SYSTEM INNOVATION: CASE STUDIES

GERMANY - The City of the Future Project

OECD

The City of the Future Project

Case study under the OECD Systems Innovation project

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1. Introduction

In spring 2013, the OECD Working Group on Innovation and Technology Policy (TIP) began work on the Systems Innovation project. This looks at **systemic transformation processes** in a range of sectors – mobility, energy, waste management, urban renewal, health, etc. – to pick out generally applicable best practices for their management. The project was inspired by the trend, long evident in many OECD countries today, towards more systemic innovation policies based around **grand challenges**. This mission-driven approach goes hand in hand with a redefinition of innovation to take in not only technological but also social innovation.

The project's main participants besides Russia and Korea are Northern and Western European member countries whose national innovation policies reflect this new understanding of innovation processes. In Germany, the Federal Government focused research and innovation policy around a mission-driven approach in the High-Tech Strategy 2020 adopted in 2009 and updated with the new High-Tech Strategy in summer 20141. The Federal Ministry of Education and Research (BMBF), as the ministry responsible for this new strategy, contributes to the OECD project with the following case study on **City of the Future**, one of the **forward-looking projects** under the High-Tech Strategy.

The case study was compiled on behalf of BMBF by a team from the project management agency VDI/VDE-IT between October 2013 and April 2014. It is based on an analysis of documentation on the City of the Future project and on telephone interviews with 20 stakeholders from research, industry and local government. As members of the National Platform for the City of the Future, these stakeholders have a broad insight into current processes. With their differing backgrounds they cover the full range of perspectives on the project.

Forward-looking projects are a key implementation element in the High-Tech Strategy and their forward reach therefore is closely linked with the continuing of that strategy. The High-Tech Strategy has so far proven a very durable innovation policy approach that has now been kept up for three legislative periods in a row.

As the following case study shows, such projects and similar transformation processes stand a strong chance of being brought to fruition if they build on **established forces of change** that are expected to persist due to extraneous factors such as long-lasting technology trends and societal changes. Another key success factor for forward-looking projects is the inclusion of **existing stakeholder networks and processes** in a bottom-up approach. As many such networks came into being long before the projects were officially launched, their existence is not reliant on the projects and they will probably outlive them in one form or another.

The following case study is based on the example of the City of the Future project to illustrate the experience gathered by a range of stakeholder groups in implementing a specific transformation process. It shows how the Federal Government has used the forward-looking project format to **actively shape** those processes. The project is still in its early days and many implementation stages that lie ahead are only just visible on the planning horizon. The case study thus merely represents a preliminary resumé and is in no way to be considered a final assessment or evaluation of the forward-looking project experiment.

1 http://www.bmwi.de/EN/Topics/Technology/hightech-strategy.html

2. Why system transformation in the climate/energy policy sector?

The system transformation in the City of the Future project relates to the cross-cutting climate/energy policy sector. It takes place against the backdrop of the energy and climate debate already underway in Germany for quite some time. The current process was triggered by the 2010 **Federal Government** decision adopting a **new energy strategy** to transform the German energy system. Termed the *Energiewende*, this transformation was planned with a multi-pronged approach, from using more renewable energy and upgrading power grids to phasing out nuclear power. One element was a forward-looking project, 'CO_2-neutral, energy-efficient and climate-adapted cities'.[2]

Forward-looking projects are an implementation instrument under the **High-Tech Strategy 2020** (adopted 2009 and updated with the new High-Tech Strategy - Innovations for Germany), aimed at using innovation policy to drive specific systemic changes that address grand challenges in an exemplary way. The main idea behind forward-looking projects is to bring together existing programmes and activities from the various government departments along with players in science and industry, identify common goals and implementation steps, and jointly plan future activities. Forward-looking projects are thus mostly about linking up players and processes and about shared discourse on goals, priorities and implementation steps. The projects have not been given an explicit cross-cutting governance structure, although in practice some have received significant impetus and guidance from central platforms. An initial milestone was the adoption of a Federal Government action plan on forward-looking projects in summer 2012. The forward-looking projects are also part of the new High-Tech Strategy adopted in summer 2014 and will thus be continued in the actual legislative periode (2013 - 2017).

A number of forward-looking projects in the three fields of energy, mobility and health had cities as their spatial focus. This was based on the recognition that shaping cities is one of the key challenges of the future. There are already more people living in cities than in rural regions today. In a few years, two out of three people on the planet will be city dwellers. Ensuring their sustainable development is a shared objective of policy, business, society and research. All of the grand challenges facing humanity are at their most pressing in large cities.

There are thus many reasons to embed pilot processes at local level in cities, including processes in the climate and energy policy sector:

- Germany has a predominantly (roughly 74 percent) urban population; that is, most people in Germany live in cities.
- Cities account for a large percentage of climate-relevant emissions.
- Cities are places where key players closely interact.
- Cities are a kind of laboratory for solutions to tackle major issues of sustainable living and working.
- Cities are incubators for decentralised solutions.
- Shorter distances, lower comparative infrastructure costs and better manageability give cities an efficiency bonus over rural community structures.

The ***CO_2-neutral, energy-efficient and climate-adapted cities*** **project** aims to develop ways for cities to help attain national emission reduction goals and respond to ongoing climate change and its consequences. This is to be achieved by maximising efficiency in energy supply and energy consumption. Potential areas of action here include improving building energy performance, climate-friendly and climate-adapted urban development, environmentally and economically efficient transformation of municipal and regional energy supply systems, and developing carbon-neutral urban transport.[3]

[2] The original short title, *Morgenstadt* (Tomorrow Town) was changed to *Zukunftsstadt* (City of the Future) in late 2012, partly to distinguish the project from a similarly named Fraunhofer initiative (see Milestones and Implementation Plan, page 6).

