

Making the Follow-up Costs of Settlement Development Transparent

Cost-benefit analysis tools and models

Thomas Preuß



Deutsches Institut für Urbanistik

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Abstract

The anticipated demographic change, especially a declining and ageing population, requires sound municipal decisions related to future land use. Inter-municipal competition for new residents and zoning new land for development no longer appear to be adequate solutions. Instead, there is an increasing need for settlement development and urban planning that more forcefully considers the short-, mid- and long-term investment and operational costs of technical and social infrastructures. Greater emphasis on cost transparency can help avert urban sprawl that brings with it unfavourable social, economic, and ecological impacts. In the long term, sufficient settlement and population densities are required in order to ensure the cost-effectiveness of infrastructures for local and private budgets. In many areas, infrastructures must be adapted to changing age patterns and a future decline in population. A systematic assessment of future expenditures and revenues related to zoning decisions will be required to meet these challenges. Municipalities can employ cost-benefit analysis, fiscal impact assessments and urban planning cost-calculation tools to aid them in this endeavour.

Keywords: demography, cost-benefit analysis, cost transparency, infrastructure, fiscal impact analysis, zoning

1. Land utilization in Germany

From 2004 to 2007 a land area of 113 ha was consumed for settlement and transport purposes every day in Germany (cf. Federal Statistical Office 2008). During that time the land used for settlement and transport grew in a disproportionate relationship to population development. The expanded use of land for settlement and transport in Germany can primarily be attributed to the demand for residential building space.

From the 1990s onwards, despite stagnating population growth and moderate economic development, land was zoned for building development in many areas. As a result, there has been a significant increase in underused and derelict spaces in previously developed settlement areas since 1993. Current estimates indicate that there are now at least 150,000 ha of derelict land in Germany; approximately 114,000 ha located in what was West Germany and more than 36,000 ha in the former East German Länder and Berlin (cf. Bundesregierung 2008: 143-145).

1.1 Demand for land and zoning practices in municipalities

The majority of new land zoned for settlement development is still poorly integrated into existing settlement areas. Thus, only one quarter of the land for new settlements borders directly on previously existing settlements. At the same time, land-use intensity in areas of new settlement varies from region to region. A comparatively high population density can be observed in the southern and western Länder. Particular settlement pressure on undeveloped space exists in urban agglomerations where housing is in high demand (cf. *ibid.*).

The demand for privately owned homes in new housing estates continues to be relatively high, most notably in thriving regions. On the other hand, many municipalities are already experiencing a drop in demand for building land or problems with vacant housing in old central districts with established development. Current population development and land utilization trends evident throughout Germany indicate that many regions – some now, some in the mid- to long-term – will invariably be faced with problems regarding the efficient use of technological and social infrastructures. If this trend should continue into the future, the financial consequences will manifest themselves in the form of growing per-

capita costs and strains on municipal budgets and public authorities.

In Germany, the municipal revenue system is heavily contingent upon the populations of local government units and, as such, determines their financial leeway. As a result, municipalities are forced to compete with one another for residents, and especially for young families. This battle arises from the expectation that winning additional residents will bolster the revenues flowing into municipal coffers, *inter alia* via increased resource allocations from the municipal financial equalization scheme, higher proportional income taxes and via real estate taxes.

The demographic shift is making competition for young, well-paid residents even fiercer. To date, municipalities have attempted to attract young families by designating land for new housing estates, which primarily consist of single and two-family terraced houses.

However, unlike in the past, a number of municipalities are already beginning to have difficulties finding enough residents to settle and fill new building areas to capacity due to the demographic trends. This has stiffened competition for this target group; a fact that has only partly resulted in high-quality land being zoned for development (quality competition) and which, more commonly, has led to the granting of zoning permits for an increased number of new estates (quantity competition). As a result of losing residents and the special strain of the fixed costs for municipal infrastructures, the battle for residents can lead to ruinous competition between municipalities (cf. Mönnich 2005).

1.2 The challenge of demographic change

Population loss and ageing are the major factors of demographic change. They pose great challenges for municipalities with regard to settlement and infrastructure development and infrastructure adaptation. In this context we must bear in mind that there is also demand for living space in regions that are experiencing population stagnation or decline (need for replacement housing, increased living space requirements for individual residents, fewer people per household), which greatly increases the existing claims made on new land zoned for development.

According to the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) Regional Planning Forecast for 2025 (Raumordnungsprognose 2025) Germany's population

will decrease by approximately two percent by 2025. While the forecast indicates that the population in the Länder of the former West Germany will remain stable, it predicts a population decline of 11 percent in the new Länder and Berlin. The anticipated changes in the under-20 and over-60 age groups in the eastern part of Germany are also alarming. The Regional Planning Forecast shows that there will continue to be a cleft in development dynamics from region to region. An ever-growing group of cities and towns showing shrinkage patterns can be juxtaposed with an ever-dwindling group that is, in part, experiencing robust growth in terms of population, budget resources and workforce (cf. Bundesamt für Bauwesen und Raumordnung 2008).

Even in regions with declining or stagnating populations, a considerable amount of land is being zoned for new development, as the average number of people living in a single household is decreasing and individual inhabitants are tending to occupy more living space.

Within regions and cities the phenomena of growth and shrinkage can often be observed simultaneously and in close proximity to one another.

The demographic changes taking place within age groups are leading to under-utilization of services such as social infrastructures. Many municipalities that continue to record population growth are registering dwindling enrolment at nursery schools and primary and secondary schools.

In a number of German regions a relatively high demand for private homeownership prevails. On the other hand, older residential buildings in rural village and town centres stand vacant or continue to be occupied solely by older residents. This results in reduced settlement densities and a loss in functional significance of town centres and simultaneous settlement growth in peripheral areas.

The anticipated demographic development creates new urban design tasks with regard to developing settlement sites and infrastructures. If one considers infrastructure longevity and the persistence of settlement patterns, it is apparent that today's planning decisions and their building measures will have long-term effects. This makes it all the more necessary to establish cost transparency at an early stage of planning to create sustainable settlement sites and infrastructures.

2. Issue of the future: follow-up costs

Planning, preparing land for building and concomitant planning measures incur considerable costs. The nature and extent of the costs depend on the respective development investment and the standard of development. Costs are incurred in the following areas:

- **Internal development:** The level of site development costs is dependent on the share of the development land in relation to the building area as a whole (the sum of all building sites including pertinent land used for transport, green areas and expanses of water). The more expansive and less densely built-up the area is, the larger the share of the development land. Internal development includes transport facilities, road drainage systems, street lighting as well as public green spaces and noise mitigation barriers.
- **External development:** New building sites must be connected to existing areas of the community and to existing transport infrastructures and pipeline infrastructures. This can sometimes necessitate significant structural modifications beyond the actual area of new construction. The location of the new building site in relation to community borders and the size of the area of new development are the primary factors in determining the level of the costs such measures will incur.
- **Costs for compensation measures:** The granting of zoning permits for new development sites often entails encroaching upon nature and countryside; this encroachment must be offset (e.g. via renaturalization measures, use expansion, reforestation etc.). The extent of the costs for such measures depends primarily on the endowment level and the quality of the measures.
- **Planning and coordination costs:** Apart from the direct costs linked to planning the building sites, there are additional process costs (planning preparation, project coordination, participation processes, expert opinions etc.).

