and socio-economic profile of urban areas?

The previous research issues, themes and questions are succinctly summarized in Figure 13 which presents the knowledge arena of the URBAN EUROPE SRF.

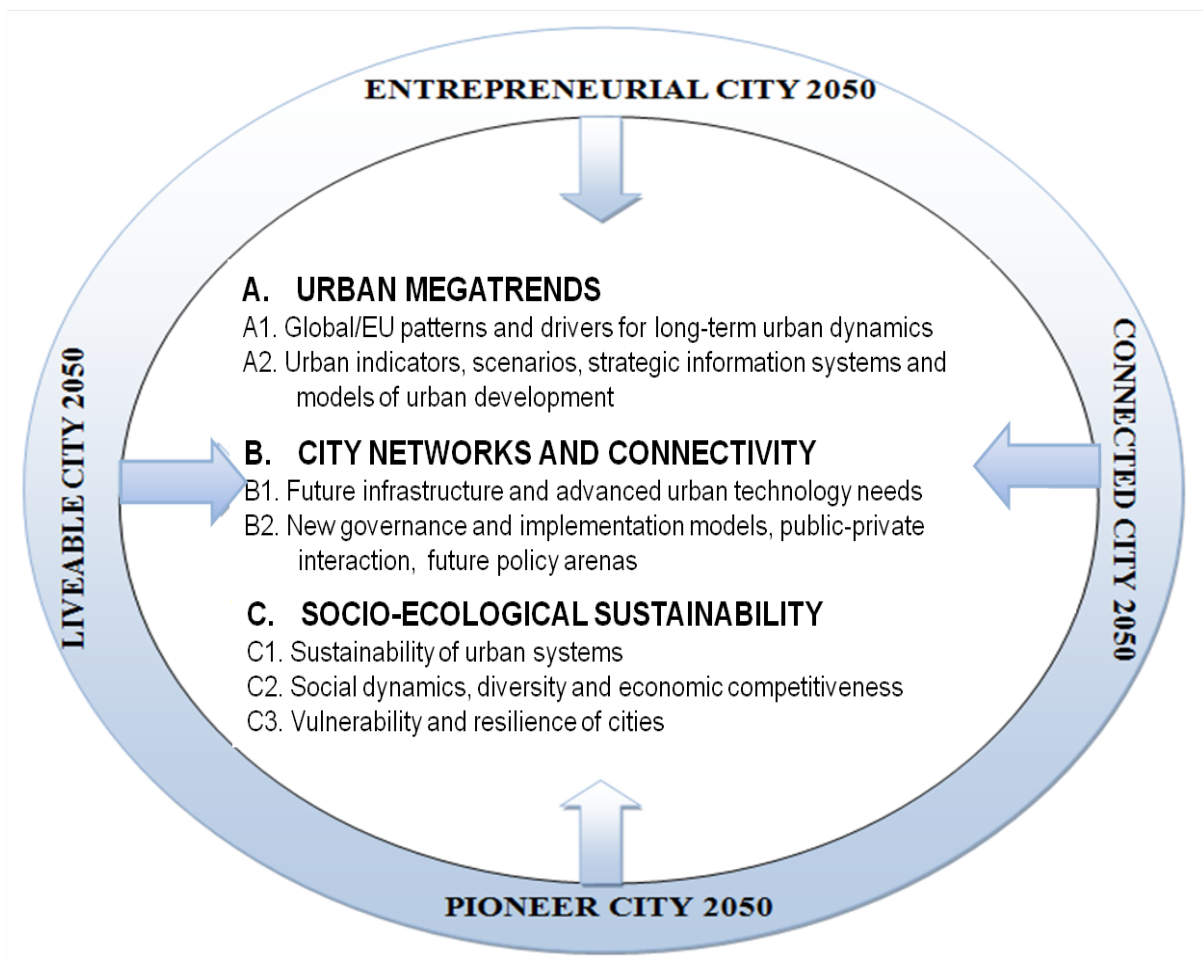


Figure 13: Knowledge Arena of the URBAN EUROPE SRF

4.5. FRAMING CONDITIONS

Clearly, the set of possible research ideas or projects that are in agreement with the above mentioned three main research issues and related themes and questions of URBAN EUROPE is vast. Hence, we need smart ways to ensure more focus, mainly along two lines, outlined in Subsections 4.5.1 and 4.5.2.