[3] Source: HTS-Aktionsplan; http://www.bmbf.de/pub/HTS-Aktionsplan.pdf

The project builds on discourse and development paths that started more than 20 years ago with a view to promoting sustainable and self-sufficient cities. Notably following the 1992 Rio Summit, sustainability strategies were developed at local level that triggered numerous local initiatives and established networking structures for the exchange of knowledge and experience as part of the Local Agenda 21 process.[4] In Germany, the *Energiewende* further strengthened the focus on transforming energy supplies and seeking decentralised solutions for German cities. Initiatives targeting areas such as energy self-sufficiency also helped bring together local players.[5]

The systems transformation aimed for in the project shares a number of similarities with other systemic approaches that likewise address municipal-level transformation processes in the climate/energy policy sector but come under a different overarching innovation policy context and hence also different strategic and decision-making contexts. Municipal electromobility initiatives (*Schaufenster* or 'showcase' projects) in particular have substantive overlap with the City of the Future project.

Because cities act as laboratories for a wide range of transformation processes, there are large numbers of projects and processes with a city focus. To cite examples from two thematic areas:

The term **megacities** is used in connection with the rapid growth of and the extreme challenges of managing huge cities in emerging economies. Energy supply and coping with the consequences of climate change are just two of the many challenges facing such cities. In the final analysis, however, the situation of megacities in emerging economies cannot be compared with the challenges facing German cities as there are major differences in terms of scale, economic environment and not least political structures.

Another concept, that of **smart cities**, relates mostly to Western industrialised nations and is code for using new technology to address municipal challenges. The focus here is on ICT-based 'big data' solutions and smart control systems, taking e.g. advantage of smartphones and apps to make better use of the massive quantities of structure and process data that cities now have at their disposal. There are clear overlaps with the project here, although at the same time the smart cities discourse covers a far wider context going well beyond the climate/energy policy area.

3. Phases of system transformation

Cities in constant flux, or where is the starting point?

The task of describing process steps in the project is closely bound up with the special nature of cities as the locus of implementation. Even **identifying a starting point** is an exercise in uncertainty. Cities are the oldest large-scale social structures in history, far older for example than the nation state model. They have always been under constant pressure to transform and adjust because of shifting environmental conditions and changing societies. Cities are thus caught up in a process of ongoing development long predating the project and set to continue long after it ends – and taking in far broader areas of life. Important leverage points for project implementation are found in traditional municipal responsibilities such as infrastructure building, upgrading and management. As these activities are continuously going on, they represent permanent processes of urban change among which the specific project process has to find its place.

The starting point of the project is thus a **political signal** at national level indicating that players at that level now intend to step up their involvement in ongoing transformation processes and exert a greater shaping and guiding influence. It heralds a new **prioritisation of the issue** at national policy level. This is precisely the logic followed in the Federal Government's choice of the ten forward-looking projects under the High-Tech Strategy, one of which is City of the Future. The national policymakers

[4] Lokale Agenda 21: http://de.wikipedia.org/wiki/Lokale_Agenda_21
[5] http://www.kommunal-erneuerbar.de/

also looked to the projects' mobilising effect and hence greater involvement of relevant players in existing processes.

A major additional challenge lies in making use of **existing processes and structures** for the **new national agenda** while avoiding the creation of additional, duplicate structures. Taking a more national perspective can help revamp and regroup messy, opaque organic structures to strip out redundancy and amplify synergies. A reinforced upper layer can also better synchronise and harmonise established processes, objectives and indicators. One ever-present danger is that of "reinventing the wheel". Local stakeholders rightly insist that the focus should be on improving what has already been put in place rather than on launching one new initiative after another.

From the perspective of the High-Tech Strategy, the 'start' of the project is closely tied to the 'official' **launch of the *Energiewende* in Germany** as the key higher-level process in the climate/energy policy sector (though again one with no true starting point) and with the further elaboration and implementation of the High-Tech Strategy as the higher-level innovation policy process. Important dates and programmes in this context include:

- The Federal Government's energy and climate change strategy with clear targets and implementation roadmap (National Climate Protection Programme 2005; Energy Concept 2010; Sustainability Strategy)
- HTS 2009 plus Action Plan 2012
- Individual activities commencing 2010

Milestones and implementation roadmap

'CO_2-neutral, energy-efficient and climate-adapted cities' was included from the very outset as one of the forward-looking projects set out in the High-Tech Strategy 2020 document adopted in 2009. Initially also known as *Morgenstadt* (Tomorrow Town), the project was renamed *Zukunftsstadt* (City of the Future) in 2012. A further step in giving this and the other forward-looking projects more concrete form came with the adoption of the **High-Tech Strategy Action Plan** in 2012. This was the first interdepartmental consultation, and the first consultation with major stakeholders, on key points of the project: **main project objectives**, related **action** including financial **resources**, and initial **milestones** for continuation.

The following targets were laid down in the action plan:

- Doubling of the thermal refurbishment rate from about one percent to two percent a year
- 20 percent reduction in heat consumption by 2020
- 80 percent reduction in building primary energy consumption by 2050
- 25 percent reduction in urban production energy consumption by 2020
- Increase in the renewable share of final energy consumption to 18 percent by 2020 and 60 percent by 2050
- Reduction in land take to 30 ha per day by 2020
- One million electric vehicles in Germany by 2020 and six million by 2030

An interdepartmental agenda process involving representatives of government departments and other stakeholders from research and industry was launched as a follow-up to the action plan. The BMBF and the then Federal Ministry of Transport, Building and Urban Development (BMVBS, now the Federal Ministry of Transport and Digital Infrastructure/BMVI) agreed in March 2013 to establish the **National Platform for the City of the Future**. The platform's aim is to draft a **research agenda** promoting the development of carbon neutral, energy-efficient and climate-adapted cities. Experts from local authorities, research, industry and civil society are working to compile this agenda by spring 2015. A first draft was presented on a national conference in September 2014.

In addition, the official "science year 2015", initiatied by the BMBF, will be focussed on the topic of the city of tomorrow. A competition for the city of tomorrow is planned in 2015 to fund the development of individual strategies and visions of about 50 cities for the year 2030+.

Thus whereas an initial roadmap is currently being put together for the National Platform for the City of the Future, the main City of the Future project itself does not yet have a binding joint roadmap systematically linking the different policy processes at national, regional and local level. This lack of a roadmap and milestones together with the fuzzy start and end points makes it hard at this stage to outline a phase model (say with start, take-off and new equilibrium phases) for the process as a whole. Having said that, individual cities might be able to pinpoint where they are in such a phase model by looking at the ambition levels, background conditions and opportunities attached to their own transformation strategies. Competitions like *Bundeshauptstadt Klimaschutz* (Germany's Climate Protection Capital) launched by Deutsche Umwelthilfe e.V. have developed scoring matrices and produced a city ranking. On the basis of several competitions, it should be possible to classify participating cities in an appropriately adapted phase model. This has not yet been done so far.

