Internal Development in Urban Growth Regions

Opportunities and Challenges for Technical Infrastructures

Für Mensch & Umwelt

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Content

Results of the Project

Ecological impacts of integrated internal development concepts on the infrastructures of urban growth regions

Foreword

Contrary to many forecasts in the past, the population in Germany has grown significantly in recent years to currently 84.1 million people[1]. Long-term population forecasts have been and continue to be revised upward, not least under the influence of migration movements. Currently, almost 80 percent of the population lives in large cities and their surrounding areas[2]. Spatial concentration is particularly noticeable in cities and metropolitan areas, the so-called growth regions. In these areas, ecological, economic, social and cultural developments are particularly dynamic.

With the 'City for Tomorrow', the Federal Environment Agency has developed a vision of a livable city of the future that is low-noise, green, compact and mixed, and in which people can be environmentally mobile (UBA 2017). The strategic research agenda 'Urban Environmental Protection' (UBA 2018) has also identified research priorities to strengthen the environmental perspective in urban development and named better coordinated urban and infrastructure development as a key task for research and implementation. To this end, a research and development project focused on the environmental impacts of integrated inner city development concepts on the infrastructures of urban growth regions, looking at water supply and wastewater disposal, waste management, transport (esp. public transport), and local and district heating/cooling. Central questions were how the effects of internal development are to be evaluated from an environmental point of view, where potentials lie and which ecological and economic connections exist between infrastructure development and internal development.

This brochure presents the most important results from the studies in five model cities. These impressively show the considerable potential of internal development to counter growth and at the same time minimize environmental pollution and costs for additional technical infrastructures. In particular, Dispersed Internal Development, i. e., the development of potential on vacant lots and underutilized land, the addition of more stories to buildings, etc., shows high synergies for the use of already existing infrastructures. At the same time, it became clear that urban green infrastructure with its functions for quality of life, recreation and climate adaptation plays an important role for the success and acceptance of inner city development.

The brochure is aimed at the specialist units in the municipalities responsible for urban planning, construction, transportation, waste, energy and green spaces. It aims to provide impetus for strengthening inner city development and linking it with environmentally compatible and resource-saving infrastructure development. It also formulates recommendations for federal policymakers to better support municipalities in coping with the ongoing growth pressure.

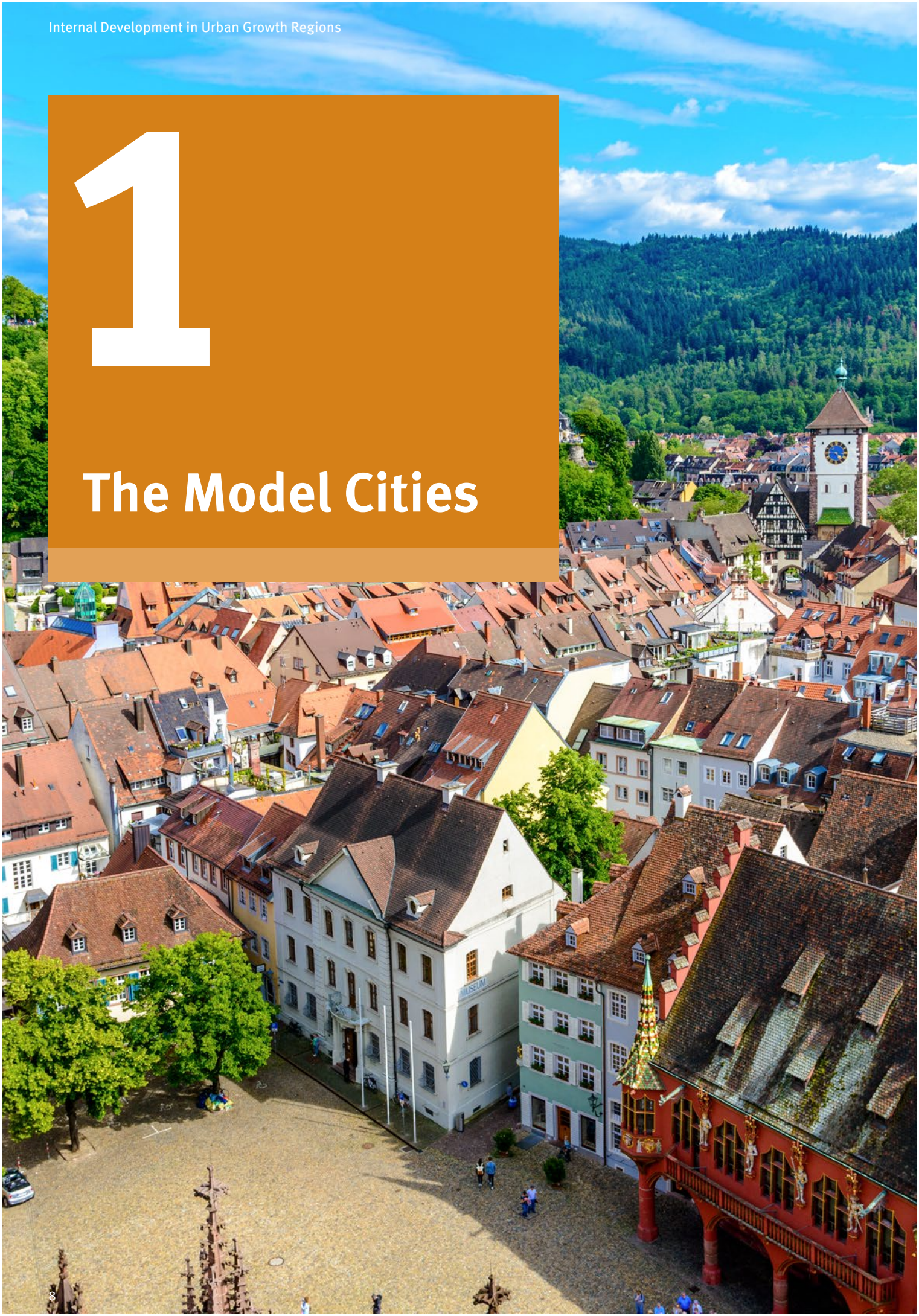
Our express thanks go to the project teams from Oeko-Institut e. V. and the Institute for Urban and Regional Development (IfSR), the stakeholders involved at the Federal Environment Agency and the Federal Environment Ministry, and the numerous participants from the city administrations of the five model cities Freiburg, Karlsruhe, Leipzig, Osnabrück and Ulm.

Martin Schmied, Federal Environment Agency, Head of Division I 'Environmental Planning and Sustainability Strategies'

1 Population: Official population of Germany 2022 – Federal Statistical Office (destatis.de, as of 27.10.2022)
2 BBSR – Spatial observation – Ongoing urban observation – Spatial boundaries (bund.de)

1

The Model Cities



Introduction

In Germany, significant population growth has been observed for a number of years in economically and culturally attractive cities and regions such as Berlin, Cologne, Dusseldorf, Munich, Leipzig, Rhine-Main, Rhine-Neckar, Hamburg, Stuttgart, etc. The population in these growth regions is expected to continue to grow strongly until 2030. A strong influx into these growth regions is also expected in the years up to 2030, which will also lead to high birth rates due to the age structure of the immigrants. In addition, many urban counties – i. e., counties with dense settlement structures in the closer and wider service area of the large cities – are also experiencing population growth, which is fed by inflows from outside the region and migration within the region. It is therefore appropriate to speak of urban growth regions, which must become the focus of research and politics. The need for additional housing, social amenities, commercial space, etc. also implies greater demand for supply infrastructures such as water/wastewater, waste, energy, public transport or roads (pedestrian, bicycle, motorized private transport).

The urban development challenges in urban growth regions are increasing. Internal development is a key strategy for meeting the additional demand for housing and commercial sites in the context of limited land in cities and their immediate surroundings. Forced internal development is also a key element in achieving the goal of the 2016 sustainability strategy (reducing the daily new use of settlement and transport land to less than 30 hectares by 2030). Increasing settlement density can, on the one hand, increase the efficiency of technical supply and disposal systems and in public transport (e. g. impetus for shorter intervals of existing bus lines). On the other hand, strong population and job growth in urban growth regions can push existing infrastructures such as local public transport to the limits of their capacity (cf. discussions like e. g., in Frankfurt am Main or Munich via the neuralgic bottlenecks of the central and heavily frequented S-Bahn tunnels).

Cities in Growth Regions

Particularly Relevant Infrastructures

- Water supply/wastewater disposal
- Transport
- Waste
- Local and district heating/cooling

Cities in growth regions face massive challenges. A booming economy and large-scale immigration are leading to tight land and housing markets. Prices are rising sharply and there are drastic supply bottlenecks in the housing market, leading to an exodus of lower- and middle-income households in particular from the core cities to the urban fringe of a region. The question increasingly arises to what extent the potentials of inner city development can meet the needs for the provision of living space in terms of quantity and quality. Possible effects on the urban climate due to uncontrolled redensification as well as bottlenecks of technical infrastructures are to be discussed. There is a threat of a new wave of suburbanization in Germany's growth regions, with extensive negative ecological effects, for example, in the areas of land consumption, new construction and maintenance of infrastructures, commute induction, social segmentation and resource consumption. The focus of this research project was on urban growth regions and the infrastructures that are particularly relevant due to the exploitation of internal development potentials. The above figures illustrate the technical infrastructures that are the focus of the project.