4.5.1 General criteria for selecting URBAN EUROPE projects

The following conditions have to be met by any research activity under the umbrella of URBAN EUROPE:

- Compliance with the overall mission and vision of JPI URBAN EUROPE
- Compliance with the four-pillar strategic framework, in which a focus on interfaces of the four distinct cornerstones is a *conditio sine qua non*
- Emphasis on long-range strategic research issues in urban agglomerations in Europe, that are not too city-specific, but cover a broad range of strategic interests in Europe
- A clear added value of the research orientation in URBAN EUROPE, both from a local/national and a European perspective
- Execution of research themes on a cross-national basis
- Emergence of a critical mass of research efforts in a given domain to enhance European quality and visibility in the field
- The choice for research directions and strategic research themes should not duplicate existing research (e.g. ERANETS), but should strengthen capacity building in URBAN EUROPE from original and novel angles
- The research should not be competitive with respect to existing RTD initiatives in Europe in this field, but should ensure synergy and mutual commitment
- The research lines to be adopted should meet the needs of urban stakeholders (e.g. the URBAN EUROPE Forum), so that the SRF should have a solid basis in demand articulation expressed by its stakeholders.
- The research should meet European innovation ambitions, which mean that the Triple Helix concept – from the perspective of a total chain approach – should be strived for (including the interest of all stakeholders).

4.5.2 Degrees of cooperative agreement in the URBAN EUROPE SRF

A Joint Programme Initiative may adopt various cooperative forms depending on the degree of common commitment to be made by the various stakeholders involved. In general, three categories of cooperative models can be distinguished in the framework of the JPI URBAN EUROPE:

1. Synergy of existing research

This would imply voluntary cooperation among research teams involved with any of the three above mentioned research themes, especially in those areas where already existing research teams in various countries are working on largely similar a common research challenges. It is

certainly worth exploring how 'picking low hanging fruits' can create more coherence, critical mass and efficiency in research on urban issues in Europe.

2. Design and execution of experimental studies

Research on the 'new urban world' will most likely be unconventional and of a high risk. Against this background it may seem reasonable to start a series of experimental studies in order to demonstrate the proof of concept.

3. Joint implementation of a common research programme

In various domains of urban development there is scope for fresh research initiatives based on a sound mass and focussed on promising novel research themes or urban problems. This would need a joint call of participating countries which would also bring in the necessary financial resources.

4.6. RESEARCH OUTCOMES

URBAN EUROPE creates a European model to pool expertise and develop initiatives to establish European urban areas as an attractive high quality place to live and work and set Europe apart as a global front runner for future urban development. The SRF aims to lay down the foundation for an operational research programme for URBAN EUROPE. It aims to realize the strategic policy goals of the JPI and to outline the way to get there. Consequently, it describes viable action plans for research initiatives on future urban issues that are shared by a critical mass of stakeholders, while focusing on unique strengths and opportunities of strategic urban policy in Europe, with a long-term horizon.

Regarding the diversity of urban challenges and the integrative research approach of the JPI URBAN EUROPE, a variety of research outcomes on different levels with specific benefits for different actors are expected. The JPI URBAN EUROPE research activities aim at (1) building a common ground and creating a joint knowledge basis for researchers and relevant stakeholders to comprehensively understand urban development processes and related determinants, (2) advancing scientific excellence in urban research by following an integrated, synergetic and human-oriented approach and (3) developing tools for policy and decision makers for strengthening European urban areas and creating attractive and sustainable cities.

Building a common ground for urban research and city developments in Europe

URBAN EUROPE consolidates scientific findings and experiences and prepares the ground for joint information sources and research activities, e.g. by

- building upon activities and knowledge of existing strong research programmes,
- providing the basis for transparent and reliable information on the dynamics of urban systems (including linkages with existing databases, e.g. ESPON, EVS, ESS, Urban Audit),

- designing focused and integrated data bases or information system on relevant urban issues,
- sharing knowledge and pools resources among European researchers and policy-makers (adds value to European knowledge creation and policy making),
- designing operational geo-science information and behavioural data to better map out or understand uncertain urban futures,
- establishing a *learning European community* on urban development for identifying best/worse practice examples and transferring it into European knowledge and
- setting up the basis for *future joint research projects* with close links between science, industry and policy.

Advancing scientific excellence in urban research

URBAN EUROPE endeavors to achieve significant progress in science and technology, e.g. by

- providing a *guide to the key research goals* identified which, with sufficient research funding, could significantly contribute to create a liveable, sustainable and economically viable environment for European citizens,
- elaborating on the four pivotal thematic areas of the JPI URBAN EUROPE Vision, namely *Society, Mobility, Ecology, and Economy and Innovation* (which identify many specific research topics),
- proposing a multifaceted but focused strategic approach: it presents different *interconnections and synergies between research areas*. These interrelations between the different research domains reflect the wide range of different perspectives which have been incorporated due to the active participation of different stakeholders,
- proposing *new technologies* (future internet, e-mobility, new energy concepts, transport technologies etc.) to exploit positive network externalities, to gain the *highest customer acceptance* (socio-economic research, social innovations) and to overcome possible barriers to diffusion and adoption
- introducing appropriate *large scale demonstration and case studies* to demonstrate the potential integration among *transportation, energy and communication networks* and
- *sharing interdisciplinary and international experience and competence*, which will lead to an efficient and optimal development of products and processes.