The demand for settlement development planning that is sustainable and meets demographic and cross-generational needs makes long-term follow-up costs of land development an "issue of the future" for cities, municipalities and regions. In the future, the costs and benefits of zoning land for development should receive greater attention in the context of site-related planning and decision-making while an increasing emphasis is put on the long-term conse-

quences of zoning, including, among other things, technical and social infrastructure.

The German Council for Sustainable Development has called for more cost and planning transparency when zoning land for settlement, as infrastructure decisions made today greatly influence the scope for action in the future. As they see it, town planners must clearly show what natural, technical and financial resources are available in the area and what financial burdens (hidden costs) from overextended infrastructures, zoning practices and maintenance expenses municipal fiscal policymakers must reckon with (cf. Rat für nachhaltige Entwicklung 2004: 18).

Various Federal Ministries and their key offices, in part through their own research initiatives, have also dealt intensively with issues of cost transparency and recommend introducing fiscal impact analyses or, as the case may be, cost-benefit analyses when pursuing zoning policies for new residential development (cf. Bundesministerium für Verkehr, Bau und Stadtentwicklung/Bundesamt für Bauwesen und Raumordnung 2007: 70; Umweltbundesamt 2008: 20; Bundesamt für Naturschutz: 9).

Creating transparency with regard to the follow-up costs of land use is the central aim of a series of projects in the funding priority area in the Programme "Research for the Reduction of Land Consumption and for Sustainable Land Management (REFINA)" of the Federal Ministry of Education and Research (BMBF) (cf. Preuß/Floeting 2009).

Zoning new land for building purposes also entails creating new (in part networked) infrastructures or expanding existing infrastructures. In general, this affects both technical and social infrastructures. Some municipalities react to the threat or reality of under-utilization of infrastructures such as nursery or primary schools by zoning more land for housing development. Depending on the development dynamics (growth or shrinkage), they hope to stem depopulation trends or to prevent a slowdown in population gains and address the problem of a disproportionately ageing population through such practices. They often proceed on the basis of overly optimistic assumptions regarding the in-migration of new inhabitants, subsequent increases in tax revenues and the rapid settlement on new building land.

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text of site-related planning and decision-making, while an increasing emphasis is put on the long-term consequences of zoning, including, among other things, technical and social infrastructure.

Creating transparency with regard to the follow-up costs of land use should therefore be a central concern of sustainable municipal land-use policy. Increased cost transparency can ease the process of deciding between various planning alternatives and lead to a greater degree of sustainability. In this context, cost-effective planning approaches can often simultaneously be approaches that minimize land use. Planning of this sort exploits previously developed building areas and contributes to more efficient utilization of existing infrastructures – particularly with regard to future demographic development. It reduces residual overhead costs (costs that are not immediately eliminated even though the infrastructure is not being used or use has ceased) and limits the extent of new infrastructure outlay.

The costs of technical and social infrastructure constitute an important factor in the context of determining the follow-up costs of settlement development.

The constitutional mandate to maintain equal living conditions requires that basic infrastructural provisions are guaranteed in both growing urban areas and peripheral regions with shrinkage tendencies. In this connection, however, equality is not tantamount to supplying equal standards of provision, but rather to securing a level of infrastructure provision that is adapted to the respective needs of a given area (cf. Bundesamt für Bauwesen und Raumordnung/Bundesministerium für Verkehr, Bau und Stadtentwicklung 2006: 3).

In the face of demographic change, issues regarding the efficiency of development (the relationship of cost-intensiveness and land-use requirements for internal and external development to land that will actually be used for physical structures) of new construction measures and the adaptation of infrastructural facilities is becoming ever more important.

The Parliamentary Advisory Council for Sustainable Development of the German Bundestag recommends drawing up a cost-benefit accounting when planning infrastructures so they can be dimensioned to withstand demographic fluctuations and to suit needs, or be adapted as required (cf. Parlamentarischer Beirat für nachhaltige Entwicklung des Deutschen Bundestages 2007: 3). Creating spatial and settlement structures that safeguard efficient and cost-effective infrastructure provision is a task that should be initiated at Land and regional planning levels (cf. Ministerkonferenz für Raumordnung 2006: 21).

As the population becomes disproportionately aged, more and more middle-aged and elderly people continue to reside in their family dwellings after their children have moved out or their partners have passed away. The resulting residual overhead causes infrastructure utilization to drop or cease completely decades after construction, yet local governments must continue to pay for maintenance, even as usage fees sink. Per-capita-costs for infrastructures inevitably increase as a consequence of such processes of decreasing settlement density in existing buildings. However, low-density settlement practices require greater infrastructure expenditure than higher-density settlement.

Three characteristics of settlement patterns are of particular relevance to infrastructure costs:

1. The density of development (floor-space index, housing density),
2. The arrangement of developed areas within the community (e.g. the distance of housing expansion to the main municipal transport and sewerage infrastructures),
3. The concentration level of settled land in larger residential settlements on a regional scale (e.g. creating more efficient economies of scale through spatial concentration of building activity) (cf. Bundesamt für Bauwesen und Raumordnung/Bundesministerium für Verkehr, Bau und Stadtentwicklung 2006: 6).

Whereas technical infrastructures – in particular networked infrastructures which entail long-term follow-up costs – can only be adapted to demographic development trends at great expense, social infrastructure facilities, as far as they can be realized politically, can be more easily adjusted.

While the assessment of the environmental impacts of construction projects is already a legally mandated responsibility of spatial planning, the evaluation of the fiscal consequences of building site development with regard to the associated technical and social infrastructure requirements has yet to be adopted as a planning and decision-making convention (cf. Akademie für Raumforschung und Landesplanung 2008: 2). Residual overhead costs must be accounted for in the case of population decline, as the costs of providing infrastructure services cannot be rolled back proportionally to the decline in demand due to facility management, legal and political restrictions. This is true of both social and technical infrastructure. Social infrastructures with higher fixed costs such as gymnasiums generally have higher residual overheads than childcare facilities,

where personnel and operating costs are the primary expenses (cf. Bundesamt für Bauwesen und Raumordnung/Bundesministerium für Verkehr, Bau und Stadtentwicklung 2006: 8).