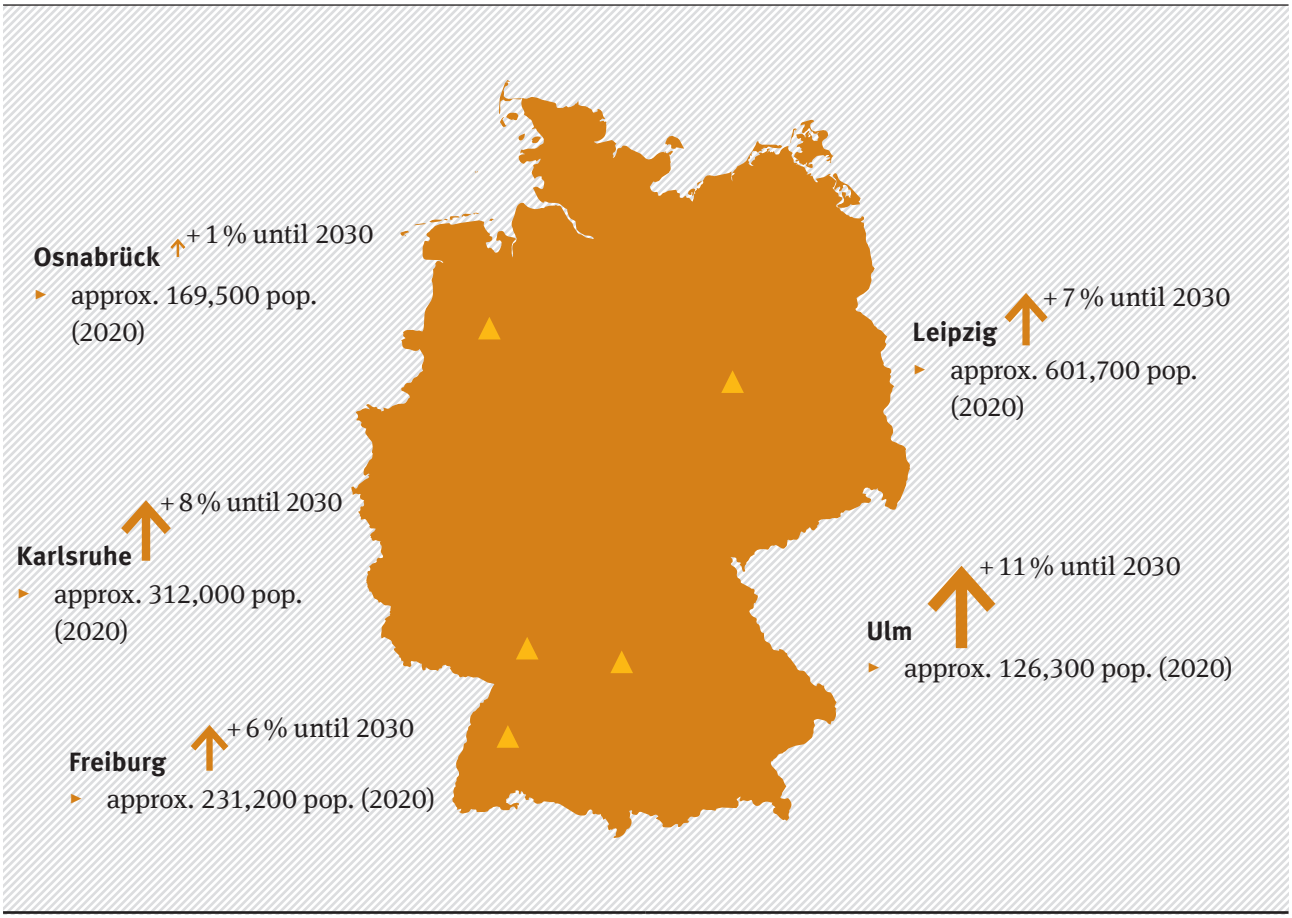
The aim of the project was to investigate the ecological and environmental effects of integrated internal development concepts on the infrastructures of urban growth regions within the framework of scenarios for settlement development. The central question was how the necessary infrastructures can be expanded or rebuilt in a timely manner through integrated planning so that land-saving internal development can take place according to the model of the compact city, even under growth conditions, while at the same time ensuring good living and environmental conditions.

Selection of Model Cities

The project was carried out in cooperation with five interesting model cities (large cities with more than 100,000 inhabitants) in growth regions. The model cities were selected in coordination with the Federal Environment Agency at the beginning of the project. The representatives of the model cities were continuously involved in the development of the scenarios and the discussion of the results. A key criterion for selection as model cities was expected sustained population growth. The model cities could cover different size classes and initial conditions, for example in terms of expected population growth.

Figure 01

Model cities – Location and Expected Population Growth 2020 to 2030



Source: Own Illustration IfSR

Brief Presentation of the Model Cities

Leipzig

Leipzig had almost 610,000 inhabitants[3] at the end of 2021. In a 10 year comparison with 2011, this means an increase of a good 92,000 inhabitants, an increase of around 17.8 %. This makes the city of Leipzig one of the cities with the strongest growth dynamics in Germany. This fulminant population growth is due to the special initial situation of the city.

In contrast to the situation in the other four model cities, Leipzig had considerable housing vacancies (Wilhelminian style stock, etc.) and brownfields in its settlement area just over a decade ago. This was due to Leipzig's development after reunification: Leipzig was considered a shrinking city with all the consequences.

The end of the noughties saw the start of a complete turnaround with corresponding population growth, which was supported not least by extensive relocations from the manufacturing sector (primarily the automotive industry as well as retail and logistics companies) in Leipzig and the immediate surroundings of Leipzig. Leipzig's growth in terms of population and jobs is expected to continue in the period 2020 to 2030 – albeit at somewhat more moderate growth rates than in the past ten years. Compared to the well-known swarm cities in the western federal states, the land potential in Leipzig is still significantly high for both residential and commercial use.

3 https://www.leipzig.de/news/news/leipzig-hat-jetzt-609869-einwohner

Freiburg i. Br.

The population of the university city of Freiburg im Br. increased by a good 17,000 between the end of 2011 and the end of 2021 – an increase of 8.2 % in ten years[4]. The university city with a high proportion of the service sector has long enjoyed great popularity and is thus subject to strong pressure to move in. Efforts to realize the population growth in the internal development are limited due to already exhausted potentials on conversion areas in the past and due to various redensification measures (addition of more floors, building in 2nd row, etc.).

Since the land potential from the land use plan has also been heavily used up in the immediate vicinity of Freiburg, the city is planning to create living space for up to 15,000 people in its own urban area with the new Dietenbach district in the external development. On February 24, 2019, this plan was supported by a majority of the Freiburg population in a referendum. This sets the course for Freiburg's further growth against a background of overall scarce land potential. Compared to other cities with similar land pressures, the construction of traditional single-family homes in Freiburg no longer plays a role.

Karlsruhe

At the end of 2021, Karlsruhe had an increase of around 12,000 inhabitants, or 4.2 %, compared to the previous year[5]. This moderate growth compared to the other model cities is not due to a lack of attractiveness of the city. Rather, Karlsruhe faces the difficult task of coping with growth pressure in the city and the region in the face of a very limited supply of land. In recent years, only 600 new apartments have been built each year. In the next few years, moderate potentials can be realized on conversion areas for residential construction.

Due to the high demand pressure and the overall limited land potential in the city area, Karlsruhe is pursuing the policy of also developing building land potential in the surrounding area within the framework of the Karlsruhe neighborhood association. In this context, the Karlsruhe neighborhood association, which includes ten other surrounding municipalities in addition to the city of Karlsruhe, has updated the joint land use plan 2030[6]. In the area of commercial space, Karlsruhe focuses primarily on urban locations for office use and the research and development sector.

4 https://fritz.freiburg.de/asw/asw.dll?aw=Bevoelkerung%2FBESTAND_UEBERSICHT

5 https://www.karlsruhe.de/b4/stadtentwicklung/statistik.de

6 http://www.nachbarschaftsverband-karlsruhe.de/b2/fnp2030/HF_sections/content/1624868734837/1638258149250/Brosch%C3%BCre_FNP2030_3mm%20Anschnitt.pdf

Osnabrück

Osnabrück had 168,385 residents at the end of September 2021, an increase of a good 11,000 people or around 7.2 % within 10 years[7]. In contrast to the other four model cities, the detached single-family house is the house type of choice in Osnabrück, if the financial possibilities of the interested parties permit this. Here, the competition from the surrounding communities, which provide the corresponding areas and can thus contribute to the migration from Osnabrück to the surrounding areas, must be taken into account.

Osnabrück is expected to see moderate population growth over the next ten years. The city is working intensively to activate the potential for internal development, among other things by setting up a housing contact point. Osnabrück has difficulty meeting the existing demand for commercial space (especially for logistics) within its own city limits. In part, the surrounding area takes its place.

Ulm

At the end of December 2020, Ulm had 126,405 inhabitants. This means an increase of around 3,600 people within 10 years (plus 2.9 %)[8]. For the next decade (until 2030), a population growth of around 11 % is expected for the city of Ulm. As in Osnabrück, demand for single-family homes in Ulm will remain brisk. The land required for future population growth in Ulm is to be realized primarily on conversion sites in the city area in the coming years.

The commercial sector in Ulm is represented not least by the electronics industry, the automotive industry and the pharmaceutical industry. In addition to industrial activities, a number of research institutions characterize the city beyond the university. The city of Ulm is known nationwide not least because of its sustainable land and building policy, which dates back to 1889. Thus, the city of Ulm has always exerted an active influence on the local real estate market in line with the city's strategy.

7 https://www.osnabrueck.de/fileadmin/eigene_Dateien/01_osnabrueck.de/011_Rathouse/statistics/user_upload/OS_Current_Interactive_2021_2_%C3%BCrevised.pdf

8 https://www.ulm.de/rathaus/stadtverwaltung/statistiken-und-offene-daten/ulm-short-and-short

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Scenarios

Scenario Setting

Three scenarios for population and land development were developed for each model city. The underlying values for population development were based on urban calculations. All scenarios consider both internal and external residential and commercial development, but with different emphases.

With the help of the scenarios, a realistic development corridor of the settlement development could be shown depending on different political-planning goals, activities and framework conditions. Different influencing factors and their effects, such as the increased activation of internal development potential or different residential densities in external development, were presented in the scenarios and discussed with the representatives of the model cities.

The data basis for the settlement area potentials was prepared differently in the model cities. In order to be able to base the scenarios on thematically and temporally comparable data, land potentials were determined individually for each model city using a uniform method. This was done on the basis of a mapping of settlement structure types and considerations of the possibilities of creating living space by closing gaps between buildings, adding storeys and attic conversions, demolition and new construction at higher densities, and supplementary development.

The assumptions for the activation of the above-mentioned redensification potentials in the period under consideration were individually coordinated in expert discussions with the model cities. Assumptions were also made for the activation of conversion areas. Values for housing construction in external development in the urban area were agreed and specific density values were defined for low density and high density for the scenario analysis.