Strengthening European cities and city developments

URBAN EUROPE prepares and supports the transformation of European urban areas towards desirable urban visions of cutting-edge attractive places to live and work, e.g. by

- strengthening the *socio-economic and logistic profile of EU cities and industries through its broad social science basis*, while its creates a liveable, sustainable and economically viable environment for European citizens,
- developing *integrated models for simulation and optimization* of long-range urban development scenarios,

- providing decision makers and the scientific community at large with *research, development and demonstration road maps* to achieve the short- (2015), medium- (2020-2025) and long- term (2040-2050) goals of JPI URBAN EUROPE plans,
- developing *new policy tools which help urban planners* in the process of urban development policies (i.e. data pools, European urban observatory etc.),
- developing *tools for new planning, management and governance models* for future cities based on a multidisciplinary analysis of social and economic developments to reduce (or avoid) social tensions in urban areas with a view to socio-ecological sustainability,
- creating *applicable and feasible tools and instruments for policy makers* to turn urban areas into places of vitality, liveability and accessibility (add value to quality of life) and
- exploiting *the uniqueness and strength of European urban centers* in the light of globalization and intensified competition (adds value to European competitiveness).

5 Epilogue

The implementation of the JPI URBAN EUROPE is based on a multi-stakeholder, multi-task approach, so that in a stepwise way all ambitions can be realized. This calls for smart instruments – both organizationally and financially - , which have to be tested during the pilot phase of URBAN EUROPE to be started in the second part of 2011. It seems reasonable to use whenever appropriate existing instruments. Further information on the details of this pilot phase as well as on the framework conditions (and related instruments) will be included in a follow-up document.

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ANNEX A: List of strategic research agendas published by stakeholder organisations thematically related to URBAN EUROPE

Code	Organisation	URL
Mobility		
1	ERTRAC European Road Transport Research Advisory Council	http://www.ertrac.org/
2	eMobility - Mobile and Wireless Communications Technology Platform	http://www.networks-etp.eu/fileadmin/user_upload/Publications/SARA/Emobility-SARA-100731.pdf
3	UITP International Association of Public Transport	http://www.uitp.com/eupolicy/pdf/SRA-EN.pdf
4	eSafety Forum	http://ec.europa.eu/information_society/activities/esafety/doc/rt_d_projects/fp7/sra_ict_mob.pdf
5	ENT Era Net Transport	http://www.transport-era.net/about-ent.html
6	ECTRI European Conference of Transport Research Institutes	http://www.ectri.org/Documents/Publications/Strategic-documents/ECTRI-Strategic-Paper_September-2008.pdf
7	EURFORUM European Research Forum for Urban Mobility	http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_RCN=8823126
8	EC	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0551:FIN:EN:PDF
9	EC	http://ec.europa.eu/transport/publications/doc/2009_future_of_transport_en.pdf
25	Siemens – Green light for sustainable urban development	http://www.siemens.com/entry/cc/de/urbanization.htm
26	IBM – Smart Cities	http://www.ibm.com/smarterplanet/at/de/sustainable_cities/visions/index.html
Environment		
10	Urban net	http://www.urban-net.org/
11	ECTP European Construction Technology Platform	http://www.ectp.org/documentation/ECTP-SRA-2005_12_23.pdf
12	WssTP Water supply and sanitation Technology Platform	http://www.wsstp.eu/files/WSSTPX0001/stakeholder%202010/WssTP%20SRA%20version%20final.pdf
Energy		
14	EERA European Energy Research Alliance	http://www.eera-set.eu/Research_Fields
15	ESTTP European Solar Thermal Technology Platform	http://www.estif.org/fileadmin/estif/content/esttp/downloads/SRA/ESTTP_SRA.pdf
16	Smart Grids Technology Platform	http://cordis.europa.eu/technology-platforms/pdf/smartgrids.pdf
17	European Wind Energy Technology Platform	http://www.windplatform.eu/fileadmin/ewetp_docs/Bibliography/Synopsis_2008.pdf

Code	Organisation	URL
18	Photovoltaic Technology Platform	http://www.eupvplatform.org/fileadmin/Documents/PVPT_SRA_Complete_070604.pdf
Socio-Economic		
20	JPI More Years, Better Lives	http://www.era.gv.at/attach/12010_03_10_JPIMoreYearsBetterLives_GPC-Proposal.pdf
21	Globalization and World Cities Research Network (GaWC)	http://www.lboro.ac.uk/gawc/
22	European Urban Research Association (EURA)	http://www.eura.org/
23	European Urban Knowledge Network (EUKN)	http://www.eukn.org/
24	Urban Affairs Association (UAA)	http://www.udel.edu/uaa/about_uaa/index.html
27	Philips – Livable Cities/ Philips Livable Cities Award	http://www.newscenter.philips.com/main/standard/news/publications/201004_livable%20cities.wpd http://www.because.philips.com/
27a	ESPON	http://www.espon.eu/main/Menu_Programme/
Technology Oriented Initiatives and Platforms (industry led)		
28	Artemis	https://www.artemis-association.org/downloads/SRA_MARS_2006.pdf
29	Photonics21	http://www.photonics21.org/download/SRA_2010.pdf
30	ENIC European Nanoelectronics Initiative Advisory Council	http://www.eniac.eu/web/SRA/SRA_HR2.pdf
31	EPoSS European Technology Platform on Smart Systems Integration	http://www.smart-systems-integration.org/public
32	ECPE European on Power Electronics	http://www.ecpe.org/download/power_electronic/ECPE_SRA_EnergyEfficiency.pdf
33	NEW OSH ERA	http://osha.europa.eu/en/about
34	CRUE ERA-NET	www.crue-eranet.net/about_CRUE.asp
35	JPND	