In service areas experiencing population loss and, subsequently, sinking consumption, a drop in service fee revenue – from drinking water and sewerage networks, for example – may be accompanied by increased operating and maintenance costs for flushing systems. This leads to a rise in costs specific to those infrastructures. Fewer users must bear the expenses for the fixed costs of operating public service networks, making fee increases inevitable in the long term (cf. *ibid.*: 10; Koziol 2004).

Municipalities, which must always bear a portion of development and maintenance costs, and private households, which finance a large proportion of infrastructures through contributions and fees, lose out equally in this process. However, this trend also affects fee-payers and taxpayers on the whole as a portion of the infrastructure costs, i.e. the consequence of urban sprawl, are distributed "socially" among all the residents of a service area, instead of being calculated more individual (inter alia depending on maintenance costs). Thus site-specific factors such as building density and the length of supply pipelines are not reflected in the fees charged to individual users.

3. Revenues and expenditures and the respective costs and benefits of settlement area development patterns

Identifying all the costs and benefits of a measure is a prerequisite for making sound planning decisions. Many municipalities lack competence in this area. On the one hand, the effects of land-use management decisions on municipal finances are too complex; on the other, no comprehensive and uniform approach exists regarding cost-benefit analysis methods when determining planning decisions (cf. Bundesamt für Bauwesen und Raumordnung 2007: 41 ff.).

Overview 1 shows municipal revenues and expenditures in the context of zoning land for residential development.

Beyond consideration of the various related revenue and expenditure issues, the time cycle of fiscal impacts of releasing land for development is also a key factor (cf. Figure 1). While costs for real estate acqui-

sition, planning and development arise at an early stage of the project, resources deriving from property taxes, the municipal financial equalization scheme and proportional income tax payments do not begin to flow until a few years after settlement of the estates has ensued. How high these revenues will be

depends on how quickly the estate is settled and the final occupancy on the building site. Income from business taxes, on the other hand, is dependent upon a company's type, structure and industry as well as the current economic situation. These revenues are subject to heavy fluctuations.

Overview 1: Municipal revenues and expenditures for the development of residential and commercial land*

Revenues	Revenues from property sale (R, C) Unconditional grant allocations from the municipal financial equalization scheme (R) Municipal share of income tax (R) Special grant allocations* (R) Business tax (C) Municipal share of turnover tax (C) Property tax A (for agricultural properties) (R, C) Property tax B (for non-agricultural properties) (R, C) Other municipal revenues** (R, C)
Expenditures	Cost allocations, e.g. to offices, rural districts and government districts (R) Portion of costs borne by municipality to prepare building land*** (R, C) Planning costs (R, C) Additional investment costs for social**** infrastructure (R) Additional investment costs for technical***** infrastructure (R, C) Additional running costs for social infrastructure (R) Additional running costs for technical infrastructure (R, C)

*Source: German Institute of Urban Affairs (2009).

R = Residential land

C = Commercial land

* e.g. for primary schools, childcare facilities

** e.g. dog and amusement taxes, secondary residence tax, licensing fees

*** Portion of costs borne for building site development plans (apportionment, tender planning, interim acquisition, investment contract), financing costs

**** Childcare and primary school facilities

***** internal and external transport infrastructure, open spaces and compensation areas, road drainage systems, street lighting, winter services, and, if necessary, noise mitigation barriers

The degree to which the municipality must bear the follow-up costs, i.e. the degree to which the cost savings would be advantageous, depends on the extent to which the municipality has the scope to engage others in cost sharing. As a result, municipal expenditures for the initial construction of infrastructure vary greatly: While in most cases local governments have to bear the gross of the costs for things such as external development including transport facilities, utility companies assume the construction costs for electricity, gas, water and district heating pipelines.

At any rate, systematically ascertaining the expenses related to a project can heighten awareness of the costs of settlement development. In addition, such assessments can help avoid sweepingly optimistic assumptions regarding income inflows, or, as the

case may be, help forecast the revenue that may be generated. This generally leads to more accurate statements concerning residential housing than it does regarding commercial development.

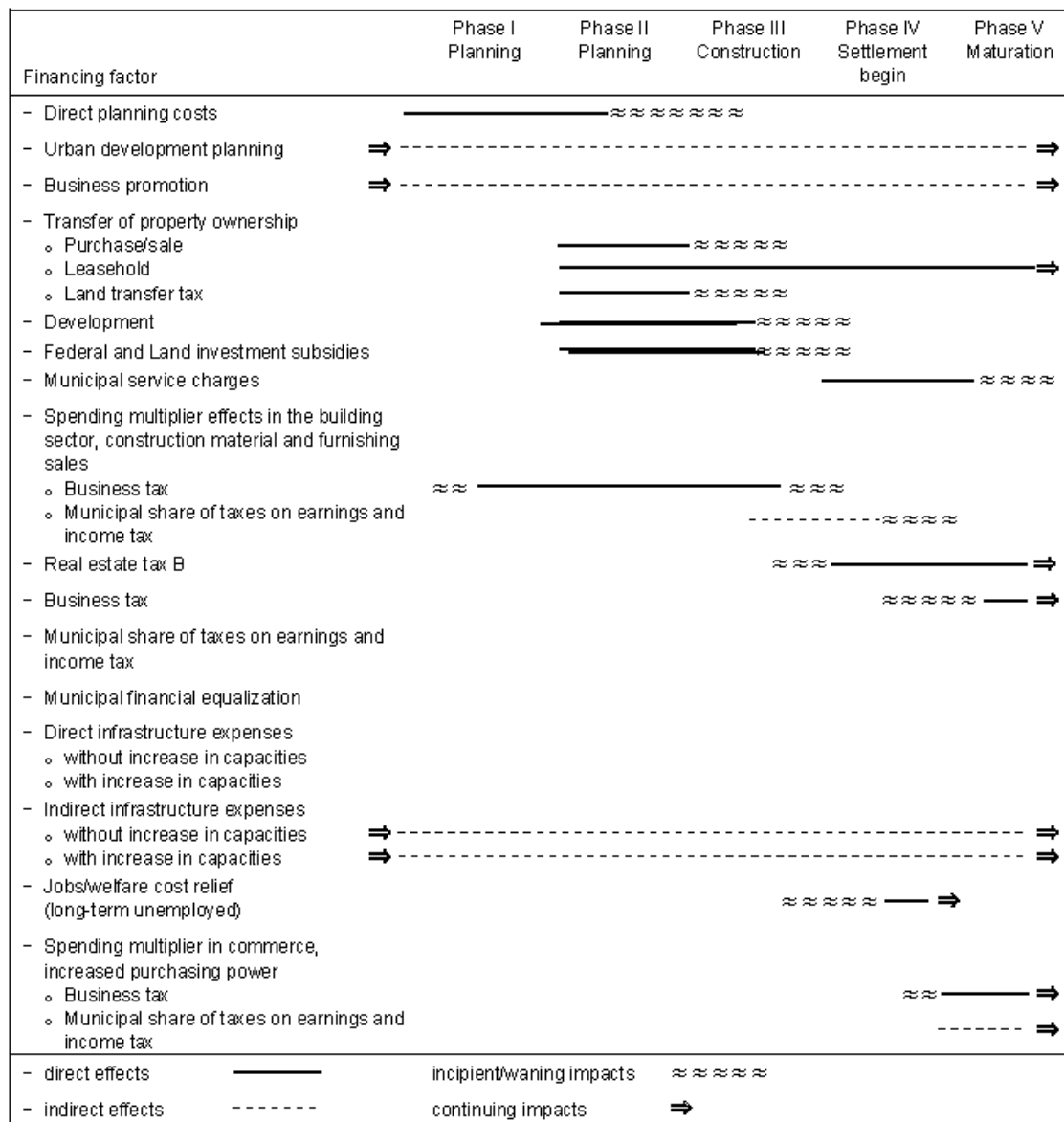
A case-specific investigation of the relationship between revenue and expenditure should always ensure for residential and commercial development areas. General statements concerning the profitability of designating land for development are impossible and would be unreliable.