4. **Relevant implementation activities**[6]

Most of the forward-looking projects follow a philosophy of establishing one or more **visions and future-focused projects** as **examples** of systemic transformation processes within the fields of action under the High-Tech Strategy. For the City of the Future project, a vision entitled *Morgenstadt* was developed together with stakeholders and presented to the general public with broad press coverage. The main driving force and substantive impetus for this vision was provided by Fraunhofer-Gesellschaft, which through its then President Professor Hans-Jörg Bullinger was a member of the Industry-Science Research Alliance, the central innovation policy advisory board for the support and onward development of the High-Tech Strategy. The resulting vision had a pronounced **technology-oriented** focus.

> *"The Morgenstadt vision is the ideal of a future sustainable city. Using high-visibility communication strategies such as a publicly displayed ecological footprint, the city administration makes the city an engine of climate protection. Local reference rents incorporate energy performance criteria as an incentive for owners to invest in thermal refurbishment. All new building is to zero net energy consumption standards. Further energy efficiency gains are obtained from the use of combined heat and power (CHP), where heat from power generation is fed into district heating networks. The system is complemented by a well-developed smart grid for intelligent control of building systems. Street and road design follows the shared space concept where all road users have equal priority and negotiate the space among them. The Morgenstadt vision thus unites the ideal concepts of the smart city and presents a perspective of how neighbourhood management with popular backing can raise the quality of urban living."*[7]

At least four major activities have so far contributed to project implementation: two *Energieeffiziente Stadt* (Energy-Efficient Cities) initiatives under BMBF and the Federal Ministry for Economic Affairs and Energy (BMWi), the *ZukunftsWerkStadt* competition, and the National Platform for the City of the Future**.**

> *The **Energieeffiziente Stadt competition** launched by the Federal Ministry of Education and Research (BMBF) targets energy-efficiency gains in cities and communities. The aim is to develop and put into effect trailblazing ideas that advance the Federal Government's climate targets while taking into account local structures and functions, treating the city 'system' as an integrated whole and giving a key role to innovations involving services. The desired outcome is practical knowledge for local administration and a boost to innovation in industry and society.*[8]

[6] Government departments are cited in the following as they stood **before** the renaming and reallocation of portfolios following the 2013 election.

[7] http://www.bmbf.de/pub/morgenstadt.pdf

[8] https://www.wettbewerb-energieeffiziente-stadt.de/

*The **Energieeffiziente Stadt funding initiative** promoted by the Federal Ministry for Economic Affairs and Energy (BMWi) focuses on funding pilot projects exemplifying the smart deployment and interconnection of innovative technologies and approaches to maximise energy-efficiency gains and minimise carbon emissions. Special importance is attached to the transference of R&D outcomes to the pilot projects.*[9]

*Winners of a cities competition launched a year earlier by the Federal Ministry of Education and Research met in Leipzig on 3 June 2013. Some 15 cities and rural districts took part in the competition for the **Zukunftswerkstadt** (the German name is a play on words between a futures workshop and the city as a work of the future) The project follows an integrated approach taking into account the fact that innovation, whether technical, economic or social, works best when developed on an inclusive basis. Members of the community are thus involved in local projects of sustainable urban development, leading to the joint development of implementation-ready ideas.*[10]

*To promote the substantive development of the City of the Future project, the Federal Ministry of Education and Research (BMBF), the Federal Ministry of Transport, Building and Urban Development (BMVBS) and the Federal Environment Ministry (BMU) launched the **National Platform for the City of the Future** in 2012. The National Platform for the City of the Future aims to develop a **cross-cutting strategic research agenda**. Ongoing programs are to be better coordinated and research projects linked at various levels to promote the development of carbon-neutral, energy-efficient and climate-adapted cities. Another aim is to open up new areas for innovation and research. The National Platform for the City of the Future office is run jointly by Fraunhofer-Gesellschaft and the German Institute of Urban Affairs (Difu). Focus issues include energy and resource efficiency together with city governance. These are approached from a systems perspective. Future users of the new technologies are involved from an early stage to ensure that the outcomes are transferred into practice. Some 100 experts are currently working to develop an integrated, needs-based research and implementation agenda for the City of the Future.*[11]

The National Platform is one of the key networks involved in implementing the City of the Future project. It also reflects the opportunities and challenges faced by the Federal Government in implementation:

- The Platform's main task is to draft a **research agenda**. Stakeholders, however, are more often interested in **implementation-relevant outcomes**. This creates a challenge for the Platform to consider and support the transfer of research outcomes into practice from an early stage.
- Early **involvement of implementation-relevant stakeholders** is widely welcomed in development of a research agenda.
- The National Platform has proved a flexible structure that responded to initial **learning experience** in the starting phase by **including additional stakeholder groups** and thus addressing an extended range of issues and perspectives.
- **Including civil society** remains a challenge because the heterogeneous nature of civil society and lack of central organisation make for a poor fit with a committee-based approach.
- The Platform must cope with the tremendous range of existing research projects, initiatives, structures and processes in the field and must therefore work to achieve **greater transparency**. With the screening phase now completed, the next task is **prioritisation**.
- **All responsible government departments** must be well linked into the platform so that it fully reflects the current processes as they stand. The platform is well on track in this regard.

[9] http://www.eneff-stadt.info/en/research-funding/
[10] http://www.bmbf.de/de/21394.php and http://www.fona.de/de/14451
[11] http://www.bmbf.de/press/3423.php; http://www.difu.de/projekte/2013/geschaeftsstelle-nationale-plattform-zukunftsstadt-npz.html; http://www.difu.de/publikationen/difu-berichte-22013/geschaeftsstelle-nationale-plattform-zukunftsstadt.html; http://www.bw.dasl.de/wp-content/uploads/ZukunftRosenstein.pdf

- The diverging interests and perspectives of stakeholder groups require a **negotiation process** that must be kept open-ended and free of political interference.
- The platform has a **limited-term mandate** that ends with compilation of the research agenda. Whether and how the platform's cooperation functions can be taken over by a lasting structure at national level remains open.