ANNEX B: Research Landscape Matrix: research themes vs. city images 2050

<i>Urban Images 2050</i> <i>Strategic Research Issues</i>	Entrepreneurial City 2050	Connected City 2050	Pioneer City 2050	Liveable City 2050
Urban Megatrends	<ul style="list-style-type: none"> The EU city-landscape changing EU cities facing major structural changes (demography, economy, culture, etc.) long-term-oriented solutions emergence and facilitation of streams of knowledge and innovation steer entrepreneurs identifying entrepreneurial behaviour city as an incubator and innovation hub of economic activities production and diffusion of new knowledge leading to new products, services and processes produce new economic activities suited to locational endowments of an urban environment urban concentration roar of land prices scarce of land fate of agglomeration diseconomies Increase salary workers in rural areas increased population density constant change of underlying economic structures sheer amount of economic activities drive up consumption of resources (land, water, energy, etc.) consecutively pollution. forces of concentration and decentralisation Governance challenges changing demands of economic activities maximize innovative and creative potential gain access to emerging markets outside Europe diseconomies of agglomeration superior innovative potential city constantly reinvent itself Maintaining a vibrant knowledge production Attracting human capital for knowledge creation and exploitation urban diversity (e.g. ethnic diversity, minorities, subgroups and subcultures) creative milieu fostering the innovative output competitive arrangements Understanding the role of entrepreneurship for urban development interface of disciplines ranging from humanities to social sciences and technical fields understand regional variation of economic success cross-roads of these disciplines provide new insights on entrepreneurship and urban development 	<ul style="list-style-type: none"> future position competitiveness in a globalised world geographical scale of networks societal and policy challenges foresee future pattern of geographical concentration of people and goods and its relation to high densities of economic activities future urban networks for sustainable connectivity changing demography on the structure and functioning intra- and inter-urban networks spatial development and locational choices of firms and households formation and development of cities integrated policy implications understand functioning of these networks contribution to city's prosperity and sustainability understand possible role and potential in contemporary and future cities broad interdisciplinary perspective quality of service functioning of urban areas, systems of cities, and regions and countries multifunctional land use in urban areas physical, virtual and social networks changes on different geographical levels current and future development static as well as longer-run dynamic perspectives short-run and long-run dynamics of networks in time Consideration of robustness, reliability, flexibility and dynamics effective and sustainable movement of passengers, goods, energy and information geographical density spatial coherence increasing growth of internet sales increasing growth of internet sales growth patterns EU cities larger population declining cities located in Eastern Europe aging of the populations in EU countries ageing change consumption patterns ageing and population decline new challenges to 	<ul style="list-style-type: none"> Urban agglomerations seedbeds of pioneer thinking and societal innovation cities have been ideal market place for the production and exchange of new ideas and knowledge Generating constant flow of new knowledge needs people with appropriate skills and talent Cities as attractors for creators and makers Cities as hotbeds for the assessment and implementation of new (technological) solutions and provide innovative environments implications for new business scenarios changes in the urban innovation system speed of technology highly related to the innovativeness of the city and the cooperation of the various stakeholders challenges on the attractiveness and (economic, ecological, social) success of a city adaption of city planning and governance processes composition population changes rapidly growing world population lives and located in cities lives and located in urban areas lives and located in urban regions lives and located in vulnerable deltas congestion challenges general conditions for cutting-edge innovations and developments interlinking economic growth, networks, diversity and a sustainable framework to create new knowledge and creativity forefront of new and innovative developments mindsets and environments through a holistic and integrated perspective Europe a global pioneer attractiveness for companies and people Identifying the attractors and motivators creating stimulating environments new structural challenges sustain specific qualities of European cities understand, foster and further develop the interwoven technical, social and market dimensions incorporate different adjustment costs Understand key characteristics of cities assess cities' potential to actuate the generation of globally competitive European innovation areas Evaluate success criteria by learning and 	<ul style="list-style-type: none"> cities are not only energy consumers necessity of combining different perspectives interdependencies between technological and social developments demographic trends and resilience concepts human-centred perspective impact vulnerability and uncertainty globalisation, population changes and changing living patterns influencing quality of urban environments water security challenges demands people environment changes changing living patterns of citizens Human capital attraction growth patterns EU cities larger population declining cities located in Eastern Europe aging of the populations in EU countries ageing change consumption patterns ageing and population decline new challenges to European economies effect on the European space and cities comparative analysis of urban ecological footprint development and shifts in urban land use (e.g., urban sprawl, edge cities) analysis of inter-urban and intra-urban accessibility future of cities and mega-cities in developing and emerging economies