Studies from Reidenbach (2007) and others allow us to identify factors that have a significant influence on the fiscal impacts of zoning land for construction. They clearly indicate that investment in internal, and in particular external site development, has a con-

siderable impact on the financial balance of new development. Additional expenditures for constructing, expanding and operating social infrastructures tend to have a negative effect on the fiscal balance. The actual increase in revenue is also heavily dependent upon how many new residents and businesses in fact

move into the community and whether there is a significant level of migration and displacement within the community. Finally, how quickly housing is occupied and the actual utilization levels on developed sites greatly influences the relationship between costs and benefits.

Figure 1: The time cycle of fiscal impacts of releasing land for development*



*Source: Martin Junkernheinrich (1994): Wohnen versus Gewerbe? Fiskalische Wirkungen von Baulandausweisungen, in: Informationen zur Raumentwicklung 1-2: 63.

4. Existing studies on revenues and expenditures in the context of settlement development

Calculating and forecasting revenues and expenditures in the context of developing individual construction projects and building sites has been a topic of research in Germany and internationally for some 30 years now. Some of these are individual studies carried out in the run-up to or after completion of building land development. The results of studies of this nature have also been incorporated into the reports on figures and manuals employed by urban and transport planners and architects and engineers in their work.

In this context, the ensuing section focuses on cost-calculation in urban planning and fiscal impact analysis, both fundamental to cost-benefit analysis tools assessing zoning practices for building land.

4.1 Cost-calculation in urban planning

Cost-calculation for urban planning objectives is used to analyze the extent to which an urban development project can be realized or financed in a cost-effective manner. Cost-calculations of this nature account for factors that bear on costs and revenues; moreover, they examine financing risks and how a municipality can influence costs, income and risks when implementing a project. Lastly, they assess the reciprocal impacts of economic cost-effectiveness and urban planning considerations. Cost-calculations for urban planning take place in the form of an economic efficiency evaluation in terms of a dynamic investment appraisal aimed at computing a residual land value (determination of an economically viable purchasing price on the basis of defined project costs and revenues) and calculating a cost-based sales price (cf. Dransfeld 1999).

Since the 1970s, various sets of figures and methods have been developed to calculate the costs of urban development projects. On the basis of ex-post analysis, calculation methods were developed to estimate the costs of larger building projects (cf. Gassner 1972; von Barby 1974). In this context benchmarks for urban planning were determined (cf. Borchardt 1974). Furthermore, a set of figures concerning the subsequent costs of public investments was identified on the basis of a survey of municipalities (cf. Lenk/Lang 1981; Lenk 1996). In the 1990s the mathematical model ERNA was developed to calcu-

late development costs (cf. Holst 1997). Ecoplan (2000) compiled a study for various types of settlement areas that provides an in-depth assessment of infrastructure costs for water, sewerage, transport and electricity. An evaluation of follow-up costs in terms of land management concerns was also incorporated into urban planning cost-calculations (cf. Kötter 2002: 143 ff.).

4.2 Fiscal impact analysis

Fiscal impact analysis comprises general calculations or estimations of changes in revenues and expenditures in the wake of new laws and measures. The effects of granting zoning permits for new building land, the incorporation of communities and restructuring existing building land are considered alongside land-use issues. The precursor of fiscal impact analysis is the practice of cost-benefit analysis developed in the 1970s and 1980s in the United States (cf. Reidenbach et al. 2007: 27 ff.).

The fiscal impact analysis factors in the government revenues and expenditures a building project generates (generally for the municipality). It disregards the costs and benefits to the private sector as it does costs and benefits that cannot be given a monetary value and effects that cannot be quantified. As such, the costs and benefits resulting from the use of natural assets and countryside, among other factors, have yet to be included in calculations of this nature. Fiscal impact analyses are performed for individual building sites as well as summarily for sections of municipalities, municipalities and metropolitan regions. As a rule, residential land and commercial land are analyzed independently.

In the United States, interest groups such as the American Farmland Trust, among others, have been compiling fiscal impact analyses; the trust implements these in the preservation of strategic agricultural resources and developed the Cost of Community Services (COCS) studies method (cf. Freedgood et al. 2002). Apart from this, different stakeholders investigate the costs of suburbanization to promote strategic smart growth approaches. Such analysis also employs the COCS approach, in conjunction with the stakeholders' own calculation methods (cf. Bodenschatz/Schöning 2004).

In German-speaking countries a great number of research findings and publications are available that examine the fiscal aspects of urban development – viewed from the perspective of revenues and expenditures. As early as the 1970s, some cities began studying migration to the periphery of urban areas

and its effects on municipal revenues (cf. Magistrat der Landeshauptstadt Wiesbaden 1977: 56 ff., 128 ff.). They also investigated revenue-related issues connected to regional migration and the land requirements that arise as a result of such population movement, focusing on the consequences for municipal taxes and the impacts on municipal financial equalization.

The Hamburg-Harburg University of Technology employed model calculations and research findings to analyse the effects of new residential areas on municipal budgets in the area of Greater Hamburg (cf. Gutsche 2003). The Institute of Spatial Planning at the Technical University Dortmund (IRPUD) used a model for the urban region of Dortmund to create an exemplary calculation of how different strategies in city cores affect population settlement patterns in cities and surrounding areas and the implications this has for municipal finances (cf. Moeckel/Osterhage 2003).