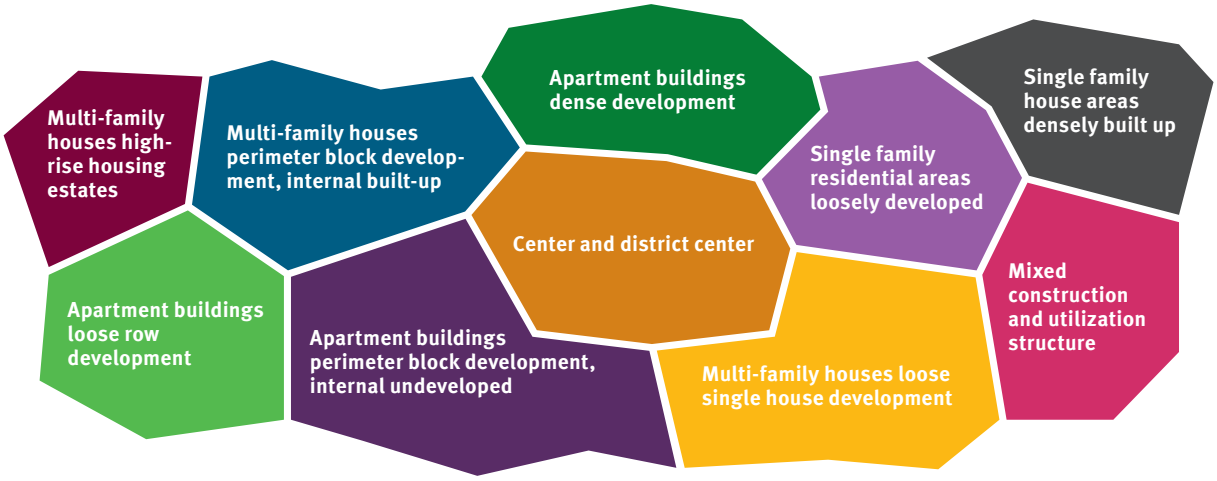
The scenarios were created for the period 2020–2030. In all scenarios, it is assumed that the demand for housing and workplaces that arises as a result of the calculated population development and cannot be met in the respective model city itself under the assumptions made will be taken into account by providing corresponding areas and construction measures in the surrounding area.

For each Scenario, the Number of Additional Residents was Determined for the Model City ...

- ... can find housing within the framework of internal development.
- ... can find housing on areas of conversion measures.
- ... can be supplemented with housing on potential sites in external development, and
- ... may not be provided with housing in the city and must find housing in the surrounding area.

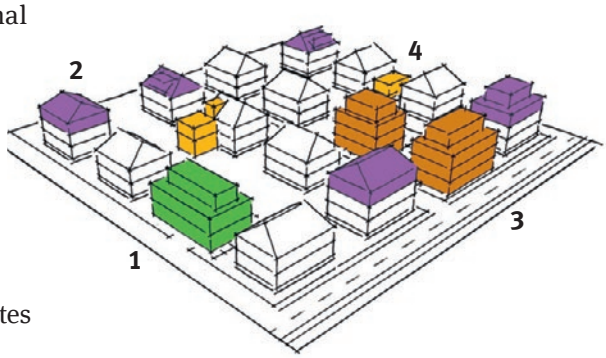
Basics of Scenarios

Mapping of Settlement Structure Types in the Model Cities (Residential)



Residential Units in Internal Development:

Formation of individual assumptions on the internal development potential of settlement structure types per hectare according to four internal development types:

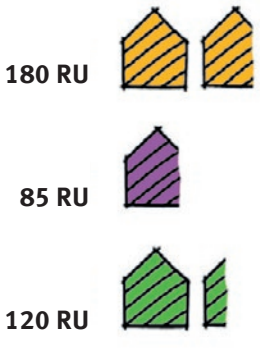


1. Development of gaps between buildings
2. Addition and attic conversion
3. Demolition and new construction in higher density
4. Complementary development

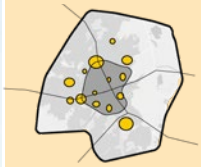
From theoretical to activatable potential: differentiated activation rates according to the four internal development types and the settlement structure types. Individual data from the cities on housing units on conversion sites (former military sites, commercial brownfields, railroad sites, ...).

Residential Units (RU) in External Development

- Information provided by the cities on settlement areas in external development and on their ability to be activated in the period under review.
- Integration of concrete urban planning, such as the development of a new urban district.
- Mapping of different priorities in external development: dispersed urban development or concentration at one or more large locations.
- For this purpose, different assumptions on the density.

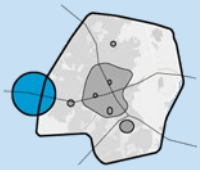


Scenario Assumptions at Overview



Scenario
Internal Development

- The respective cities are actively supporting the filling of gaps between buildings, the addition of new stories and loft conversions, demolition and new construction at higher densities, and supplementary development in existing buildings. Housing and population densities in existing settlements are increasing.
- In the area of commercial development, the focus of industry development is on the research, office and service sectors, or a high demand for sites for non-disturbing business and creative industries.
- In the area of technical infrastructures, there is a trend toward network upgrading and expansion in the existing network and in the area of public transport.



Scenario
External Development (Compact)

- Internal development is not supported to the same extent as in the Internal Development Scenario. External development is concentrated at several large locations. The share of activated internal development potential is halved compared to the Internal Development Scenario. For external development, higher proportions of land with a higher proportion of multi-story residential construction and a concentration on one or more locations are assumed.
- In the area of commercial development, a focus of industry development is placed on the research, office and service sectors, or a small proportion of land for manufacturing.
- In the area of technical infrastructures, there is a trend toward network expansion of technical infrastructures and public transport at concentrated, high-density locations.

Scenario
External Development (Dispersed)

- The development of settlements is increasingly taking place in the rounding off of the settlement body in the outer area – distributed over several small locations that do not require any or only a small amount of external development. A higher proportion of development there takes place at moderate and low densities. Internal development is not supported to the same extent as in the Internal Development Scenario. The share of activated internal development potential is halved compared to the Internal Development Scenario.
- In the area of commercial development, in addition to sites for office use and services or research/innovation, robust sites for manufacturing companies are also being developed.
- In the area of technical infrastructures, there is a tendency to expand the network and the public transport services in the area at several smaller locations.

Results Compact. Model City Freiburg.

Settlement Structure

The settlement structure of the model city of Freiburg is characterized by a comparatively high proportion of areas with multi-family houses as loose development of single houses. In these areas, internal development potential is identified primarily through demolition and new construction at higher densities and through structural additions. In areas with single-family homes, only a small amount of internal development potential is seen, such as vacant lots that can be activated.

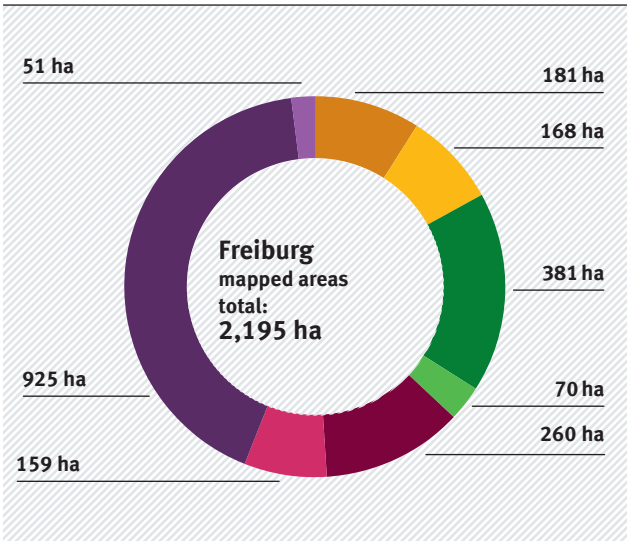
Extensive conversion areas are not to be expected in the foreseeable future, apart from the 'Güterbahnhof Nord' area currently under development.

As part of the preparation of the Freiburg Perspective Plan, the city administration has defined development areas in which focal points for redensification are seen or – also on the contrary – the need for an improved open space situation and no further redensification should take place. On this basis, framework plans are developed, followed by development plans and concrete projects. Freiburg has also approached the subject of the potential for adding storeys with its own study and examined the potential in this regard.

Figure 02

Scenario Input Variables in Freiburg

Area Shares According to Settlement Structure Types in Hectare



- Center and district center, high density | 8 %
- Multi-family houses as perimeter block development | 8 %
- Multi-family dwellings as loose single-family dwellings | 17 %
- Multi-family houses as loose row development | 3 %
- Multi-family houses as dense development | 12 %
- Multi-family houses in high-rise housing estates of the 1970s/ 1980s | 7 %
- Single-family residential areas, loosely built | 42 %
- Mixed building and use structure | 2 %

Source: Oeko-Institut e. V., IfSR

Tab. 01

Model City of Freiburg | Basis for Scenarios for Settlement Development: Basic Assumptions and Effects on Settlement Development at a Glance

Additional Residential Units (RU) 2020 to 2030:

Scenarios 2020 to 2030	Internal Development 	External Development Compact 	External Development Dispersed 
Internal Development	2,400 RU	1,200 RU	1,200 RU
Conversion Areas	700 RU	700 RU	700 RU
External Development	3,750 RU ›› approx 45 ha	4,500 RU ›› approx 50 ha	2,500 RU ›› approx 40 ha
›› Outward migration or no inward migration: additional residential development area in the surrounding area	1,206 RU ›› approx. 30 ha	1,656 RU ›› approx. 40 ha	3,656 RU ›› approx 90 ha

Source: Oeko-Institut e. V., IfSR

Population Development Until 2030

For Freiburg, the following is planned for the period from 2020 to 2030, the population is expected to increase by around 14,000 people. Additional living space will also be needed due to a further increase in living space per capita. In total, the scenarios for 2020 to 2030 are based on approximately 8,000 additional residential units.

External Development – a New District

The city of Freiburg is currently developing the new Dietenbach district. Up to 6,900 affordable apartments for around 15,000 people are to be built there by 2042. Dietenbach is to become a land-efficient, climate-neutral, inclusive and colorful district with short distances, schools, sports and open spaces, daycare centers and shopping facilities. In each of the scenarios, different assumptions were made about the residential units available by 2030 for this ‘compact’ external development.

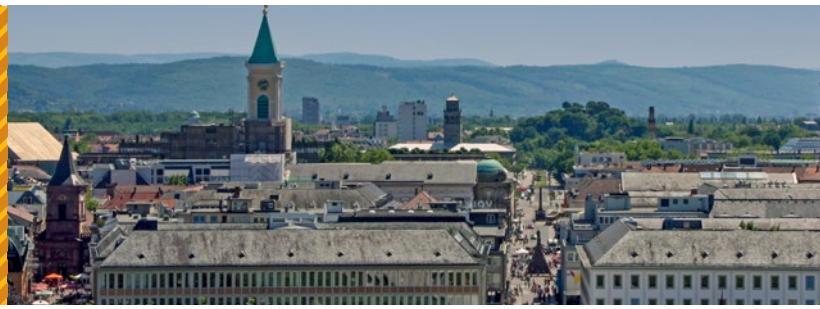
Assumptions for density in external development in Freiburg are 100 RU/ha gross building land (GBL) for high-density area developments and 40 RU/ha GBL for low-density area developments.