	<ul style="list-style-type: none"> • real estate value fosters entrepreneurship via deposit-backed loans • understanding various types and forms of entrepreneurship • Measuring entrepreneurial activities over time and space • derive 'hot spots' of creativity and entrepreneurship in certain times and spaces • dynamics of entrepreneurship over the long run • Explaining entrepreneurial activities • time-space pattern of entrepreneurship • impact of entrepreneurial activities on the urban system • Policies to stimulate entrepreneurial activities • new economic sectors and development of new firms impact and influence urban development • EU characterised by complex web of a large number of small and medium cities and relatively few very large cities • different between cities of size and economic specialisation • small and medium-sized cities have distinct specialisation profile in certain economic activities • growth patterns EU cities • larger population • declining cities located in Eastern Europe • trends population decline • ageing of the populations in EU countries • ageing change consumption patterns • ageing and population decline new challenges to European economies • effect on the European space and cities • sophisticated geo-science and information technology 	<p>European economies</p> <ul style="list-style-type: none"> • effect on the European space and cities • challenges to global main ports • scientific innovation centers • drastic transformation in infrastructure, logistics, mobility and energy supply patterns in future urban systems 	<p>gaining experience</p> <ul style="list-style-type: none"> • Study impact of cities • Investigate impact of boundary conditions of cities on European traditions and systems • Understand concept of pioneer cities as innovative approach • Consider different scale levels and spatial contexts of pioneer cities • Using social and urban diversity for enabling and enhancing innovation and creativity (risk as opportunity) • Investigating capacities for absorbing in-migrating flows and using their potential • Establish model cities and living labs as evaluation test beds <ul style="list-style-type: none"> • growth patterns EU cities • larger population • declining cities located in Eastern Europe • ageing of the populations in EU countries • ageing change consumption patterns • ageing and population decline new challenges to European economies • effect on the European space and cities 	
Urban Systems and Connectivity	<ul style="list-style-type: none"> • urban tacit knowledge transferred within cities • engage in entrepreneurial activities • engage interdependent relations • technological state of the art • diseconomies of agglomeration • fostering formal and informal networks of the urban business environment • cooperation culture • relocate outside the boundaries of the urban system • efficiency, effectiveness and reliability of urban agglomeration networks • location of people and production (demands regions) • access to, the formal and informal networks of the urban business environment • provision of educational infrastructure, utility provisions such as energy, access to the public transportation system 	<ul style="list-style-type: none"> • physical-infrastructure nature, e.g. transport-, logistics-, and energy networks. • physical connectivity in city networks • virtual connectivity using advanced ICT • connectivity with and between cities • Connection of the network on different geographical level (local, regional, national, international) • all-inclusive urban transport and logistic system • transfer of knowledge/information and goods can be realised by various networks • networks can be combine or substitute each other • movement of objects in networks • spatial angles ranging from global, to national, regional and local • sustainable connectivity • fundamental analysis Triple P to 	<ul style="list-style-type: none"> • European urban space is heterogeneous • European cities are diverse territories with unique characteristics • guarantee infrastructure accessibility and reliability • implement new mobility, energy, health or business solutions • wide extent of new technologies and their customising • advantage of currently unused capacities, resources and heterogeneity of European urban areas • interlinked world, cities • cities become nodes or hubs in polycentric networks • establish urban networks for sustainable connectivity • changing behaviour • developments in society and economy • multi-dimensional character of innovation- 	<ul style="list-style-type: none"> • environmental benefits from public transport • advantage of technological developments and innovations • understand urban planning and design • Technology (especially ICT) and infrastructures for achieving the goals • reinforce efficient processes • measurement achieve environment attractive for all groups of citizens • develop technologies and systems for analysing characteristics and determinants of sustainable and attractive urban environments • improve urban systems e.g., mobility and logistics solutions, energy supply, or water and waste management • prosperous economy and dynamic interconnections to other regions • knowledge for building efficient management and planning tools