The German Institute of Urban Affairs (Difu) studied the fiscal impacts of zoning land for development on municipal budgets from 2003 to 2005. The institute itself developed a model to attribute standard development costs and municipal revenues (including tax revenues and the effects on municipal financial equalization) to exemplary residential and commercial areas and used the findings to draw up a fiscal balance (cf. Reidenbach et al. 2007).

The Centre for Soil Protection and Land Use Policy (ZBF) at the Umwelt-Campus Birkenfeld developed an Excel-based tool that allows local governments to estimate the fiscal impacts of zoning new areas for residential development (cf. Löhr/Fehres 2005).

In a study performed on behalf of the Verband Region Stuttgart, the environmental consultancy firm Ökonsult GbR Stuttgart analyzed the costs and benefits of zoning new land for development using the examples of the town of Marbach am Neckar and the municipality of Wäschenbeuren. The study postulated three different scenarios to forecast demographic development between now and the year 2050 (zero growth, continuation of status quo, positive growth) (cf. Verband Region Stuttgart 2006; Flaig 2008).

The Land Baden-Württemberg commissioned the Economics Department at the University of Göttingen to examine the economic benefit of brownfield revitalization in cooperation with an engineering firm and the special research group Society for Institutional Analysis (sofia) at the University of Darmstadt. The study comprised 17 revitalization projects in 14 municipalities in Baden-Württemberg and

aimed to gauge the positive economic impacts that result from completed land recycling initiatives and to contrast them with the costs incurred (cf. Bizer et al. 2007; Bizer et al. 2008). A comparison of 33 residential areas in seven municipalities in Baden-Württemberg – which differentiated between several types of development areas – identified preparatory and development costs as well as the follow-up costs of road maintenance, street lighting, street cleaning, winter services and care for green spaces (cf. Seiler 2006).

The cost effects of urban sprawl in combination with demographic changes on public and private expenditures for technical and social infrastructure were examined in cooperation of the Leibniz Institute of Ecological and Regional Development (IOER) in Dresden and the Chair of Urban Infrastructure at the Brandenburg University of Technology in Cottbus. These were quantified for various types of settlements and communities (cf. Bundesamt für Bauwesen und Raumordnung 2006; Bundesamt für Bauwesen und Raumordnung/Bundesministerium für Verkehr, Bau und Stadtentwicklung 2006).

In Switzerland, Ernst Basler + Partner AG developed a software model that portrays the costs and revenues that result from new housing estates and individual development areas; this model also allows comparison of different types of sites (cf. Schultz/Friedrich 2006: 187 ff.).

Several REFINA projects address and work to further develop existing studies and methods of cost-calculation and fiscal impact analysis for urban planning.

5. Models and tools for cost-benefit analysis

5.1 Potential applications of models and tools

In practice, local governments require tools to ascertain the costs and benefits, i.e. the revenues and expenditures that result from zoning new building land. The aim of such instruments is to make it possible for the relevant administrators in local government to employ a PC application to calculate the short-, mid- and long-term impacts on revenues and expenditures of various development approaches. Here, it is paramount to be able to portray the revenues and expenditures for each phase of building site development – from planning to development, construction, settlement and the completion of the site in its utilization phase. The tools integrate cost-calculation

methods from urban planning and fiscal impact analysis.

In general, tools and models of cost-benefit analysis open up a broad spectrum of application possibilities for their users. They can be employed to these purposes:

- **Ex-ante cost-benefit analysis of building sites**
Some tools allow examination of individual construction projects and building areas as well as simultaneous appraisal of several building areas.
- **Ex-post cost-benefit analysis of building sites**
Some tools allow examination of individual construction projects and building areas as well as simultaneous appraisal of several building areas.
- **Assessment of alternative sites**
Some are capable of comparing the initial costs and follow-up costs for development of different sites.
- **Comparing different development approaches**
Because the tools offer the choice of an array of data entry parameters it is possible to compare various development approaches (variations in development density, infrastructure provision requirements) and the resulting initial and follow-up costs.
- **Comparison of settlement development strategies**
Short-, mid- and long-term strategies of settlement development can be contrasted in terms of the initial costs and follow-up costs they incur. Some potential strategies to consider include ceasing to issue zoning permits, reuse, zoning areas for development or combinations thereof.

In addition, various tools are suitable for:

- **Monitoring the utilization of infrastructures**
In addition to examining the initial and follow-up costs for infrastructures, it is also possible to integrate the tools into current studies of the short-, mid- and long-term utilization of infrastructures. Provided there is an intersection with comprehensive data covering the entire area regarding technical and social infrastructures and population development, the tools can be integrated into a monitoring/early warning system.

To complement urban planning cost-calculations commonly used thus far, these tools can also be employed in analyzing long-term follow-up costs that go above and beyond the actual construction project. Moreover, comparative follow-up cost analyses of potential building sites aid in strategically defining

spatial and temporal priorities for land development in the municipality. This allows analysis and, if necessary, comparison of an array of land development strategies, such as development of building gaps, settlement intensification, settlement expansion and brownfield revitalization.

Tools to ascertain the follow-up costs of settlement area development patterns create transparency with regard to payment flows and their short-, mid- and long-term distribution; as such, they can contribute to sounder preparation of land-use management decisions in municipalities in terms of the costs such decisions induce.

Various new models and tools developed for follow-up cost analysis in recent years are based on fiscal impact analysis and cost-calculation methods for urban planning. They allow users to estimate the short-, mid- and long-term revenues and expenditures relevant to one or several building sites.

The results of cost-benefit analysis can be applied in connection with urban land-use planning (development scheme, land-use plan) and in informal planning activities (e.g. settlement strategies, urban development strategies, strategies for urban districts). Yet they are also suitable for analyzing individual sites, e.g. in the framework of test planning. They can assist in compiling administrative and council drafts and otherwise contribute to municipal reporting on settlement development. Furthermore, web-based tools allow citizens, associations and municipal government policymakers to inform themselves about possibilities for shaping settlement development and the follow-up costs development incurs. Consequently, tools of this nature heighten awareness of the issue of follow-up costs and promote communication on the topic. They can also be applied in areas beyond direct site-related planning, e.g. public utilities, public works administration, finance departments and school administrations.

5.2 Selected models and tools for cost-benefit analysis

In the framework of the Programme “Research for the Reduction of Land Consumption and for Sustainable Land Management (REFINA)” of the Federal Ministry of Education and research funding from the Land Baden-Württemberg, various cost-benefit analysis models and tools have been and are being developed:

- The REFINA project Wohn-, Mobilitäts- und Infrastrukturkosten – Transparenz der Folgen der

Standortwahl und Flächeninanspruchnahme am Beispiel der Metropolregion Hamburg (Cost Transparency) developed a follow-up cost calculator called Was-kostet-mein-Baugebiet.de¹.