Additional Commercial Space by 2030

The assumptions regarding the additional commercial space required in the city of Freiburg and the surrounding area range from approx. 43 hectares in the Internal Development Scenario to 53 hectares in the External Development Dispersed Scenario. For Freiburg, a clear focus on the development of office space is seen in all scenarios for new commercial space.

Results Compact. Model City Karlsruhe.





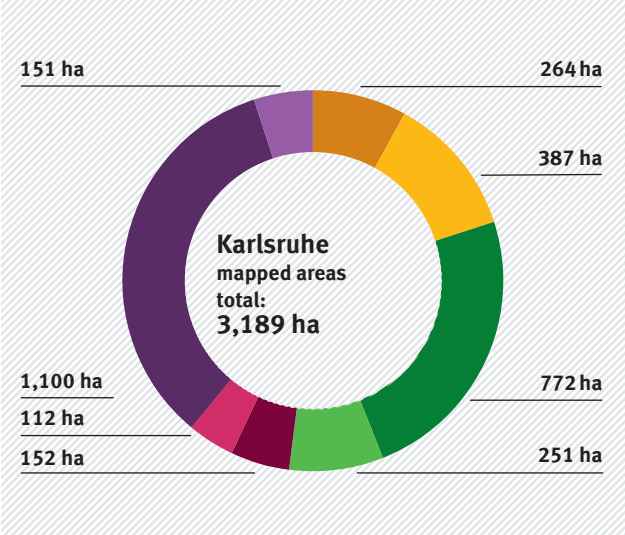
Settlement Structure

A characteristic element of the settlement structure of the model city of Karlsruhe are extensive areas with multi-family houses built in rows from the 1950s to 1960s. In these areas, the potential for internal development through building additions and storeys is identified. The scenarios take into account the fact that, according to the experience of local stakeholders, the implementation of concrete projects is often hampered by resistance from the residents of these estates. The site of the former military use of the 'Alten Flugplatz' in Karlsruhe North is the only major conversion area in the city for the next few years. Here, the scenarios call for additional 2,000 housing units assumed by 2030.

Figure 03

Scenario Input Variables in Karlsruhe

Area Shares According to Settlement Structure Types in Hectare



- Center and district center, high density | 8 %
- Multi-family houses as perimeter block development | 12 %
- Multi-family dwellings as loose single-family dwellings | 24 %
- Multi-family houses as loose row development | 8 %
- Multi-family houses as dense development | 5 %
- Multi-family houses in high-rise housing estates of the 1970s/ 1980s | 4 %
- Single-family residential areas, loosely built | 35 %
- Mixed building and use structure | 5 %

Source: Oeko-Institut e. V., IfSR

Tab. 02

Model City Karlsruhe | Basis for Scenarios for Settlement Development: Basic Assumptions and Effects on Settlement Development at a Glance

Additional Residential Units (RU) 2020 to 2030:

Scenarios 2020 to 2030	Internal Development 	External Development Compact 	External Development Dispersed 
Internal Development	5,160 RU	2,580 RU	2,580 RU
Conversion Areas	2,000 RU	2,000 RU	2,000 RU
External Development	1,063 RU ›› approx. 12 ha	1,575 RU ›› approx. 17,5 ha	1,688 RU›› approx. 25 ha
›› Outward migration or no inward migration: additional residential development area in the surrounding	5,641 RU ›› approx. 110 ha	7,709 RU ›› approx. 155 ha	7,596 RU ›› approx. 150 ha

Source: Oeko-Institut e. V., IfSR

Population Development Until 2030

For Karlsruhe, the population is expected to increase by around 24,000 persons are expected. Additional living space will also be needed due to a further increase in living space per capita. In total, the scenarios for 2020 to 2030 are based on approximately 14,000 additional residential units.

External Development in Coordination with the Surrounding Area

The assumptions for density in external development in Karlsruhe are very high compared to the other model cities: 120 RU/ha gross building land for area developments in high density and 50 RU/ha gross building land for area developments in low density. The city of Karlsruhe operates a joint land use planning with the surrounding cities and municipalities in a neighborhood association. The development of residential and open spaces is to be coordinated across municipal boundaries. Residential building land is also in short supply outside the core city of Karlsruhe. The development of the ‘backward’ locations in most municipalities dates back to the 1990s. In view of the pressure to grow, local stakeholders believe that the ‘backward’ locations without rail connections are more likely to be developed.

Additional Commercial Space by 2030

The assumptions regarding the additional commercial space required in the city of Karlsruhe and the surrounding area range from approx. 100 hectares in the Internal Development Scenario to 140 hectares in the External Development Dispersed Scenario. In Karlsruhe, the demand for commercial space is concentrated on urban locations for office use or research and development. This is also estimated for the further development. Areas for production-related logistics are hardly available in the entire region. The intensification of the use of commercial space is of great importance for the development of the business location.

Results Compact. Model City Leipzig.



Settlement Structure

In the city of Leipzig, there is a high proportion of multi-family houses built as perimeter blocks. characterizing. There is potential for redensification in the inner areas of the blocks, and there are also undeveloped or sparsely developed areas around the perimeter of the blocks. When activating the inner block areas, a careful consideration of the concerns of green space supply and climate protection is an important goal for urban development. Another special feature is the majority of multi-family houses that are located in high-rise housing estates from the 1970s to 1990s. In this type of settlement, selective internal development potential can be identified, such as the building over of single-storey local shopping infrastructures or redensification on the partly large green spaces.

The city of Leipzig is also characterized by mixed building and use structures in the neighborhoods and along arterial roads with a not always conflict-free coexistence of residential and commercial areas. In Leipzig, a vacancy rate of approx. 6 % is assumed, the activation of which requires more extensive construction measures in some cases. This was also included in the determination of the internal development potential.

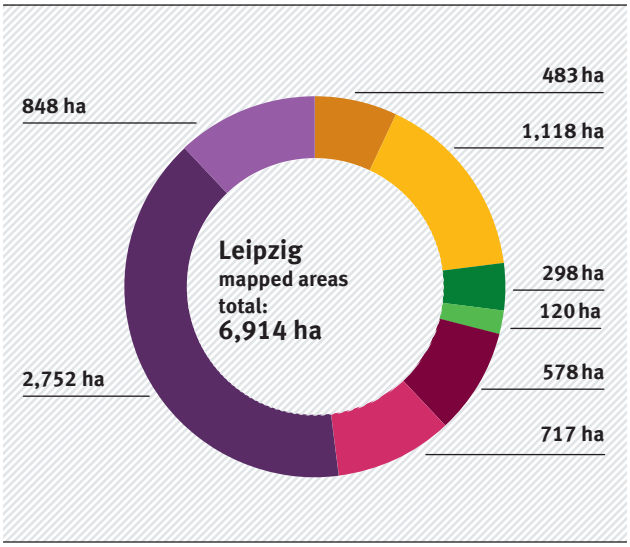
Population development 2020 to 2030

For Leipzig, the following is forecast for the period from 2020. The population is expected to increase by around 42,000 by 2030. In addition, housing will also be needed due to remanence effects. In total, the scenarios for 2020 to 2030 are expected to add approx. 26,000 additional residential units taken as a basis.

Figure 04

Scenario Input Variables in Leipzig

Area Shares According to Settlement Structure Types in Hectare



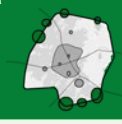
- Center and district center, high density | 7.0 %
- Multi-family houses as perimeter block development | 16.2 %
- Multi-family dwellings as loose single-family dwellings | 4.3 %
- Multi-family houses as loose row development | 1.7 %
- Multi-family houses as dense development | 8.4 %
- Multi-family houses in high-rise housing estates of the 1970s/ 1980s | 10.4 %
- Single-family residential areas, loosely built | 39.8 %
- Mixed building and use structure | 12.3 %

Source: Oeko-Institut e. V., IfSR

Tab. 03

Model City Leipzig | Settlement Development Scenarios:
Basic Assumptions and Effects on Settlement Development at a Glance

Additional Residential Units (RU) 2020 to 2030:

Scenarios 2020 to 2030	Internal Development 	External Development Compact 	External Development Dispersed 
Internal Development	12,705 RU	6,906 RU	6,906 RU
Conversion Areas	2,400 RU	2,400 RU	2,400 RU
External Development	2,500 RU ›› 50 ha	6,500 RU ›› 100 ha	4,000 RU›› 125 ha
›› Outward migration or no inward migration: additional residential development area in the surrounding area	8,224 RU approx. 400 ha	10,023 RU approx. 500 ha	12,523 RU approx. 600 ha

Source: Oeko-Institut e. V., IfSR

External Development

In addition to the share of internal development, the density of new area developments is an important factor in meeting the demand for residential space. Assumptions regarding the density of external development in Leipzig are 80 units per hectare of gross building land (GBL) for high-density developments and 20 units per hectare of GBL for low-density developments. Due to the lower density, a rather land-intensive development is assumed in the external development.

Additional Commercial Space by 2030

The assumptions regarding the additional commercial space required in the city and surrounding areas range from approximately 210 hectares in the Internal Development Scenario to 270 hectares in the External Development Scenario. In the scenarios for Leipzig, the focus of new commercial space is clearly on space for manufacturing and only a small proportion of office space.

Results Compact. Model City Osnabrück.

Settlement Structure

As in Ulm, the settlement structure of the model city of Osnabrück is characterized by a comparatively high proportion of areas with single-family homes. There is great potential for internal development in the form of gaps between buildings, but also as supplementary buildings or buildings in second rows. However, activation is considered difficult.

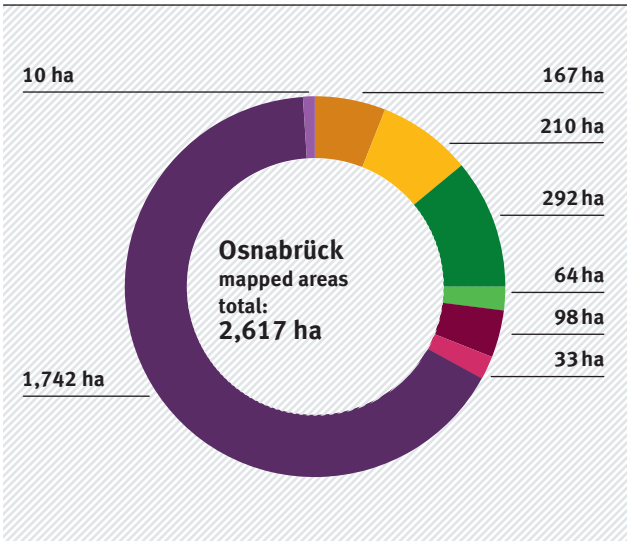
Osnabrück also has a number of gaps between buildings or underused areas in the more central locations, such as garage and parking spaces. Activation makes particular sense here, since these areas can be built very densely and a correspondingly large number of residential units can be created. The public transport system is also already better developed than in peripheral locations. The former military area of the Landwehr barracks is the only remaining larger conversion area in the city of Osnabrück for the next few years. The area is currently under development. The scenarios assume an additional 800 residential units by 2030.