A further important factor for the development of the City of the Future project in particular is the overarching energy and climate policy context of the *Energiewende*. Research issues that go beyond the scope of the project are addressed at higher level in the *Energiewende* Research Forum launched in March 2013:

> *The **Energiewende Research Forum** brings together high-ranking representatives of government departments, the Länder, the German Science Academies, scientific organisations and universities with representatives of industry and societal groups to discuss, from a scientific perspective, key issues raised by society and industry with regard to the transformation of the energy system. Acting on the basis of the German Science Academies' analyses of the Energy Systems of the Future project, the Forum works with stakeholders to assess research proposals, recommendations, scenarios and options for transforming the energy system. The Forum provides answers and raises questions regarding research and implementation in the overall context of energy reform. It makes proposals in the form of recommendations by the scientific community to relevant decision makers in industry, policymaking and civil society. It also identifies areas for further research and ideas for long-term research topics from the point of view of all stakeholders in industry and society.*[12]

Diverse activities by specific government departments are also thematically related to the project. Most of all, the then Federal Ministry of Transport, Building and Urban Development (BMVBS) and now the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), as the departments responsible for building and urban development, have long funded urban development measures that support municipalities in adapting to changing conditions.

The following current measures are especially relevant:

- **Energy-efficient new buildings:** As buildings account for about 40 percent of final energy consumption, reducing this consumption is very important in attaining the Federal Government's energy and climate policy targets. A major factor is thermal refurbishment of the over 19 million buildings in Germany. Accordingly, the target is for all new buildings to be climate-neutral by 2020. The Federal Government supports technical innovation and offers financial incentives to this end.[13]
- **Energy-saving refurbishment:** One means of promoting energy-efficient building is the *Sanierungskonfigurator* ('Refurbishment Configurator'), a service primarily for owners and tenants. The website aims to motivate owners and tenants to think about thermal refurbishment and supports them in making the decision. Incentives to act in the programme include the prospect of long-term savings in energy bills and an increase in market value.[14]
- **Energy-related urban renewal:** The Federal Government launched *Energetische Stadtsanierung* (Energy-Related Urban Renewal), a KfW funding programme, on 15 November 2011. The programme aims to spark extensive activities to improve energy-efficiency in buildings and infrastructure.[15]
- ***Zukunft Bau* building research initiative:** The *Zukunft Bau* building research initiative was launched in June 2006. The initiative is divided into two funding areas: application research and contract research. Some 500 research projects were carried out in the first five years of

[12] http://www.bmbf.de/de/12337.php
[13] http://www.bmvbs.de/DE/BauenUndWohnen/EnergieeffizienteGebaeude/energieeffiziente-gebaeude_node.html;jsessionid=946B480C1C069191F0148DCC5CC67F18
[14] http://www.sanierungskonfigurator.de/
[15] http://www.bmvbs.de/DE/BauenUndWohnen/EnergieeffizienteGebaeude/EnergetischeStadtsanierung/energetische-stadtsanierung_node.html

the initiative, with contract values and funding amounts totalling EUR 52 million. The aim is to improve energy management in modern buildings and refine the components needed for energy-efficient building envelopes and the use of renewable energy.[16]

- ***Effizienzhaus Plus* including electric mobility:** The outcome of this in-house research project by the Federal Ministry of Transport and Digital Infrastructure (BMVI) is *Effizienzhaus Plus,* a house that generates more energy than it uses, as a permanent showcase for the professional and general public in net-positive energy housing and electric mobility. The project also aims to promote closer interdisciplinary cooperation between architects, car manufacturers, energy utilities and building systems providers. As well as feeding surplus electricity into the grid, the house also provides power to charge electric cars.[17]
- **Urban development assistance:** The Federal Government has long funded urban development activities that are not specifically aligned with the aims of the City of the Future project. The *Soziale Stadt* ('Social City') programme, however, tries out participatory approaches to neighbourhood development that are highly relevant to the City of the Future project. Various temporary policies such as the investment pact for the thermal refurbishment of schools, preschools, sports facilities and other municipal social infrastructure likewise directed substantial resources towards the goals of City of the Future.

The High-Tech Strategy and its follow-on processes for the development of forward-looking projects were designed to involve not only government, but also further stakeholders (such as research institutions, industry and civil society) with their own initiatives from an early stage. The following initiatives are especially relevant to the City of the Future project:

- **Fraunhofer Morgenstadt City Insights:** Fraunhofer-Gesellschaft launched the Morgenstadt City Insights innovation network to learn from global best practices, technologies and solutions for smart and sustainable urban environments. The innovation network addresses the challenges of climate change, scarce resources, demographic change and growing mobility needs and provides a neutral knowledge platform for bringing together existing approaches and for developing technical, organisational and policy strategies, approaches and instruments. The project operates as a long-term cooperation between industry, research and stakeholders in pioneer cities.[18]
- **Bundesverband Smart City e.V.:** The city of the future is the focus of a national association, Bundesverband Smart City e.V. (BVSC), which was founded in 2011. BVSC aims to advance the *Energiewende*, making use of the EU Smart Cities initiative and promoting interdisciplinary research. It seeks integrated residential, living, working, mobility, recycling and energy solutions for the cities of tomorrow. BVSC regards itself not as a lobby group but as an integrated and interdisciplinary professional and research association.[19]
- **German Association of Towns and Municipalities Innovators Club:** The Innovators Club (IC) initiated by the German Association of Towns and Municipalities (DStGB) addresses strategic future issues facing municipalities such as education, climate change, energy, urban development, communication, IT and cooperation. The Innovators Club is a forum for interdisciplinary cooperation bringing together some 40 lord mayors, mayors and district administrators with leaders from policymaking, business and research.[20]

Alongside national activities and networks, initiatives at regional and Länder level are also important for German cities, as are European networks and funding programmes. The universe of such activities is fairly large and diverse, so the initiatives listed in the following are no more than examples explicitly mentioned by interviewees:

[16] http://www.forschungsinitiative.de/
[17] http://www.bmvbs.de/DE/EffizienzhausPlus/Elektromobilitaet/effizienzhaus-plus-elektromobilitaet_node.html
[18] http://www.iao.fraunhofer.de/lang-de/geschaeftsfelder/engineering-systeme/864-morgenstadt.html and http://www.iao.fraunhofer.de/images/produktblaetter/morgenstadt-city-insights.pdf
[19] http://www.bundesverband-smart-city.de/pdf/CHANC-GE_Artikel_Smart_Cities.pdf
[20] http://www.innovatorsclub.de/innovatorsclub/

- **Covenant of Mayors:** A network of currently over 5,000 cities and municipalities that aim to meet or even exceed the EU's 20 percent CO_2 reduction goal.[21]
- **Transform Agenda for Low Carbon Cities:** A network of currently six cities (Germany being represented by Hamburg) committed to reducing CO_2 emissions, generating more electricity from renewables and improving energy-efficiency.[22]
- **Initiativkreis Ruhr:** An alliance of over 60 companies from the Ruhr region, and among other things the initiator of the InnovationCity Ruhr competition won by the City of Bottrop in 2010. Some 125 individual projects for climate-friendly urban renewal while remaining a hub for industry are now underway as part of the InnnovationCity initiative.[23]

5. Implementation monitoring and evaluation

As an analysis of current urban development process and project approaches in Germany shows, a variety of **target and performance indicators** and similar **monitoring and evaluation systems** are already available and in use. Some pilot projects have developed entire indicator systems, such as the Green City Index,[24] that can serve as models for future processes. At the same time, experience in regions such as the Ruhr shows that off-the-peg indicator sets do not do justice to the specific conditions in each area. Some initiatives have had better experience with target corridors developed with local stakeholders in a bottom-up approach and subsequently subject to regular review and adjustment. Other initiatives have had good experience with a small number of headline indicators that have a mobilising effect and well express the overarching message of commitment to transformation.

Indicators thus play a role both in **specific indicator systems for fine-tuning** individual initiatives and as **selected individual indicators** serving as policy signals for wider processes. However, indicators have not yet been used to evaluate the overall transformation strategy. No approach is currently available for such a systemic evaluation of the project.

Also, a number of important goals as yet defy quantification. Enhanced **quality of life** is one example of an important goal dimension in various transformation processes that indicators can only capture to a limited extent. Other parameters can only be measured at high cost or with a substantial time lag, or are not readily accessible to the city population. **New technologies, decentralised measurement** and **open access/open governance** policies could deliver progress here. At the same time, more open information policies may well also bring more attention to the process itself.

6. Major transformation mechanisms and implementation challenges

Implementation of the project is affected by key challenges that are mostly felt at city level and require specific action to address them.

Networking

The **model approach** taken in the City of the Future project is not only aimed at implementation in selected cities and the related learning processes, but in the medium term also promotes intensive **exchange of experience** between participating cities and other local authorities. To this end, the project can build on well-established, existing platforms for exchange between local authorities such as the German Association of Cities (DST), the German Counties Association (DLT), and the German Association of Towns and Municipalities (DStGB).

There are already various **explicit networks for exchange** on transformation processes for the City of the Future, and these are considered important and useful. Some pioneer cities (such as Bottrop)

[21] http://www.covenantofmayors.eu/index_en.html
[22] http://urbantransform.eu/
[23] http://www.i-r.de/projekte/innovationcity-ruhr/
[24] http://www.siemens.com/entry/cc/de/greencityindex.htm

are frequently asked to share their experience in such networks and play an important part as best practice examples.

On the other hand, the large number of existing networks presents a problem for local authorities whose limited human resources make it impossible to be actively involved in all potentially relevant networks. A **structuring and focusing influence** from the overarching national level could **improve transparency** and **reduce duplication** here and thus aid the transfer of expertise. External logistical and financial support for local authorities is also helpful and necessary in some cases for networking activities themselves. There is then still **no guarantee** that exchange will take place, however, but external support (such as accompanying research) can help significantly.

Exchange of experience is seen as important **within** networks, but there is only limited scope for **diffusion of learning outcomes between** them and hence for **scaling up individual processes**. Attainment of wider scale often depends on the presence of a higher-level entity that lays down specific outcomes from experience as standards or advocates new practices. Learning thus not only takes place horizontally, but by **indirect reflection** through a higher layer. For example, guaranteed feed-in tariffs for renewable-generated electricity[25] were a predecessor of Germany's Renewable Energy Act, developed at local level and scaled up to national level by national legislation.

An important transformation mechanism alongside the networking of cities themselves is **networking between cities and other stakeholder groups**, notably researchers, industry and policymakers. Ideally, new research findings are disseminated into practice in cities and firms, which work with policymakers to decide a concerted course of action and provide each other with mutual support. In reality, there are **conflicts of interest** here that cannot be fully resolved. Interests are not always the same even within stakeholder groups (such as among cities or among policymakers). Hence cooperation networks are also **arenas for negotiating conflicts of interest**.

Transferring research findings into practice is also a major challenge. According to stakeholders, platform approaches such as the National Platform for the City of the Future are a relatively efficient and successful structure for **interdisciplinary exchange**. **New cross-cutting structures** have also proved productive at lower levels, such as within the city administrations. An example is the city of Ludwigsburg, which has established a cross-cutting sustainable urban development unit. Other cross-cutting structures could be applied in the hitherto vertically structured area of municipal energy supply, for example with local energy agencies or multimodal control centres for all energy sources.

Finally, the City of the Future process, with its official and unofficial platforms and networks, funding programmes and rules, cannot be viewed as a whole in isolation from **other transformation processes**. Some stakeholders are involved in different transformation processes at the same time and can compare experience. The German process to develop a research agenda for demographic change is thus compared with the development of a research agenda for the City of the Future. In the medium term, experience and **learning** takes place at a higher cross-process level.

Participation

Implementing the project requires the development of strategies to address major challenges and notably those bound up with the **overarching *Energiewende* process**.

Germany's new energy strategy will only succeed if innovative technological solutions are introduced and, what is more, if it goes hand in hand with a **shift in public awareness** and with **related changes in behaviour patterns**. Priorities must be redefined and scarce resources such as time and money reallocated.