- The software tool LEANkom, a product of the REFINA project LEAN² – Kommunale Finanzen und nachhaltiges Flächenmanagement (LEAN² – Municipal Finances and Sustainable Land Use Management), makes it possible to depict the fiscal impacts (revenues and expenses) of local residential development patterns. It enables the assessment of different municipal housing settlement strategies and integrates population models in the cost-benefit analysis².
- Baden-Württemberg funded the development of the fokus^{bw} software for calculating the economic viability of residential areas within the frame of WISINA project³. fokus^{bw} accounts for the revenues and expenditures of housing settlement strategies and allows analysis of various development strategies (internal development, external development, combinations of internal and external development)⁴.
- Assessment of investments and follow-up costs entailed in developing residential and commercial land in the Gießen-Wetzlar urban region was among the research focuses of the REFINA project Nachhaltiges Siedlungsflächenmanagement Stadtregion Gießen-Wetzlar (Sustainable Management of Settlement Areas in the Urban Region of Gießen-Wetzlar). The initiative investigated the investment and follow-up costs for technical infrastructure (residential and commercial) using two scenarios with varying levels of newly zoned development land, compared them and integrated them in a governance model for the urban region⁵.
- In the REFINA project FIN.30 – Flächen intelligent nutzen (FIN.30 – Using Land Intelligently) the cost-calculation model FIN.30 was introduced to evaluate potential housing development sites. It serves to help prepare and aid in deci-

sion-making that results in economically optimized settlement development. It considers the approach to calculating site-related costs of developing building land and refinancing approaches in the context of the preparation of building land. It collates individual calculations of potential housing development sites with similar development patterns into a collective evaluation. The calculation results are weighted variously and used to formulate land development strategies⁶.

- Management of regional settlement areas using a (monetary) value-based assessment of the ecological, infrastructural and private economic dimensions of potential development sites is the focus of the REFINA project Regionales Portfoliomanagement (Regional Portfolio Management). This data processing tool makes it possible to compile an impact balance sheet for individual areas, for a model portfolio and for the entire potential building area in a region. It is designed to support a sustainable settlement using a regional portfolio management approach that promotes a cooperative strategy⁷.

The complexity of the tools and models varies significantly. Their operation requires users to invest various degrees of time and effort (entry of basic data, data management, interfaces with existing systems etc.).

Overview 2 shows a selection of tools and models that have recently been developed or are currently in development. The models and tools described there feature specific characteristics regarding target group, spatial plane of reference, types of uses examined, consideration of revenues and expenditures and the ways in which they are capable of portraying development strategies.

Target groups and topic dealt with

The tools and models are primarily directed at users in local government; however, some are also aimed at municipal policymaking and citizen initiatives. Furthermore, cost-benefit analyses are generally of interest to project developers and housing developers too. Most models and tools deal with land for housing construction.

1 Additional information at www.was-kostet-mein-baugebiet.de.

2 Additional information at www.lean2.de.

3 WISINA has been funded by the Ministry of Environment Baden-Württemberg within the Programme BWPLUS "Lebensgrundlage Umwelt und ihre Sicherung". The realisation of WISINA has been attended by the Project Management Agency Forschungszentrum Karlsruhe.

4 Additional information at www.fokosbw.de.

5 Additional information at <http://refina-region-wetzlar.giessen.de>.

6 Additional information at www.fin30.uni-bonn.de.

7 Additional information at www.wohnregion-bonn.de.

Spatial plane of reference

The spatial plane of reference of the tools and models spans from individual sites to regions. Some tools and models are capable of reaching conclusions for various spatial planes of reference (individual sites, building areas, cities), others focus on individual sites, districts, specific building areas or residential development sites.

Settlement development strategies

The tools and models allow for analysis of an array of strategies and scenarios of building land development (external development, internal development, combinations of external and internal development).

Types of areas and locations

As a rule, a fiscal analysis within or between defined types of areas and locations is possible to compare pertinent variations in zoning schemes with one another. Such analyses allow appraisal of new housing estates in green belts, new estates on the outskirts, less utilized land within towns and cities, consolidated areas (partially or entirely developed areas on the outskirts of the settlement community), open spaces and brownfields in central areas.

Building types

For the most part cost-benefit analysis tools differentiate between the types of buildings that are constructed in residential areas according to the density of inhabitants: single-family homes, semi-detached homes, terraced homes and multiple-family homes/multi-storey dwellings.

Portrayal of costs and revenues

All tools and models portray parts of the cost/expenditure dimension; some also illustrate the benefit/revenue dimension. All tools and models address the infrastructure costs that accompany settlement creation. In addition to infrastructure costs, many tools and models consider further cost parameters such as the costs of preparing building land, preparation of plot and financing, local public transport, the costs of transportation of pupils and the costs for compensation measures. With regard to social infrastructure, the tools and models account for issues surrounding nursery and primary schools.

Examination of the phases of development in an area

Some cost-benefit analysis tools and models depict the phases of a development project in an area with its causally attributable expenses: from property acquisition to the planning, preparation and construction of technical infrastructure to the sale of the plots, the completion of the settlement of the area with new inhabitants and the ensuing utilization phase. The time periods analyzed by the models and tools vary. They generally foresee a time period of between 15 to 25 years or longer. Data input by users

For the most part, users of cost-benefit analysis tools are requested to provide data about the number of housing units planned, building type and to assign a specific location type. More elaborate tools begin with individual entry of data concerning the specific land zoned for new development; data include land requirements for community facilities and green areas as well requirements for additional spaces and for land for transport connections.

Calculation results and data output

Using the data entered, the cost-benefit analysis tools use a basic cost model to calculate the follow-up costs for technical infrastructure (roads, sewer system, gas, electricity, drinking water). It accounts for outlays for the initial construction of infrastructure networks, their long-term operation, maintenance, repair and eventual modernization.

In the area of social infrastructure (nursery schools, primary schools), data on population development can be used as a basis to generate estimates of future demand. In some cases the tools consider data regarding distances between a series of infrastructural facilities that already exist and current utilization levels.

Data output generally ensues in the form of calculations and graphic depictions. The data can be employed for various purposes, e.g. as the basis for presentations and conceptual drafts. Moreover, various tools allow data to be exported to a separate Excel file for subsequent use in diagrams.