Additional living space will also be needed due to a further increase in living space per capita. The potential for this is considered particularly large in Osnabrück.

Figure 05

Scenario Input Variables in Osnabrück

Area Shares According to Settlement Structure Types in Hectare



- Center and district center, high density | 6.4 %
- Multi-family houses as perimeter block development | 8.0 %
- Multi-family dwellings as loose single-family dwellings | 11.2 %
- Multi-family houses as loose row development | 2.4 %
- Multi-family houses as dense development | 3.8 %
- Multi-family houses in high-rise housing estates of the 1970s/ 1980s | 1.3 %
- Single-family residential areas, loosely built | 66.6 %
- Mixed building and use structure | 0.4 %

Source: Oeko-Institut e. V., IfSR

Tab. 04

Model City Osnabrück | Basis for Scenarios for Settlement Development: Basic Assumptions and Effects on Settlement Development at a Glance

Additional Residential Units (WE) 2020 to 2030:

Scenarios 2020 to 2030	Internal Development 	External Development Compact 	External Development Dispersed 
Internal Development	1,847 RU	924 RU	924 RU
Conversion Areas	800 RU	800 RU	800 RU
External Development	120 RU ›› approx. 3 ha	660 RU ›› approx. 12 ha	600 RU ›› approx. 15 ha
›› Outward migration or no inward migration: additional residential development area in the surrounding area	683 RU ›› approx. 20 ha	1,066 RU ›› approx. 35 ha	1,126 RU ›› approx. 37 ha

Source: Oeko-Institut e. V., IfSR

Population Development until 2030

Osnabrück's population is expected to grow by around 3,500 people between 2020 and 2030. Population growth is expected to occur primarily in the next 5 years. Additional residential space will also be needed due to remanence effects. Overall, the scenarios for 2020 to 2030 are based on approximately 3,500 additional residential units. Overall, the population development in Osnabrück is not estimated to be as dynamic as in other growth regions.

External Development: Focus of Demand is on Single-Family Homes

The assumptions underlying the scenarios for density in external development in Osnabrück are comparatively low: 60 RU/ha gross building land (GBL) for area developments in high density and 30 RU/ha GBL for low-density area developments. Due to the lack of suitable areas in the city of Osnabrück, the scenario 'Compact External Development' is considered interesting in principle, but not very realistic. The building land designation is partly characterized by an urban-rural competition for 'house builders'.

There are still extensive land reserves in the communities surrounding Osnabrück, and a correspondingly large amount of construction is taking place there, especially detached single-family homes. Recently, however, it has also been observed that more multi-family houses are being built there. There are no density specifications from regional planning or coordination routines for housing development at regional level in Osnabrück.

Additional Commercial Space by 2030

The assumptions regarding the additional commercial space required in the city of Osnabrück and the surrounding area range from around 20 hectares in the Internal Development Scenario to 30 hectares in the External Development Dispersed Scenario. There are only few suitable commercially usable area potentials in Osnabrück, both in the internal and external development. Many of the commercially usable area potentials have restrictions that prevent their use or activation. There is a great demand in the region for larger areas for production-related logistics.

Results Compact. Model City Ulm.



Settlement Structure

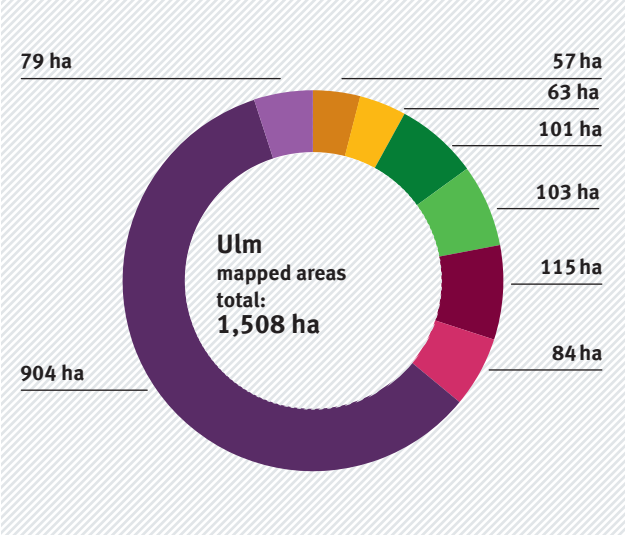
As in Osnabrück, the settlement structure in the model city of Ulm is characterized by a comparatively high proportion of areas with single-family homes. As in the other cities, however, the activation success of the existing building vacancies here is estimated to be low. A spatial evaluation of building completions in the city of Ulm in recent years shows that a large number of additional housing units have been achieved in internal development, and there in particular through demolition and new construction at higher densities. According to estimates by the city administration, this development will continue in the future. Areas with multi-family houses also represent the area type with the greatest potential for internal development in Ulm.

The model city of Ulm is characterized by a high proportion of conversion areas. Approximately 4,500 additional residential units are expected here by 2030.

Figure 06

Scenario Input Variables in Ulm

Area Shares According to Settlement Structure Types in Hectare



- Center and district center, high density | 4 %
- Multi-family houses as perimeter block development | 4 %
- Multi-family dwellings as loose single-family dwellings | 7 %
- Multi-family houses as loose row development | 7 %
- Multi-family houses as dense development | 8 %
- Multi-family houses in high-rise housing estates of the 1970s/ 1980s | 6 %
- Single-family residential areas, loosely built | 60 %
- Mixed building and use structure | 5 %

Source: Oeko-Institut e. V., IfSR

Tab. 05

Model city Ulm | Basis for Scenarios for Settlement Development:
Basic Assumptions and Effects on Settlement Development at a Glance
Additional Residential Units (RU) 2020 to 2030:

Scenarios 2020 to 2030	Internal Development 	External Development Compact 	External Development Dispersed 
Internal Development	1,560 RU	780 RU	780 RU
Conversion Areas	4,485 RU	4,485 RU	4,485 RU
External Development	500 RU ›› approx. 8 ha	1,280 RU ›› approx. 20 ha	1,280 RU ›› approx. 40 ha
›› Outward migration or no inward migration: additional residential development area in the surrounding area	no RU/areas needed	no RU/areas needed	no RU/areas needed

Source: Oeko-Institut e. V., IfSR

Population Development until 2030

The population of Ulm is expected to increase by around 13,000 people between 2020 and 2030. Additional living space will also be required due to a further increase in living space per capita. In total, the scenarios for 2020 to 2030 are based on approximately 6,500 additional residential units.

In contrast to the other model cities, Ulm succeeds in meeting its projected housing requirements entirely within the city limits. The large amount of conversion land makes a significant contribution to this.

External Development

The density assumptions underlying the scenarios for external development in Ulm are 65 units per hectare of gross building land (GBL) for high-density developments and 25 units per hectare of GBL for low-density developments. In Ulm, as in Freiburg, the development of a new urban district is planned – however, it is expected that the majority of the residential units will not be built until after 2030.

A small proportion of the new urban district is already taken into account arithmetically in the External Development Compact Scenario.

Additional Commercial Space by 2030

The assumptions regarding the additional commercial space required in the city of Ulm and the surrounding area range from approx. 80 ha in the Internal Development Scenario to to 100 ha in the External Development Dispersed Scenario.

Ecological Results of the Scenarios

Goals and Target Group of Ecological Assessment

With the help of ecological assessment , it can be applied ...

- whether increased internal development associated with the construction of additional technical infrastructures has ecological advantages compared to increased external development,
- ... how directionally secure or pronounced any advantages are,
- ... whether there are conflicts of objectives, i. e. whether ecological advantages in some environmental areas are offset by ecological disadvantages in other environmental areas, and
- ... which key parameters significantly influence the result.

The main target group of this ecological assessment are decision-makers in politics and planning, both on the municipal and on the higher level.

System Boundaries of Balancing

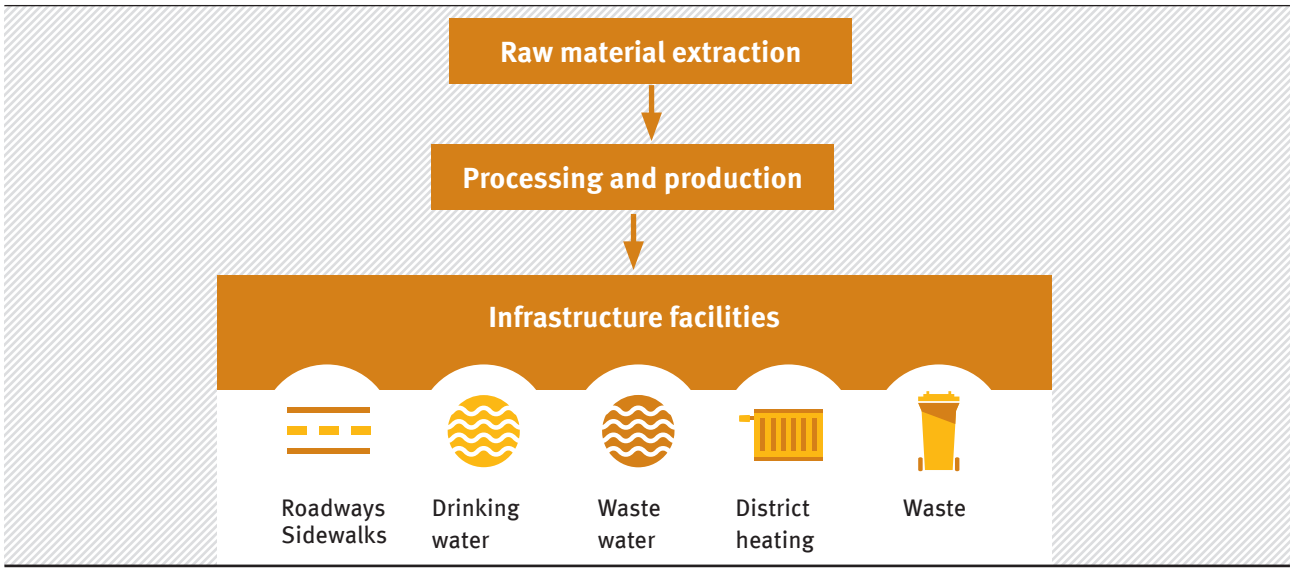
The infrastructure sectors considered in the ecological accounting in this study include

- Roadways and sidewalks/cycle paths
- Drinking water supply
- Waste water disposal
- Local/district heating/cooling
- Waste disposal

With regard to the geographic system boundary, ecological balances are basically drawn up for the five participating model cities Freiburg, Karlsruhe, Leipzig, Osnabrück and Ulm. Since the expected growth cannot always take place in the city area, some of the growth takes place in the surrounding areas of the cities, which is also covered by the geographic system boundary.