<ul style="list-style-type: none"> urban regions attracting investment urban regions harnessing productivity and competitiveness Production chains developed into worldwide networks spread over several continents cities spearhead of Europe's globalization policy create sustainable, vital and dynamic environments for citizens and companies efficient and effective movement of goods, people and knowledge Understanding the role, functioning and potential of hubs and gateways Understanding the interrelation of the different networks in the urban environment allowing a determination of the joint influence of different networks in the striving for sustainability traffic congestion relocating ('decentralising') to cheaper locations uneven geography of creativity and entrepreneurship understand non-prospering urban systems change development trajectories concentrated urban growth functional specialization of urban regions Europe hubs of innovation functional specialization and the trends in specializations Urban regions diversified service nodes at international, national or regional scale head office nodes specialized services centers specialized knowledge nodes urban regions are consumption centers urban regions import or export nodes innovation hub depends upon actual functional specialization and trends in current specialization establishment of urban areas in Europe as hubs of innovation understand functioning of urban labour markets highly educated people change jobs larger regions mechanisms for knowledge transfer and spillovers are much more efficient in larger regions labour markets in different large urban regions function quite differently understand functioning of urban labour markets to maximize the knowledge diffusion and knowledge creation potential of large EU urban regions EU urban regions become innovation hubs multinational firms control most exports, imports and private R&D 	<ul style="list-style-type: none"> understand the structure of networks, the demand of mobility pattern and user acceptance on different spatial scales Advanced transportation infrastructures, smart logistic systems and accessible communication systems new transport and communication technologies on spatial mobility of people and goods transport accessibility in urban agglomerations protecting quality of life and reduce the ecological footprints new demand for accessibility of places and mobility of people movement of information (via social and knowledge networks in combination with ICT networks) on reverse commodity supply chains of passenger mobility movement of information on the integration of inter- and co-modal transportation movement of information on integration of advanced freight and services logistics systems in urban areas movement of information on integration of land-use policy and planning (and utilisation) movement of information on integration of infrastructures movement of information on integration of policy development, technological development movement of information on integration of economic and financial issues multi-dimensional function of urban networks network externalities urban connectivity functioning physical and virtual networks (transport-, logistics-, ICT-, energy-, knowledge-, social networks) networks determine and define opportunities for spatial accessibility and interactions communication and information flows different networks are interrelated Optimize system of networks mutual interactions between networks Examine different types of urban networks better prosper from urban networks Understanding the spatially differentiated urban 	<ul style="list-style-type: none"> building urban agglomerations development of new technologies efficient, effective and reliable infrastructures (such as energy, ICT, water, waste treatment and management, etc.) new technological opportunities accessible for all citizens provide added value for enterprises and people Establishing model cities and living labs as evaluation test beds improving efficiency of new technological solutions stimulating environments for creative minds building comparative urban advantages understand and connect individual innovation initiatives with urban institutions Developing new concepts for efficient, effective and reliable infrastructures (energy, ICT, water, waste treatment and management, etc.) ensuring accessibility of infrastructure/services/technologies/information Integrate latest technological developments in mobility, energy and ICT Understand new relationships of citizens with their city based on the new technologies understand urban metabolism related to various flows (energy, communication, materials) develop ambient urban intelligence Investigate relevant conditions and success criteria of living labs and innovative urban environments understand non-prospering urban systems change development trajectories concentrated urban growth functional specialization of urban regions Europe hubs of innovation functional specialization and the trends in specializations Urban regions diversified service nodes at international, national or regional scale head office nodes specialized services centers specialized knowledge nodes urban regions are consumption centers urban regions import or export nodes innovation hub depends upon actual functional specialization and trends in current specialization establishment of urban areas in Europe as hubs of innovation 	<ul style="list-style-type: none"> adding value incorporating eco-system services into planning processes improvement of services by combining different services (e.g. energy and health care supply) transport planning fit in future working patterns influence city structures internal and external accessibility of cities affected by climate change and the energy transition new and sustainable logistics concepts and freight transport systems on mobility behaviour (e.g. increase of home delivery systems) maintain high level of traffic an external safety urban size with respect to environmental decay (smart growth and new urbanism) sustainable accessibility of cities in the long term social segregation and uneven distribution of high quality infrastructure available (and new) mechanisms to allocate scarce urban land urban space needs ongoing adjustment radical technological and behavioural changes to keep crowded urban regions attractive to live in Technology & infrastructure. ICTs enabling functionalities understand how cities, urban regions and systems of cities function understand non-prospering urban systems change development trajectories concentrated urban growth functional specialization of urban regions Europe hubs of innovation functional specialization and the trends in specializations Urban regions diversified service nodes at international, national or regional scale head office nodes specialized services centers specialized knowledge nodes urban regions are consumption centers urban regions import or export nodes innovation hub depends upon actual functional specialization and trends in current specialization establishment of urban areas in Europe as hubs of innovation