Overview 2: The parameters of cost-benefit analysis tools and models

Tool/Model (Developer)	Target Group	Spatial Plane of Reference	Type of Utilization	Benefits (Revenues)	Costs (Expenditures)	Scenarios/Strategies	Miscellaneous
Software tool: Folgekosten-Schätzer; module: Technical Infrastructure (REFINA Cost transparency)	Local government Municipal policymakers Citizen initiatives	Individual sites Building area Land-use planning	Residential	not shown	Technical infrastructure, green areas	Comparison of different scenarios involving gaps between buildings, plots in core areas and/or areas on the periphery	MS Excel application Possibility of site-related data entry Adjustable time period, max. 100 years Tool accessible for no charge at www.was-kostet-mein-baugebiet.de
Software tool: Folgekosten-Schätzer; module: Social Infrastructure (REFINA Cost transparency)	Local government	District Residential area City-periphery area/region	Residential	not shown	Social infrastructure	Scenarios freely definable (existing building, new building)	MS Access application Possibility of site-related data entry Adjustable time period Integrated population forecast Interface with MESO reporting system Tool accessible in conjunction with consultancy services
Software tool LEANKom (REFINA LEAN ²)	Local government	Individual sites Building area Total building area City	Residential	Real estate transactions Property tax Municipal share of income tax Unconditional grant allocations/cost allocations	Preparation of building land/financing Technical and social infrastructure Open space and compensation areas Public transport transport of schoolchildren Planning costs	Comparison of freely selected strategies and subsequent comparison of varying development approaches or complex urban development strategies	Self-developed software solution Interfaces with ArcGIS and MS Excel Site-related and cross-municipal data entry Integrated population modelling for building areas and districts, 20-year forecasting time period, highly adaptable to specific municipal demands, will be launched as a service in spring; software available for purchase from autumn 2009
Software tool fokusbw (FH Nürtingen and STEG)	Local government	Building site District/city (social infrastructure)	Residential	Real estate sale Property tax A Property tax B Municipal share of income tax Unconditional grant allocations	Preparation of building land/financing costs Technical and social infrastructure	Four predefined courses of action for land development in internal and external areas	Portrayal of typical population structure and development of areas with new housing estates Forecasted time period: 25 years will be launched in spring of 2009 by STEG Stadtentwicklung GmbH, a web-based demo version is also available at www.fokusbw.de

Tool/Model (Developer)	Target Group	Spatial Plane of Reference	Type of Utilization	Benefits (Revenues)	Costs (Expenditures)	Scenarios/Strategies	Miscellaneous
Infrastructure cost model, Gießen-Wetzlar Region (REFINA Nachhaltiges Siedlungsflächenmanagement Stadtregion Gießen-Wetzlar)	Local government	Pilot region Gießen-Wetzlar	Residential commercial	not shown	Technical infrastructure	Two scenarios that take into account land for settlement expansion and existing sites: trend scenario, land recycling scenario	Consideration of site-specific characteristics of land Employs benchmarks and specific outlay factors for development investment and cost Calculation of the follow-up costs for infrastructure until 2020
Cost-calculation model (REFINA FIN.30)	Local government	City	Residential	Site-related revenues (real estate sales); according to selected building land model Citywide revenue (e.g. funding support) No consideration of proportional income tax and municipal financial equalization (site-specific and citywide)	Preparation of building land/financing Technical and social infrastructure	Varying residential densities: freely selectable or dwelling type with defined inhabitant density: single-family, two-family, terraced homes	MS Excel application Consideration of area-specific cost levels for technical and social infrastructure Individual entry of site characteristics Creation of a ranking of potential housing areas Forecasted time period: 15 years Creation of cost-effectiveness classifications Planned link to ArcGIS
Cost-calculation model for regional settlement management (REFINA Regionales Portfoliomanagement)	Local government	Pilot region Bonn, Rhein-Sieg/Ahrweiler	Residential Commercial	Private usufruct of real estate Impacts of structural investment on the surrounding area/neighbourhood	Internal and external development Social infrastructure Noise Flood control Preparation of plot Environmental costs of land utilization	Different planning scenarios	Model in development Linked with GIS Consideration of the costs and benefits of various types of zoning practices from an economic perspective in terms of regional socio-economic optimization (private enterprise, infrastructure, ecology) Calculation of the ecological worth according to a value-based costs-equivalence approach Time period: approx. 20 years

6. REFINA research on follow-up costs: lessons learned

In the context of the REFINA funding measure, the issue of follow-up costs occupies a key position within the wider topic of "economic instruments". In the manner of an ever-learning and networked research consortium, the stakeholders who examined this issue – research institutions, system developers and municipalities – exchanged information informally and in several workshops on methodology and specialist approaches and analyzed the respective solution schemes.

The following section summarizes some of the key findings of this process of exchange and knowledge-assimilation that are essential to the development and further enhancement of cost-benefit analysis models and tools.

Accuracy of portrayal and manageability in implementation

When developing cost-benefit analysis models and tools, two basic requirements must be met. On the one hand, in order to be of sufficient informative value, they should comprehensively portray existing payment flows and the factors that influence them. On the other hand, they cannot be conceived with so much complexity that they are too difficult for users in local governments to employ. However, extremely sophisticated applications must be accompanied by qualified consultancy services. Depending on the depth of analysis and intended application of the findings, cost-benefit analysis tools vary as to how well they can be aggregated and their compatibility with other data-driven systems.

Necessity of target group-specific tools

Models and tools should differ in their depth of analysis and complexity depending on the target group. Reliable support for local governments and municipal policymakers in land management decision-making requires data processing that is as detailed and municipality-specific as possible, so that inaccuracies regarding the computed costs and revenues can be kept to a minimum.

Simple models and tools with all-inclusive data acceptance are important since they are essential tools for interested members of the general public; they offer a straightforward introduction to the topic and can contribute to awareness of the problem complex of settlement and infrastructure development.

Inputting data from individual municipalities

To reproduce the actual circumstances at a location as accurately as possible, tools should offer the possibility of entering specific data about building areas and infrastructure needs. Municipal data stores are of particular importance in the case of social infrastructure costs, which are more complex in nature than technical infrastructure costs and differ depending on demographic development within the boundaries of the municipality or catchment area under examination. Furthermore, in the event of under- or over-utilization of infrastructures, the semi-fixed costs must be taken into account.

Integration of population models

To attain information that reflects the actual increase in the number of inhabitants that result from issuing zoning permits for new building land as accurately as possible (people moving in from outside the community, migration within the community), cost-benefit analyses should incorporate both site-related and municipality-specific population data. To satisfactorily portray populations and income structures in new building areas, models can exploit data from the socio-economic Panel (SOEP)⁸, as done in the LEANkom tool. The population models from the FolgekostenSchätzer software, on the other hand, primarily use data from the German microcensus⁹. The Income and Expenditure Survey (EVS) is yet another possible data source¹⁰. Data on population composition and development gathered in localities themselves can also be included in the data pool.

8 The SOEP is a representative survey of private households that is repeated annually in Germany and comprises 20,000 people. On the basis of this survey, the German Institute for Economic Research (DIW) compiles an anonymous set of microdata on the composition of households, occupational and family biographies, employment participation and earnings.