Figure 07

System Boundaries of the Ecological Balance (Simplified Scheme)



Source: Oeko-Institut e. V., IfSR

Overarching Findings: Example Leipzig

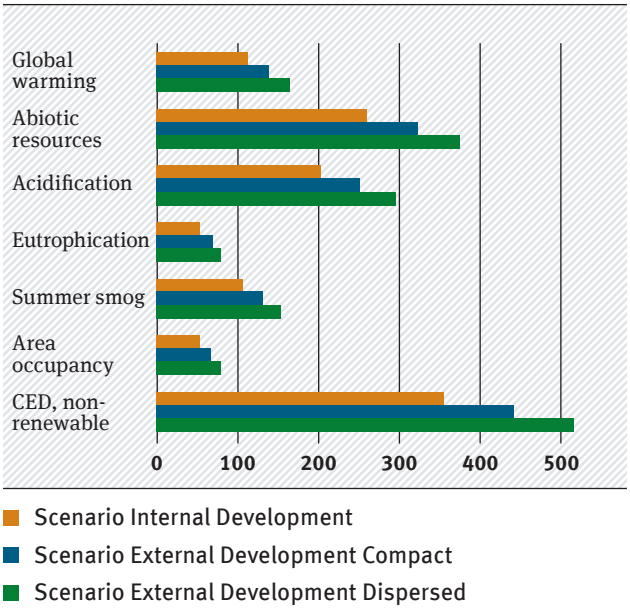
In the following, the environmental impacts associated with the construction of the necessary infrastructure to enable growth in the model cities are presented and analyzed. The following descriptions refer to the model city of Leipzig as an example.

The figure below shows the results for Leipzig for the scenarios Internal Development, External Development Compact and External Development Dispersed for all impact categories examined in a standardized form.

Figure 08

All Impact Categories in Leipzig

Daily Population Values Per Housing Unit

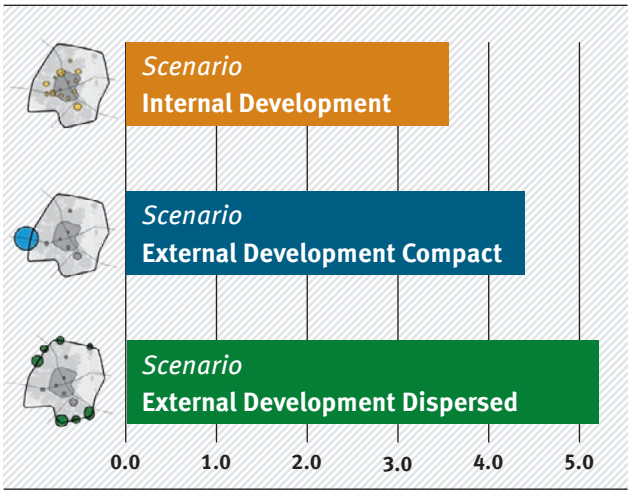


Source: Oeko-Institut e. V., IfSR

Figure 09

Ecological Assessment: Results GWP per Scenario Leipzig

In Metric Tons of CO_2 Equivalent Per Housing Unit



Life cycle assessment results for the impact category global warming of infrastructure construction for three scenarios up to 2030.

Source: Oeko-Institut e. V., IfSR

The following results can be summarized from the ecological balance:

- The Internal Development Scenario Leipzig has a clear ecological advantage over the External Development Compact and External Development Dispersed Scenarios: greenhouse gas emissions are 19 % and 32 % lower, respectively.
- The External Development Compact Scenario has notable ecological advantages compared to the External Development Dispersed Scenario: greenhouse gas emissions are about 15 % lower.
- The ecological ranking of the three scenarios is also confirmed for the other impact categories examined. The ecological advantageousness of the Internal Development in comparison to the scenarios Compact External Development and External Development Dispersed also amount to approx. 19 to 20 % and approx. 30 to 32 % for the other impact categories examined.
- Accordingly, there are no conflicting goals with regard to the results of the life cycle assessment.
- Infrastructure construction has a particularly strong impact on the demand categories ‘cumulated energy demand, non-renewable’ and ‘consumption of abiotic resources’. Both impact categories are affected in particular by the demand for crude oil, which results from the production of bitumen for the production of asphalt layers for roadways.

Conclusion of the Results of Ecological Assessment

First of all, it should be emphasized that the results of the ecological assessment shown in the example of Leipzig have also been shown in a similar way in the other model cities, so that the conclusions obtained for Leipzig are also valid for the other model cities – regardless of comprehensible differences in detail.

It is important to note that both for Leipzig and the other model cities, the respective Internal Development Scenario of the city has the lowest environmental impact. It should be emphasized here that the Internal Development Scenarios also contain portions of External Development. If the environmental impact caused by the construction of additional infrastructure is accounted for, e. g. per residential unit built, there are considerably larger differences in the comparison of the settlement structure types. In Leipzig, for example, the construction of a housing unit in an external development with lower density causes almost four times the greenhouse gas emissions compared to the construction of a housing unit on a conversion area.

Every residential unit and every commercial unit that is realized in the internal development instead of in the external development ultimately pays into Germany's climate goal according to the Paris Agreement.

Infobox

Infrastructure demand in the area of housing depend primarily on density.

As an example: calculation bases of the production costs of infrastructure per additional housing unit for internal development, conversion and external development areas in low density as well as in high density in the model city Leipzig:

- Internal development: 600 euros per additional RU (mix of total internal development)
- Low-density external development (20 RU/ha): 28,000 euros per additional RU
- External development in high density and conversion (80 RU/ha): 6,800 euros per additional RU

Economic Results of the Scenarios

As part of the economic analysis, the costs for the initial construction of the additional infrastructure required for the Settlement Development Scenarios were determined and analyzed for each model city. Costs for operation, maintenance and renewal of the built infrastructure were not considered, nor were the land acquisition and financing costs. The results show the total costs incurred on the municipal side and for private property owners. The different types of settlement structure and redensification are considered in a differentiated manner according to the priorities in the scenarios.

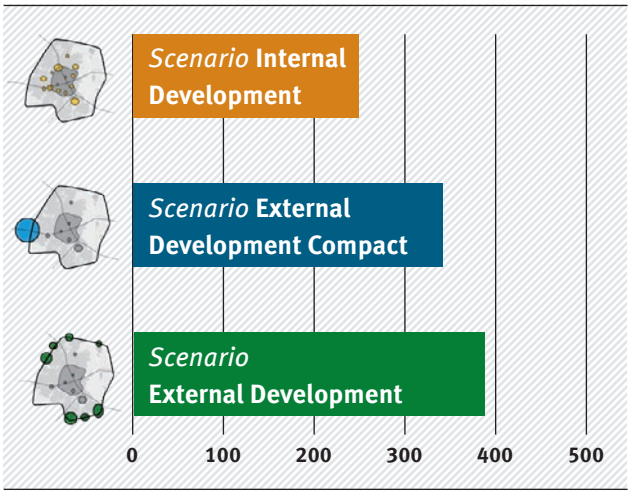
In most cases in which additional residential units are realized in internal development, no additional infrastructure has to be built. Only for the redensification type 'structural addition' is additional infrastructure required for development, which is taken into account according to the individually determined potential in the model cities. Additional infrastructure requirements are assumed for residential units created in the context of conversion, just as in the case of external development.

In all scenarios, a relatively high number of additional residential units is created in the internal development. However, only a small share of the total costs for additional infrastructure is generated by internal development. In the example of Leipzig, the scenario 'External Development Dispersed' shows that a relatively small number of low-density housing units in relation to the total number has a large impact on the total costs for additional infrastructure. It is also clear that a large portion of the cost is incurred through the development of land in the surrounding area.

When considering the commercial theme, this difference is not as pronounced as in the residential theme. However, in the case of the commercial sector, the increased internal development is expected to have a significant shifting effect on the demand for land

Figure 10

Production Costs Infrastructure | Leipzig
2020 – 2030 (in Million Euros)



Internal Development | Conversion (80 RU/ha) | Low-density External Development (20 RU/ha) | High-density areas (80 EWE/ha) | Development of areas in the surrounding area (20 RU/ha)

Source: Oeko-Institut e. V., IfSR

to the surrounding areas. Manufacturing companies in particular, which require robust areas, will then be dependent on areas in the surrounding area. In the surrounding areas, commercial density is also expected to be lower than in the core city.

Environmental and Economic Impact

The Internal Development Scenario Leipzig has a clear ecological advantage over the External Development Compact and External Development Dispersed Scenarios: The greenhouse gas emissions are 19 and 32 % lower, respectively. In addition, the scenario 'External Development Compact' shows significant ecological advantages compared to the scenario 'External Development Dispersed': Greenhouse gas emissions are about 15 % lower. When considering the economic impacts in Leipzig, it becomes clear that the number of low-density residential units has a major impact on the total cost of the additional infrastructure. Much of the cost of additional infrastructure is incurred in developing land in the surrounding area.

Discussions in Practice

3

Findings

Challenges

Recommendations for Action

Findings

The scenarios for population and land development and their bases were discussed intensively in the coordination rounds with the model cities. Even though the structure of the cities, the pressure to move in and the possibilities for activating residential and commercial space on brownfield sites in the inner area are very different, similar initial situations were described in all cities with regard to the potentials and obstacles for internal development.

Internal Development Potentials are Often Underestimated in Terms of Quantity.
The quantitative assessment of internal development potential based on a mapping of vacant lots or similar only represents a part of the actual internal development. Often, redensification processes take place on areas that are not actually the focus of urban planning, for example by demolishing existing buildings and then building new ones at a higher density.

Theoretically, there is a Great Deal of Potential in Internal Development – Only a Fraction can be Activated.
The currently available activation instruments and their application only tend to allow a low activation of the potentials. Some of the existing instruments are described as unsuitable for the challenges of internal development. For example, the urban development requirements of the BauGB can hardly be implemented in practice. In most cases, however, the available instruments are not applied comprehensively. The reasons for this are a lack of personnel or financial resources in the municipalities. There are not enough personnel for owner consulting or financial resources for land acquisition. Reasons are also seen in the lack of willingness of local politicians to apply appropriate instruments. There is only a limited willingness in politics to enforce restrictions on the use of private property for the benefit of the common good, and there are major concerns about the complexity of corresponding procedures.