Public participation in transformation processes is of key importance. Urban planning has long used public participation approaches to include local residents and interested parties. Novel participation approaches, however, go beyond public consultation to the public becoming **actively involved** in planning and implementation processes and eventually also in **decision-making**. **Financial**

[25] Aachen Model, http://www.kommunal-erneuerbar.de/de/energie-kommunen/2013/februar.html

participation combined with use, such as through energy cooperatives, is another new model for participation that is already generating an estimated €1 billion in additional investment in Germany through about 900 citizens or energy cooperatives.

New models of management have evolved between citizens, stakeholders and municipal administration. Civil society, trade and industry launch new processes from the bottom up, which are then adopted and managed by local authorities. Local authorities thus increasingly take on the role of **facilitators**, setting **parameters** while implementation is partly left to private players. Civil society can only fulfil this enhanced role if it has the necessary **self-organising capabilities** to avoid a situation in which a few well-organised minorities dominate. Civil **capacity building** is therefore a precondition.

Many civil society initiatives and trends have yet to attain wider exposure and adoption. As a result, social changes currently underway (phenomena such as the sharing economy, 'prosumers' and frequent users) so far tend to be underrepresented in many transformation processes. This makes it all the more important to bring together the different stakeholders in platforms and networks.

New technologies, especially communication technologies, can also improve participation options for civil society. Crowd funding in the cultural sector and other sharing economy approaches already rely on such platforms. This area of participation is now increasingly a research focus in the social sciences, in Germany for example under the Research for Sustainable Development (FONA) programme launched by the Federal Ministry of Education and Research (BMBF).[26] Decentralized and distributed data collection – such as using people's mobile devices – would offer further scope for participation.

Long-term perspective

Another challenge in transformation processes relates to the **long-term perspective**. This unaccustomed timescale has notable implications for financing: Cities need long-term financial resources to make major investment in infrastructure. New funding options are provided by new players such as state investment funds, life insurance companies and pension funds. These will only become involved, however, if they can expect a steady long-term return on investment. In other countries, **platforms and networks** have been formed to enhance the negotiating capabilities of local authorities with regard to such investors. Examples include Sweden's Kommuninvest (which includes most Swedish local authorities) and Switzerland's *Kommunalfinanzierungsagentur* (Municipal Funding Agency). A further option for long-term funding could take the form of new commitments by the Federal Government and the Länder, such as through a national transformation fund for urban renewal or climate-friendly federal bonds. Overall, however, the issue of long-term funding for transformation processes relating to the City of the Future in Germany **does not** appear to be resolved.

Not only funding but also long-term **planning horizons** are a challenge for transformation processes. Much **infrastructure** is designed for a 30 to 50-year service life, which means that today's decisions affect infrastructure provision well into the future and in some cases are practically irreversible. This conflicts with the short planning cycles and shifting thematic focuses and political priorities driven by electoral cycles and legislative periods. Even the responsibilities for key infrastructure decisions change at regular intervals when portfolios are reassigned among government departments. Specific transformation objectives have not yet reached the level of ordinary planning processes and instruments. Climate change mitigation, for example, is not yet a significant parameter in federal transport infrastructure planning.

Changes in mentality could be supported by **new methods**. **Scenario development** is a useful tool to highlight the long-term impact of decisions (such as to establish a district heating system over a period of approximately 20 years).

[26] See for example https://www.fona.de/de/15980

Vertical cooperation: Multi-level problems

The success of overarching transformation processes such as the *Energiewende* also critically depends on national-level infrastructure decisions such as the switch to smart grids with the associated new grid infrastructure and decentralised grid architecture. The push into electromobility as one element of the City of the Future is also largely shaped at national level. The **infrastructure spending** attached to the transformation of energy systems and electromobility cannot be met by local authorities; they are more a task for national or Länder-level investment.

The City of the Future project thus faces the challenge of **vertically coordinating** of local, regional and national responsibilities, balancing diverging interests and developing efficient management approaches. At best, this is a win-win situation. Local authorities with small and shrinking resources depend on national support, while national policy targets can only be attained with the help of local authorities.

Systemic transformation processes with a local focus tend to **enhance the status** of cities and this is reflected in new vertical cooperation patterns. It is new, for example, for the European Commission and cities to be in direct contact without going through the state and regional levels in between. There is likewise a need for direct communication between the federal level and large cities of a kind that cannot always go via the Länder. Greater use must be made of the professional knowledge in municipal administrations and large cities in national programme goal-seeking and design.

The City of the Future project was launched as an initiative of the Federal Government, which intended to exert a commensurate degree of influence on the project. Means of federal-level management include **large-scale ongoing investment** by a government department in funding programmes for use by local authorities, the provision of **legislation** and other parameters, and actively shaping a **public debate**, i.e. attempting to set the agenda. Experience with City of the Future also shows, however, that it is very hard for federal-level players alone to set in motion a discussion process that cuts across all levels. Instead, the Federal Government sets new areas of focus in the existing debate. Put even more generally, this means a transformation process such as the City of the Future cannot truly be initiated at national level but can at best be influenced at that level. **True management is not possible at national level** either, as cities are driven significantly more by local economic and social factors. It is possible, however, to raise awareness and highlight scope for change. Activities with a strong symbolic dimension such as future visions are important in signalling national support for local authorities, where that support is then put into action through other measures and funding programmes.

Scaling

On the other hand, cities are incubators for new, decentralised solutions. There is competition based on diversity that can readily be seen as city-to-city locational rivalry. A number of solutions that ultimately made it onto the national law books first emerged in this laboratory environment. However, cities will only be able to help develop successful approaches to system transformation if **functioning scaling mechanisms** are available. Although know-how transfer can take place through exchange within horizontal networks, experience with City of the Future suggests that the most effective means is scaling up to a higher level.