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	<ul style="list-style-type: none"> • number of multinational firms and affiliates rapidly increasing • mergers and acquisitions, outsourcing and offshoring change global economic landscape • develop large urban regions in Europe into innovation hubs 	<p>development</p> <ul style="list-style-type: none"> • existence and dynamics of physical and virtual networks within and between cities to the international level • functioning and effects of networks • robustness and reliability of networks • optimisation of the functioning, management and interrelations of networks • address the organisation and responsibility of the supply and management of these networks • national physical infrastructure • sustainable accessibility of places in cities, robustness and reliability of networks • Connectivity in and between urban areas (connect actors and institutions) • re-assessment additional distribution concepts, including logistics service points, city distribution centres • use of ICT • foster Europe-wide applications • facilitate freight demand and flows • large logistics and production sites • harnessing technical resources • deconcentration of urban land use • urban sprawl • city center decline • increased reliance on the use of cars • loss of open space • activities move to the edges of urban areas • heavy traffic arises between main hubs in the urban region • urban regions are connected by roads • railway lines and the internet • important intersections lie in urban agglomerations • realize sustainable accessibility of cities • developing efficient and sustainable logistics concepts and freight transport systems • urban freight distribution • efficient (near) home delivery systems • regional inter-urban freight transport • re-assessment of additional distribution concepts, including logistics service points, city distribution centres, etc. • facilitate freight flows related to large logistics • facilitate freight flows related to production sites (of supra-regional interest) • developing efficient and sustainable main hubs ('gateways') • hinterland transport infrastructures 	<ul style="list-style-type: none"> • specialized knowledge nodes • urban regions are consumption centers • urban regions import or export nodes • innovation hub depends upon actual • functional specialization and trends in current specialization • establishment of urban areas in Europe as hubs of innovation • understand functioning of urban labour markets • highly educated people change jobs larger regions • mechanisms for knowledge transfer and spillovers are much more efficient in larger regions • labour markets in different large urban regions function quite differently • understand functioning of urban labour markets to maximize the knowledge diffusion and knowledge creation potential of large EU urban regions • EU urban regions become innovation hubs • multinational firms control most exports, imports and private R&D • number of multinational firms and affiliates rapidly increasing • mergers and acquisitions, outsourcing and offshoring change global economic landscape • develop large urban regions in Europe into innovation hubs 	<ul style="list-style-type: none"> • understand functioning of urban labour markets • highly educated people change jobs larger regions • mechanisms for knowledge transfer and spillovers are much more efficient in larger regions • labour markets in different large urban regions function quite differently • understand functioning of urban labour markets to maximize the knowledge diffusion and knowledge creation potential of large EU urban regions • EU urban regions become innovation hubs • multinational firms control most exports, imports and private R&D • number of multinational firms and affiliates rapidly increasing • mergers and acquisitions, outsourcing and offshoring change global economic landscape • develop large urban regions in Europe into innovation hubs
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		<ul style="list-style-type: none"> • efficient synchro/intermodal transport operations to handle international / intercontinental freight flows between urban regions across the world • efficient and effective movement of knowledge/information • efficient and effective movement of goods • understand non-prospering urban systems • change development trajectories • concentrated urban growth • functional specialization of urban regions • Europe hubs of innovation • functional specialization and the trends in specializations • Urban regions diversified service nodes at international, national or regional scale • head office nodes • specialized services centers • specialized knowledge nodes • urban regions are consumption centers • urban regions import or export nodes • innovation hub depends upon actual • functional specialization and trends in current specialization • establishment of urban areas in Europe as hubs of innovation • understand functioning of urban labour markets • highly educated people change jobs larger regions • mechanisms for knowledge transfer and spillovers are much more efficient in larger regions • labour markets in different large urban regions function quite differently • understand functioning of urban labour markets to maximize the knowledge diffusion and knowledge creation potential of large EU urban regions • EU urban regions become innovation hubs • multinational firms control most exports, imports and private R&D • number of multinational firms and affiliates rapidly increasing • mergers and acquisitions, outsourcing and offshoring change global economic landscape • develop large urban regions in Europe into innovation hubs • design of soundless transport and logistic systems • synchro-modality strategies • gateways and multi-model hubs • mobility habits of people • individual transport moves in mobile urbanised 		
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		<ul style="list-style-type: none"> society urban infrastructure technologies secure interoperability of urban infrastructure technologies foster Europe-wide applications maintenance of infrastructures reduce peak traffic strong imbalances in traffic flows (including 'tidal flows') unnecessary long-distance transport in line with user behavioural models accessibility issues national government increasing scale of the daily urban mobility and energy demand scale of governance in regional economic and spatial planning describing the actual functioning of networks positioning of cities in the planning field of urban mobility, in spatial planning the local authorities financing maintenance and sustainability of future urban networks in sharing responsibility understand role, functioning and potential of hubs and gateways as key focal points in intra- and inter-urban networks develop efficient and sustainable main hubs ('gateways') and hinterland transport infrastructures to efficient synchro/intermodal transport operations to handle international / intercontinental freight flows between urban regions across the world centrality of cities and their function as knowledge hubs and gateway to the hinterland cities attractiveness due to knowledge networks in combination with excellent physical accessibility 		
Socio-ecological Sustainability of City Systems	<ul style="list-style-type: none"> emission reduction congestion reduction safety resource allocation energy security Density and diversity main urban features and intrinsic economic potential advantage socio-economic structure pool of (specialised) talent and a fertile test-bed for new ideas scarce urban resources cities are sources of economic vitality development of local endowments within an urban 	<ul style="list-style-type: none"> respond to people's needs sustainable connectivity of cities people's demand and behavior social interaction and knowledge exchange accessibility and social inclusion/exclusion behavioral aspects of network use intra- and inter-urban networks co-location of complementary functions in urban neighbourhoods interrelation of networks integrated implementation of new connection and supporting changing pattern of people's behavior 	<ul style="list-style-type: none"> diverse skill sets of migrants and native citizens increasing cultural diversity and fragmentation of lifestyles in European cities reduce and avoid social tensions in urban areas support the creativity and pioneering spirit of all citizens Improve ecological footprint and energy efficiency interactions among companies, universities, research institutes governmental institutions and organisations, shape urban innovation system interactions between actors highlight their role 	<ul style="list-style-type: none"> hence environmental polluters smart environmental and energy initiatives (e.g., recycling, waste recuperation) act as engines for ecologically-benign strategies cities climate-neutral agents EU cities attractive places to live and work Sustainability general concept reconciliation of environmental, social and economic demands more than environmentally-benign city home for man improve quality of live and all related aspects make cities more liveable and attractive