Internal Development can Make a Major Contribution to Housing in the Model Cities.
In the course of the development of the scenarios, it was possible to show that in all model cities, both in the internal development scenario and in the external development scenarios, a large part of the land demand expected in the future due to population growth can be covered by internal development potential.

Internal Development Potential Varies – and so do the Barriers to Activation.
Single-family residential areas offer great potential for internal development. Due to the large number of individual property owners and their interests, the activation is estimated to be more difficult than in other settlement structure types. Large potentials and quantity effects in the internal development can be found in the areas with multi-family houses. However, land use conflicts between building development, green spaces, and areas for stormwater management are more frequent in the already highly densified and sealed inner-city areas.

The Regional View is Important.
Prioritizing inner-city development and high density in the core city can have the effect of displacing land requirements to the surrounding areas. Viewed at the regional level, this can result in a conflict of objectives with land-saving regional settlement development.

Challenges of Internal Development – What does this Mean for TechnicalInfrastructures?

The surveys of internal development potentials in the model cities within the scope of the project as well as numerous other studies show that enormous potentials for covering the demand for residential and commercial space lie dormant in internal development. In most cases, such potential assessments focus on the possibilities of internal development through the closure of vacant lots, and less frequently on the addition of more stories to existing buildings or demolition and new construction at higher densities. In addition to these, there is further potential for more efficient use of existing buildings.

In today's practice of urban and regional development, planning and measures for internal development are an indispensable part of planning activities. In the administration and the consulting offices, internal development is a natural part of planning thinking and procedures. In their goals and resolutions, large circles of local and regional politicians also focus on accelerated internal development.

In practice, the technical infrastructure in the context of internal development is often not built until the planning process can be adapted in retrospect, for example, when bottlenecks arise or structural measures for repair or renewal have to be carried out anyway. A systematic coordination of internal development with infrastructure planning for example, through specialized planning, expert opinions and the formal participation of public interest groups usually only takes place if an urban land use plan is drawn up or amended: However, many internal development measures are implemented without changes to existing legal foundations.

The expert interviews with the practitioners in the model cities provided information on the following topics of internal development:

- Inter-communal coordination and cooperation
- Density: Housing types
- Activation of internal development potentials
- Infrastructures relevant to internal development
  - Waste water/precipitation water
  - Waste
  - Energy (heat, cold)
  - Traffic
  - Social infrastructure

Inter-Communal Coordination and Cooperation

The intensities in the model cities with regard to inter-communal and regional coordination vary greatly. In some cases, there are fixed routines or even organizational forms of inter-communal coordination for settlement development or for the designation of residential and commercial building areas within the framework of joint land use planning (for example, the neighborhood association of Ulm) and/or regional planning (for example, the regional association of the Southern Upper Rhine and the city of Freiburg).

Discussed Courses of Action:

- Create a culture of participation, coordination routines, and obligations in inter-communal cooperation.
- Coordinate settlement development and (especially rail-based) public transport more closely.
- Develop a conceptual basis and define binding specifications for areas and densities in the regional context.
- Develop new commercial areas as intercommunally as possible in accordance with the interdependencies of the business locations.

Density: Housing Types

The detached single-family house is the house type of choice for many households, as far as their financial circumstances allow. A prerequisite for new construction is the availability of suitable plots of land, which are often made available in outward development and, depending on the planning regulations and the plot sizes on offer, often result in a low urban density. In contrast, higher densities are generally created in internal development, with multi-family houses being built for the most part.

Discussed Courses of Action:

- Develop and coordinate binding density specifications for housing at the municipal and regional level.
- Offer decision-making support on the topic of choosing a place to live and types of housing.
- Provide urban/dense housing, but with the qualities of the single-family home; plan high-density single-family home areas.

Activation of Internal Development Potentials

The experience of the model cities is that a large part of the internal development takes place in the form of privately initiated replacement construction. In this process, additional residential units are often created on balance despite demolition. This process usually takes place on land or areas that were not previously the focus of urban planning. In other words, these are areas that have not been identified as potential for internal development and for which no activation activities have taken place, such as consultation meetings for property owners. In practice, there is often no strategic control of internal development or concentration on individual potential types or spatial areas of a city. Also due to the capacity bottlenecks of the municipal administrations, there is rather a general promotion of internal development in the ongoing administrative activities and a concentration on individual projects that can be implemented quickly.

In practice, the representatives of the model cities see great potential for the activation of internal development potential, especially in the following settlement structure types:

- Single-family residential areas, especially from the 1960s/70s/80s.
- Inner-city areas with multi-family houses
- Apartment buildings as loose row development, especially in housing estates of the 1950s and 1960s
- Residential space potential from roof conversions and extensions

Challenges in Adapting Infrastructures to Increasing Densities

The four infrastructures considered in the project (water supply and wastewater disposal, waste, transport (especially public transport) and local and district heating/cooling) show challenges in adapting the infrastructures to increasing densities.

In the expert interviews conducted by telephone at the beginning of the project with city planning offices and utilities, assessments from practice were asked about restrictions in the adaptation of infrastructures. These assessments and the results of further surveys were then discussed with the model cities during the expert meetings. The following challenges were mentioned in particular:

- **Financial Challenges:** The investment costs for an infrastructure project often exceed the financial possibilities of the public authorities, especially in the transport sector. In the case of public transport, the ongoing contributions to operating costs are a particular obstacle to expansion.
- **Personnel Restrictions:** If sufficient financial resources are available, a shortage of well-trained personnel in urban planning and specialist planning as well as potential infrastructure providers can hinder the planning and development of infrastructures significantly. The upcoming generation change in many municipal administrations and the salary structure give rise to fears of a further intensification. **Complexity of Planning**

- **Complexity of Planning Processes:** Planning processes are becoming increasingly complex and complicated. The technical and procedural requirements for different technical analyses, reviews and specialized planning as well as for their consideration in other planning values are growing. The participatory processes in the course of infrastructure planning can complicate consideration and decision-making processes and lengthen the time required for the development of infrastructures. This applies to both formal and informal participatory processes.
- **Technical Obstacles:** Similarly, technical obstacles may require a change in the planning of an internal development measure, delay the infrastructure development, or make it impossible. Examples: Compliance with nature conservation requirements, resettlement of fauna, management of noise problems.
- **Lack of Acceptance Among the Population:** A lack of acceptance of infrastructure projects among the population can lead to a significant extension of the planning and construction process. Comments from the population may require a change in the planning and further participation steps. A lack of acceptance of internal development measures among the population also influences local political decision-making processes.

Notes From the Practice of the Infrastructure Sectors

- **Infrastructure Area Wastewater/Precipitation Water**
  The management of precipitation water is facing great challenges due to increasing sealing. This is especially true with regard to current heavy rainfall events and those that are expected to increase in the future. But also the infrastructure for the disposal of precipitation water, which is generated by regular rainfall, is often at the limit of its capacity and can be a limiting factor for the constructional internal development. In combination with an increase in residential density due to internal development as well as increasing heavy rainfall events, this can result in challenges for wastewater disposal in the medium term, as the wastewater flow to be discharged increases. Against this background, municipal practice considers measures for the separation of the different wastewater fractions (precipitation water, black water, gray water, possibly yellow water) to be sensible and necessary.
- **Infrastructure Area Waste**
  In practice, no structural differences in waste generation and waste composition per inhabitant are seen between internal and external development. In all model cities, waste disposal is considered to be scalable with population and settlement development without any problems. Only in the case of extensive post-densification in already relatively densely built-up existing neighborhoods is waste disposal considered more complex (more frequent trips and higher personnel costs; possibly smaller waste collection vehicles in order to be able to operate in narrow streets).
- **Infrastructure Energy (Warmth, Cooling)**
  In practice, no fundamental challenges to internal development are seen for the energy infrastructure sector. Local and district heating networks can be successively upgraded and expanded in existing settlements and adapted to increasing demand. Increasing e-mobility, on the other hand, is seen in the model cities as a potential challenge for the network infrastructure. Above all, because of the simultaneity of the energy demand in the evening hours, bottlenecks can occur with the

current expansion status of the networks. However, there is no acute need for comprehensive action, but rather for selective action. Another future challenge is the impact of cooling buildings on energy demand, especially in inner-city areas characterized by heat islands.