Upscaling and with it the standardisation of targets, requirements and implementation mechanisms conflicts to a certain degree with a situation-adapted approach. While unifying mechanisms are necessary, **uniform targets and indicators** tend to be **too hard for many cities** to cope with. Instead, experience shows that common **target corridors** better allow each city to take its own approach, and that iterative processes with conscious adjustment of target corridors can make better allowance for the circumstances of each city. Ultimately, the challenge of scaling up individual experience, approaches and goal systems remains largely unresolved. The City of Bottrop is a case in point. Bottrop has developed and put into action a highly committed transformation programme but it remains to be seen how far the Bottrop experience can be transferred to the surrounding Ruhr region.

One way of catering to the diversity of city realities is a **modular approach** where local authorities can choose according to their circumstances and means. A one-size-fits-all approach also fails to do credit to highly committed and successful communities that would like to see their example (and the effort needed to attain it) receive special acknowledgement and support.

Scaling up individual experience and approaches for general use is not the only challenge. In the opposite direction, there is the complementary question of **scaling down** higher-level approaches such as visions developed at Federal Government level that require **adaptation** to the individual needs of each community. The *Morgenstadt* vision evolved under the High-Tech Strategy is one such national vision of the future developed at federal level highlighting the readiness of the Federal Government and national stakeholders such as Fraunhofer-Gesellschaft to step up their commitment. In this case there were no plans to transfer the vision to the situation of individual communities.

A different pattern is followed by vision competitions: In its *Klimaneutrale Kommune* ('Climate-Neutral Community') competition, for example, the State of Baden-Württemberg called on towns and cities to develop scenarios for 2015 that charted the way to a climate-neutral future.[27] Experience with the City of the Future project shows with regard to such visions that the greatest mobilising effect comes from the development process itself, which should preferably involve as many affected stakeholders as possible. With this in mind, it is important that no one single stakeholder group should be allowed to dominate the process of developing the vision and hence its ultimate focus.

The following models for successful cooperation across a range of vertical levels can be already identified in the initial project implementation phase:

- **Vision process**: Development of a vision sparks general debate about the future of cities and provides the basis for efforts by local authorities to develop their own specific strategies and local visions as required.
- **Competition**: National competitions for local initiatives, such as *ZukunftsWerkStadt* or *Energieeffiziente Stadt*, which provide impetus and encourage exchange of experience between participating local authorities.
- **Platform**: Overarching platforms like the National Platform for the City of the Future, which bring together stakeholders from different levels, provide an exchange format for local initiatives that can also act as a driver for incorporation into national research funding.

Horizontal cooperation

A **multi-level problem** is also evident in shared or overlapping responsibilities at **horizontal level**. Multiple government departments are responsible for research and innovation policy aspects of the *Energiewende* (BMWi, BMUB and BMBF), while coordination is mainly effected through the *Energiewende* research platform under the **6th Energy Research Programme**. The **High-Tech Strategy** is a further approach for bringing together objectives and activities and enhancing cross-departmental cooperation. **Structural limits** remain in place, however, for example with regard to the number of budget headings and the consequent funding. For integrated urban development approaches at local level, this means that they continue having to look into multiple funding options at the same time in order to obtain funding for local-level activities.

More **cross-departmental coordination** is needed not only a national-level approach. At Länder level, under a cabinet resolution in North Rhine-Westphalia, different sources of funding for urban and housing development, urban transport and investment in public transportation have been combined and focused on urban neighbourhoods.[28] The North Rhine-Westphalia government sees this as a pilot project that if successful is to be extended to take in further policy areas.

[27] An example is the Öko-Institut study for the city of Freiburg: http://www.freiburg.de/pb/site/Freiburg/get/291387/KlimaneutraleKommune_Schlussbericht.pdf

[28] http://www.nrw.de/landesregierung/landesregierung-will-stadtquartiere-staerken-rahmenkonzept-fuer-80-stadtviertel-beschlossen-14082/

At local level, too, the project requires a diverse range of stakeholders to be brought on board, including regional energy utilities, the various local government departments, local transport operators, and housing associations. One advantage at local level is that cooperation structures are already likely to exist and stakeholders tend to have longstanding experience in working together.

Typology of transformation mechanisms

The following specific approaches from the 'CO_2-neutral, energy-efficient and climate-adapted cities' project can be identified as major types of transformation mechanisms and classified in a typology:

- **National agenda-setting and initiation of a national discourse:**
  - The *Morgenstadt* ('Tomorrow Town') vision
  - National competitions such as *ZukunftsWerkStadt* and *Energieeffiziente Stadt*
  - National Platform for the City of the Future and the *Energiewende* Research Forum
- **Experimental approaches of testing new models for implementation:**
  - Model projects such as *Schaufenster Elektromobilität* ('Electromobility Showcases', a funding programme)
  - Specific local strategies under *ZukunftsWerkStadt*
- **Networking approaches:**
  - Platform approaches like the National Platform for the City of the Future, the National Platform for Electromobility and the *Energiewende* Research Forum dialogue platform
- **Conventional research agendas:**
  - Ongoing funding activities such as the energy research programme and the *Zukunft Bau* building research initiative
  - Newly planned funding activities that take their substantive 'filling' from the outcomes of the National Platform for the City of the Future
- **Conventional infrastructural tasks:**
  - Activities such as those relating to the smart grid
- **Conventional financial support and parameter setting** – e.g. for building refurbishment
  - Energy-efficient new buildings; energy-saving refurbishment

7. Redefinition of innovation and its consequences

A number of forward-looking projects have been developed under the Federal Government's High-Tech Strategy. This strategy sees innovation policy as the pivotal force in shaping systemic change processes. In this context, it is interesting to know what specific **role innovations and innovation policy play in such change processes** and whether they are key enablers of far-reaching change. On the other hand, we must also consider the role that **systemic change processes** and related measures play in the **reorientation of innovation policy** and specific innovation processes itself, for example by taking greater account of the user viewpoint.

The debate within the City of the Future project notably focuses on the need for **technological innovation on the one hand versus social innovation on the other**. Technological solutions are considered necessary by most stakeholders, but not sufficient on their own for successfully shaping the transformation processes for the City of the Future. Many stakeholders see a special need to focus less attention on technology when seeking solutions and also to ensure that new players become involved in cooperative efforts like the National Platform for the City of the Future.