	<ul style="list-style-type: none"> sustainability framework influence globalization on the quality of the urban environment steps towards urban economy and sustainable economic growth promote beneficial change role different governance systems for urban regions multinational firms preference large urban regions attraction of activities of multinational firms a central element in urban policy clear dissemination strategies to various stakeholder groups (e.g. politicians, architects and urban and regional planners) preferences where to live for a substantial period growth and development recipes different for different groups of urban regions demand for social care and health care. enters for extraction, manufacturing or logistics sleeping” cities homes for commuters to large urban centers people in larger regions build up a much more varied work experience role and behavior of multinational firms smart urban transport operators 	<ul style="list-style-type: none"> user acceptance of changes in network structures and/or management building sustainable city networks human-centred approach understanding of behavior and identification of user demand and acceptability passenger mobility pattern high societal relevance Enhancing the focus on human behavior (needs, demands, acceptance) behavioural pattern of people and their potential for change determination and enhancement of social benefits derived from networks social and knowledge networks on a psychological base new forms of communication create economic externalities that are beneficial to all networks agents participants involved within and between urban areas Knowledge and information can be embodied in people role different governance systems for urban regions element in urban policy clear dissemination strategies to various stakeholder groups (e.g. politicians, architects and urban and regional planners) preferences where to live for a substantial period growth and development recipes different for different groups of urban regions demand for social care and health care. enters for extraction, manufacturing or logistics sleeping” cities homes for commuters to large urban centers people in larger regions build up a much more varied work experience de-carbonization of urban transport 	<ul style="list-style-type: none"> as centres of excellence appropriate institutions, education, and social environment innovative test beds creative actors with a variety of backgrounds, cultures, ideas and motivations need to form the appropriate social capital of cities urban regions enhancing social development Investigate benefits for diversity Create sense of participation identity to sustain creative social capital Provide environment creating new pioneers Building new systems of incentives for user behaviour, entrepreneurship, etc. improve efficiency of new technological solutions urban regions harnessing human resources influence population changes on the quality of the urban environment bridge the different social, economic and physical gaps sustain social stability and equitability break <i>lock-in</i> servile migrant trajectories enhance cities’ capacities to absorb in-migration flows Use of technology influencing urban lifestyles role different governance systems for urban regions clear dissemination strategies to various stakeholder groups (e.g. politicians, architects and urban and regional planners) preferences where to live for a substantial period growth and development recipes different for different groups of urban regions demand for social care and health care. enters for extraction, manufacturing or logistics tourism or recreation centers sleeping” cities homes for commuters to large urban centers people in larger regions build up a much more varied work experience adoption of energy-efficient buildings and 	<ul style="list-style-type: none"> create a “city for all” health security safety provide an attractive environment to live and work in for all citizens social issues play essential role from an integrative perspective efficiency of the city in achieving sustainability goals ecological footprint of the city carbon neutral city 2050 achieve climate change adaptation and mitigation ecologically sustainable and socially balanced city understand what makes a city “liveable” create sustainable, attractive and safe, i.e. liveable urban environments understand main characteristics and determinants liveable cities demands of different target groups determining significant indicators quality of life in city assess major challenges and opportunities liveable cities multi-faceted phenomenon: “hard” pollution indicators and “soft” quality-of-life indicators psychology individual needs (i.e. behaviour and related determinants) broad perspective on urban sustainability city pleasurable, attractive and safe place to live density green areas pollution emission waste water energy consumption noise social issues central psychology of individual decision making processes role of education interactive activities of the involved parties behavioural change and values involvement of multiple stakeholders different groups perceive qualities of urban environment group-specific preferences and priorities indicators of sustainable, vital and dynamic environments for citizens and companies measure safety and security behavioural changes improvement or deterioration of quality of life contribution Cultural Heritage to the quality of cities re-using energy, waste, reduce emissions and noise stimulate sustainable behaviour (policy planning)
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ANNEX C: “Flower Power” Research Landscape: Results from a digital content analysis

Urban Megatrends – Entrepreneurial City 2050, Connected City 2050, Pioneer City 2050, Liveable City 2050



Socio-ecological Sustainability of City Systems — Entrepreneurial City 2050, Connected City 2050, Pioneer City 2050, Liveable City 2050





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