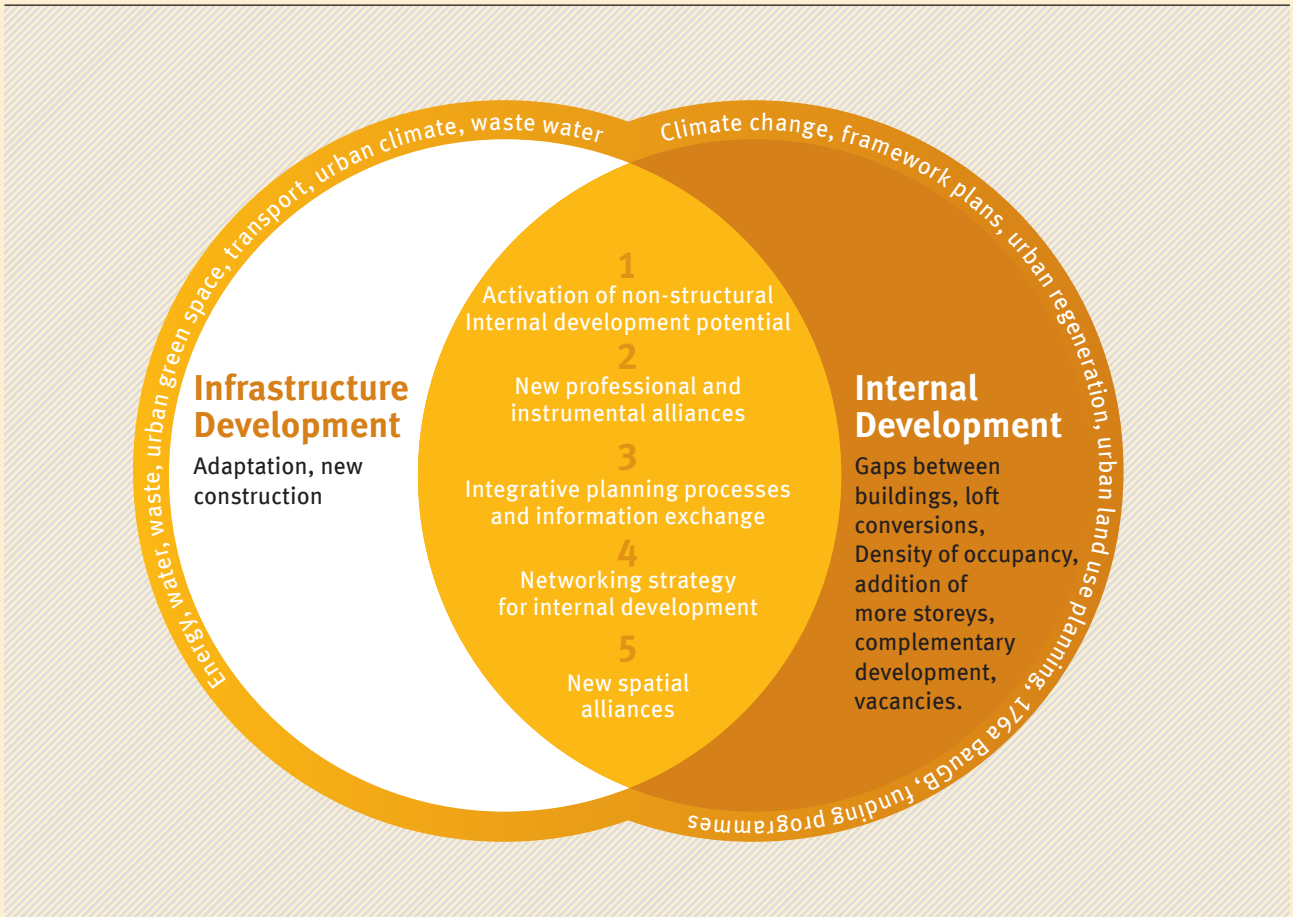
- **Infrastructure Area Transport, Focus on Public Transport**
  Investments in the green network (public transport, walking and cycling) are seen as the most secure and therefore best approach. However, there are large district-specific differences in the use of public transport services. The denser the development and thus the density of inhabitants and jobs, the more attractive the public transport service can be designed and the more absolute and relative user numbers can be achieved. In the area of motorized individual transport, the issue of parking spaces in public areas and private parking spaces in particular is seen as a point where conflicts of interest exist. 'Internal development does not make the streets more crowded with moving cars, but with stationary traffic'. A question that often arises in the model cities in this context is how to deal with the obligation to produce parking spaces even in projects of internal development and the possibilities to consider innovative mobility concepts in the process. A solution is also seen at the neighborhood level, for example through the construction of neighborhood garages.
- **Social Infrastructure**
  In addition to the technical infrastructure, which is the focus here, it was repeatedly emphasized that internal development also leads to challenges in the area of social infrastructure. In connection with population growth, there is a high demand for social infrastructure, especially for kindergartens and schools, and thus a great need for land for this purpose. In some cases, there is competition for space with other uses or the need for new combinations of uses, such as placing a kindergarten on the roof of a new or existing building.

Recommendations for Action

Based on the various expert discussions, the findings from the scenarios, further research and our own considerations, the following section formulates recommendations for action to promote internal development in conjunction with technical infrastructures.

Figure 11

Recommendations for Action in the Area of Conflict Between Infrastructure and Internal Development



Source: Oeko-Institut e. V., IfSR

Recommendation for Action 1 | Increased Activation of Non-Constructional Internal Development Potentials

Focus More on Unused and Underused Properties

Many apartments and houses are designed for a classic family household, i. e. a household with parents and child(ren). After the children have moved out, the now smaller households generally remain in family-sized apartments or houses. There are many good individual reasons for this, such as a familiar living environment or the low housing costs in the case of home ownership with debt relief. The supply of housing suitable for seniors in familiar surroundings is also usually low. In view of the fact that construction resources, i. e., technical infrastructures and buildings, are largely available, mobilizing this non-constructional internal development potential makes particular sense from both an ecological and an economic perspective.

Support services and advice on the housing situation, the organization of exchange offers or monetary support for relocations as well as active practical relocation management are measures that are already in place in many cities. These can be used to initiate relocation chains that make large apartments available to large households. Adequate staffing of municipal administrations and cooperation between municipal and private actors on the housing market are prerequisites for this.

Especially in single-family residential areas, generational change presents itself as a major challenge, but also as a great opportunity for internal development activities. One possible approach to the creation of housing suitable for senior citizens in single-family home areas in generational transition is the ‘neighbourhood house’. The idea: Existing living space in single-family homes is transformed into compact apartments suitable for senior citizens through conversion or selective replacement construction. The resulting relocation chains lead to a more effective utilization of the existing living space and infrastructure with a low input of resources. Here, both the local housing industry and local building groups can be addressed as actors with appropriate professional support.

Recommendation for Action 2 | New Professional and Instrumental Alliances

Active Co-Planning of Transport Planning, Green Planning and, in Particular, Anchoring Climate Protection and Climate Adaptation in Internal Development

Cities act with a variety of activities to promote internal development. These are often selective measures in the urban area. Coordination of these activities with infrastructure planning usually takes place late in the planning process or on an object-specific basis. Particularly in the case of informal planning and projects that do not require formal planning procedures, technical aspects of infrastructure planning are often taken into account very late or not adequately.

A systematic interdisciplinary cooperation of urban planning with traffic planning, green planning and especially climate protection and climate adaptation at an early stage in the planning process leads to an optimized overall result with regard to essential technical concerns and promotes innovative solutions. This is an important point, especially in view of the frequently existing competition for land. Cooperation should be designed in the sense of active co-planning.

A frequently used procedure for projects in internal development are planning competitions or competing design procedures. At an early stage of the planning process, the focus is often on a narrow area and on constructional and spatial aspects. Infrastructural aspects are often not addressed, or only afterwards. In order to enable adequate consideration of infrastructural aspects before significant urban planning decisions have been made, checklists can be developed, for example, and internal administrative processes can be defined.

Section 176a of the German Building Code (BauGB), 'Urban planning concept for internal development', also gives municipalities a hint to adopt a more conceptual approach to internal development. The criticism voiced by practitioners that § 176a 'forgets' the double internal development can be compensated for by appropriate holistic municipal action. Such an urban development concept can be used as a 'motor' for integrative internal development, taking into account climate goals and double or triple internal development.

Recommendation for Action 3 | Coordination of Technical Infrastructures and Internal Development through Integrative Planning Processes and Information Exchange

Create Structures of Continuous Cooperation

As a rule, technical infrastructures are designed in sectoral plans. The various sectoral plans differ in terms of content, level of detail, planning period, rate of progress, preparation process and participation procedure. The plans are also often based on different technical planning systems.

According to this differentiation, the coordination between planning of technical infrastructures and their integration into a municipal internal development strategy represents a very great challenge for those involved. The existing processes and interfaces between internal development planning and infrastructure planning (in some cases only in the context of the formal participation of authorities and other public agencies in the urban land use plan procedure) do not ensure integrated planning processes and results.

Successful management of the interface problem between planning for internal development and technical infrastructures requires formal coordination mechanisms in administrative practice. In addition, informal

structures of cooperation within the administration and with agencies outside the administration are of central importance. The common basis is an open and smooth exchange of information and data and a technically compatible basis. Informal planning of internal development, often as sub-spatial planning, can take on a catalyst function in the coordination processes.

Recommendation for Action 4 | Networking Strategy for Internal Development

Developing Concepts Together

The creation and implementation of holistic and city-wide concepts and strategies for internal development, which also include coordinated and integrated planning of technical infrastructures, are not very promising in view of their complexity and their large intersections with forms of urban development planning.

One approach can be the systematic selection of suitable subspaces and the development of spatially concentrated and deeply planned integrated concepts of internal development. Over time, these concepts can be further developed into a consistent network of subspatial planning for internal development.

In addition to technical infrastructures (with a particular focus on mobility and water management), these sub-area concepts should also include green planning and climate protection and adaptation should be included in the planning process at an early stage. Such an early process integration enables an active ‘co-planning’ of the involved areas in the conception of the internal development beyond the consideration of technical concerns. Conflicting goals, competing goals, congruent goals, and synergies can be systematically identified, disclosed, and constructively addressed at an early stage. For example, a green space planned holistically in the course of double or triple internal development can serve as a playground and local recreation area, provide a habitat for flora and fauna, function as a bicycle traffic axis, act as a fresh air corridor and also be designed as a retention area for heavy rainfall events.

The current discussion on climate and resources can be used here as a motor for comprehensive approaches to action. This also offers the opportunity to establish internal development as a permanent organizational task and to staff it, for example with internal development managers.

Recommendation 5 | New Spatial Alliances

Understanding Settlement Development and Infrastructure Planning as a Regional Task

The core cities of urban growth regions are coming up against both instrumental limits of feasibility and limits of political and civic acceptance when it comes to activating their internal development potential. There is a threat of a further wave of suburbanization of residential and commercial areas with the known negative side effects and consequences. Residential construction and commercial land uses in the surrounding areas generally do not achieve the same land efficiency as in the core city and its immediate surroundings. Land consumption and infrastructure costs are increasing, traffic loads are increasing.

A coordinated settlement area policy between the core city and the surrounding area, both in terms of external and internal development – if necessary moderated or controlled by regional planning – represents a solution approach here. The new and further development of residential and commercial areas as well as conversion projects are then coordinated inter-municipally and regionally and, if necessary, carried out inter-municipally. Transportation infrastructures, especially public transportation, are given special consideration in the coordination process. For example, regional concepts for location and density and for infrastructure equipment are to be coordinated and developed. Incentives for implementation can be created through regional compensation mechanisms and inter-municipal projects. New regional compensation mechanisms should explicitly take into account the use of land with its various effects as well as the generation of infrastructure consequential burdens for the municipal community. Accompanying and supplementing this are corresponding specifications of the regional regional planning, which bindingly limit land developments in the outer area, bindingly specify minimum densities and, especially in the case of the new designation of regionally significant commercial areas, make their development subject to inter-municipal cooperation.

Networking of the Recommendations for Action

The recommendations for action presented are not fundamentally new. Legislators and municipalities have been working on internal development for some time and have developed instruments and procedures for this purpose. The portfolio of instruments for successful internal development is – also according to the assessment of practice – essentially available. However, both academics and practitioners note that there are deficits in implementation and effectiveness.

Accordingly, the recommendations for action primarily address opportunities for improvement in the practical application of existing instruments, their networking and in increasing the impact for internal development.

At this point, it should also be pointed out that the recommendations for action presented here can in principle also be applied inter-municipally. For example, the use of specialized personnel, such as a municipal land manager, which is sometimes difficult to finance for an individual municipality, can be quite feasible on an inter-municipal basis. In land management, too, an inter-municipal approach opens up new options for promoting internal development due to the broader land portfolio.

The economic and ecological advantages of internal development were confirmed and validated by the case studies and the scenarios. The current climate and resource debate can provide further tailwind for internal development. This tailwind should be exploited.

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