Social innovations emerge in small social milieus. They often operate through social networks, and many spread accidentally so that **standard governance instruments cannot be used**. Creative milieus can completely reinterpret urban renewal in specific neighbourhoods. So far there is only a very fragmentary understanding of the processes and mechanisms involved. Urban sociology research could help improve this understanding.

The relocation of innovative solutions at the level of neighbourhoods and social milieus could also lead to new funding approaches. Participatory budgeting has already provided a wide range of experience

with participatory allocation and channelling of resources in neighbourhood management. This experience could serve as a model example, such as for innovation vouchers as a neighbourhood management tool.

Many stakeholders also consider it important to involve **technology users** from an early stage. People cannot be forced to adopt technology-based solutions (such as smartphones for mobility management). There are groups who do not accept or cannot afford such solutions.

Stakeholders close to industry call for **demonstrators** to prove **technical feasibility**, and highlight the market as an important mechanism for spreading technology-based solutions. Visions involving technology-based transformation of this kind are closer to the 'smart city' idea. For other stakeholders, however, this perspective is too interest-driven and harder to put across. Technology choices can commit to specific development paths that are costly to exit and so create path dependency.

At the same time, a participatory revolution is underway, partly on the back of technological innovations. The digital revolution cutting across all areas of life has a levelling effect and provides broad sectors of society with access to information, ways of making themselves heard and opportunities for networking. The ability to use these, however, requires individual **digital literacy**.

The discussion surrounding the technology-centeredness of transformation processes has impacts on process design as a whole. **Learning processes** can be seen at work, for example, when it comes to the selection of key stakeholders. The German Institute of Urban Affairs (Difu), as co-coordinator of the National Platform for the City of the Future, is one organisation squarely in favour of greater involvement for civil society. This evens out the balance relative to technology-centric players. Organisations such as Difu thus act as intermediaries between different communities.

A trend towards a **broader innovation approach** is also evident at political level. The increasing involvement of other government departments than those traditionally focused on research and innovation policy is restructuring the debate with new communities involved.

The experience gained with the implementation of the City of the Future and other forward-looking projects will thus provide learning **input for the overarching High-Tech Strategy** and affect **how innovation is conceived** overall.

8. **International perspective**

Monitoring of the transformation processes in Germany could gain further impetus from comparison with **experience in other countries**. The stakeholders in Germany keep a very close look on **international good practice examples**. International approaches referred to include Salzburg, Copenhagen, Singapore and Tokyo. Urban development ideas also come from urban regions very different from the German situation, such as in China. The many existing international networks may provide a channel for expertise transfer. Social innovations are sometimes quicker to transfer across national borders, and social networks are already more internationally configured than traditional technology-focused forms of cooperation.

German stakeholders are also interested, however, to adapt their solutions for urban transformation to **other urban contexts** worldwide in order to **develop markets** (this applies notably to business, but also includes research service providers such as the Fraunhofer Institutes) and/or to make their contribution in addressing global challenges, for example in emerging market megacities (primarily research institutes).

9. Lessons learned for transformation processes and what remains to be done

This case study on the City of the Future project has analysed initial implementation steps by way of example and located them in the context of urban transformation in Germany. As well as analysing the case study subject, the study also aimed to pinpoint initial indications of **generally applicable experience** that can be put to use in similar transformation processes, such as other forward-looking projects under the High-Tech Strategy. Elements of an interim conclusion include the following:

- Transformation processes like the City of the Future project cannot be initiated by top-down government action alone but must also rely on **established forces of change**.
- Transformation processes like the project cannot be driven by a single government department such as BMBF. Instead, they must receive broader policy support from **different government departments**, ideally spanning the entire range of relevant transformation factors.
- The innovation system and its players still have to **'learn' a broader definition of innovation**. This paradigm shift needs time as well as suitable mechanisms and learning opportunities.
- **Broad and close involvement of stakeholders** is therefore key to the success of transformation processes. Often the process – that is, the discourse between stakeholders – is more important than the achievement of the set goal, for example a specific vision or the adoption of an action plan. This is a precondition for **mutual learning** to take place and for consensus building processes to succeed. An important tool in this context consists of learning platforms, such as the **platforms** for the various individual forward-looking projects.
- In the largely decentralised transformation processes, the **national level is not as important and influential** as was originally thought. Symbolic and real national-level support for local transformation processes is nonetheless important and helpful.
- Systemic, locally focused transformation processes bring **new stakeholders** onto the stage. **Cities** in particular play a new role at national and even European or international level. These new players must be directly addressed and involved, without going through conventional channels via the various levels of Länder and regional administration.
- The need for stakeholders to become involved on a broad basis and for civil society to participate more strongly suggests that **novel instruments such as foresight or visions and scenarios** should be used. Here, too, the journey is often the destination: The development process with the involvement of multiple stakeholder groups is more important than the outcome.

Analysis of the processes for implementation of the City of the Future also brings out **challenges** for successful transformation processes that still await a satisfactory solution:

- Networking approaches are important and appropriate but have a tendency towards somehow uncontrolled growth. Too many parallel networking processes cannot be handled properly by stakeholders and waste resources. Efforts to **'regulate' networking processes**, for example by networking between networks, have so far rarely been successful. Optimum networking is difficult to achieve.
- The city as laboratory is a very successful metaphor that is readily used for pilot or model projects and has led to a wealth of exciting ideas. There is no lack of good practice examples today for a wide range of problems. However, **scaling up** such specific examples and approaches to the national level remains a challenge.
- Another largely unsettled question is how to give existing planning and decision-making processes a **long-term perspective**. There is general consensus that such a perspective is vital, most of all for infrastructure decisions. There seems to be consensus that this perspective is still too weakly rooted.

- Many local authorities also face considerable **funding problems** that given the often critical state of local government finance stand little chance of being solved in the near future. Ideas for new funding models are widely discussed, such as a larger role for the public through cooperatives, launching new national funds, and greater involvement of the life insurance sector. All the same, most players agree that funding is one of the biggest challenges in urban transformation.
- Finally, another key issue in new transformation approaches that is yet to be resolved is how to achieve broad **civil participation**. Public involvement up to the point of having a say in relevant process steps and spending is not the usual policy pattern. Experience and trust needs to be built up here, using new communication media and technologies in the right way as these look to be a widely accessible and affordable means of gaining broad participation.