9 The microcensus is the official representative statistical data on population and the labour market in Germany. It supplies statistical information broken down into regions, in a detailed, subject-related manner, concerning population structure, the economic and social situation of the population, families, cohabitation and data on households, employment, jobseekers, education/training and continuing education/training, the housing situation and health. Execution of the survey and processing of the data are the tasks of the statistical offices of the Länder.

10 The federal and Länder statistical offices perform the Income and Expenditure Survey (EVS) every five years (most recently in 2008). It includes, among other things, details regarding income sources and levels for private households.

Accounting for the actual occupancy of building sites

Analyses of the cost-effectiveness of new housing estates should take into account the speed at which areas of residential development are settled, i.e. occupancy levels and the utilization rates for technical infrastructures that result as well as existing and arising social infrastructures. It therefore appears advisable to re-evaluate the revenues and expenditures of building sites on an annual basis.

Adjusting tools to Länder-specific financing circumstances

The varying approaches and computation formulas of the Länder, e.g. with regard to municipal financial equalization and the financing of social infrastructures, require a range of cost-benefit analysis models and tools that are tailored to the needs of each Land and that calculate the revenue-related aspects of building area development.

Realizing and elucidating multiple-use potentials

Initial compilation of data for entry in cost-benefit analyses is extremely laborious for public administration; however, long-term use and data management can result in multiple-use applications. This applies to the integration of the tools in settlement development monitoring and the creation of interfaces. Key interfaces might be those between administrative offices involved in planning and local councils; other important interfaces might involve the administrative entities responsible for investment and budget, school development, child day-care facilities, transport infrastructure and supply and waste infrastructures.

Cost transparency requires transparent input data and assumptions

The employment of cost-benefit analysis models and tools – as with other decision-making support tools – requires that the data entered are as comprehensive and reliable as possible. Analysis results regarding the revenues and expenditures involved in settlement area development that closely reflect reality and that are exploitable can only be attained if the input data is transparent and trustworthy. Assumptions about the speed of settlement and utilization of building sites should be depicted in a similarly transparent manner.

Cost-benefit analysis as a building block in process of weighting of interests

Valid cost-benefit analyses can help support and bolster arguments for consolidated settlement development in the course of weighting of interests in conjunction with municipal land-use management decisions. Findings on expenditures and revenues connected with building site development are, however, just one component in the complex process of weighting of interests. Similarly, making planning decisions solely contingent upon fiscal criteria would neglect other factors that are important to the general welfare of the community.

Ways of implementing models and tools

There are various ways of implementing cost-benefit analysis models and tools.

In principle, it appears necessary to offer practice-oriented training courses and consultation to arm the employees of municipal planning offices, municipal policymakers and the general public with applicable information about issues related to follow-up costs and existing tools and models for cost-benefit analysis.

Simple cost-benefit analysis tools that are aimed at a wider public can be made available as Internet applications. Models and tools that are designed for use in public administration should include accompanying or integrated instructions for users, and explanations regarding content that make them more easily manageable. For analysis of more sophisticated interrelationships, consultancy sessions with qualified professionals integrating cost-benefit analysis tools should be seriously considered.

7. Conclusion

Against the backdrop of demographic change and the documented trends of declining and stagnating populations in the Federal Republic of Germany, a shift away from established land-use policies to policies that focus more on exploiting areas with existing development appears imperative. In particular, mid- and long-term follow-up costs for the maintenance of technical and social infrastructures have the potential to considerably burden municipal budgets in the future. As such, it appears advisable to promote cost transparency before zoning new land for development by appraising the actual revenues and expenditures this would incur.

Cost-benefit analysis tools enhance transparency with regard to the short-, mid- and long-term costs of building projects and can therefore contribute to sound and informed preparation of land-use decisions. In particular, they allow comparison of settlement development strategies and of alternative sites. They can serve as a tool to prepare and support decisions.

However, cost transparency is contingent upon transparent and valid input data and assumptions. Analysis results regarding the revenues and expenditures involved in settlement area development that closely reflect reality and that are exploitable can only be attained if input data are transparent and trustworthy. Assumptions about the speed of settlement and utilization of building sites should be depicted in a similarly transparent manner.

Expectations that cost-benefit analysis tools represent a panacea when it comes to solving land manage-

ment issues should be put into perspective. Cost-benefit analyses create cost transparency and ensure decision-makers have more comprehensive information at their disposal. Nonetheless, a plethora of subjective and objective factors determine local government policy; policymakers in municipal land management must responsibly and proactively assess these determinants. In practice, decisions that affect construction activity and the creation/adaptation of infrastructure are often made in separate decision-making processes, i.e. under the stewardship of various players acting independently or of the parties responsible for performing tasks and carrying out measures. Cost-benefit analyses represent just one component in a complex process of deliberation regarding commodities, values and arguments that, as a matter of natural course, can only be partially evaluated or expressed in quantitative or financial terms.

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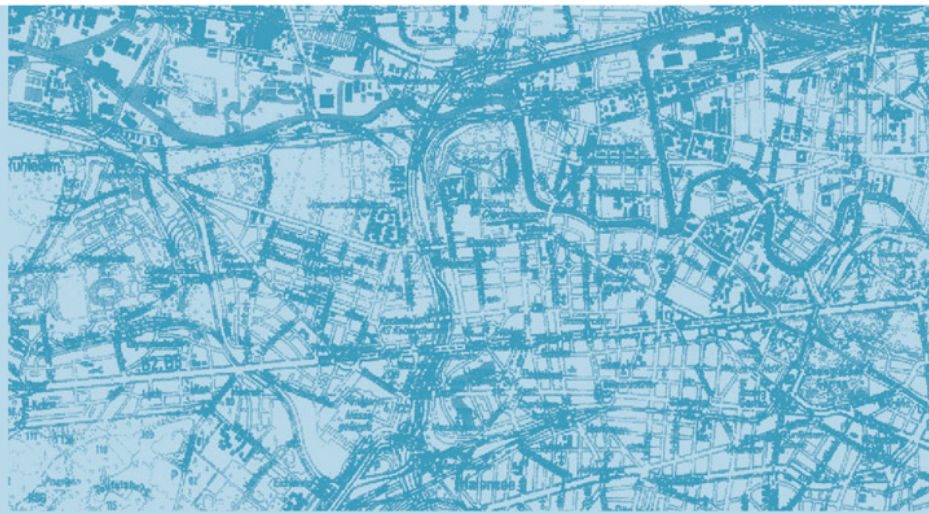
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Zusammenfassung

Die sich abzeichnende demografische Entwicklung, insbesondere sinkende Bevölkerungszahlen und eine alternde Gesellschaft, verlangen von den Kommunen flächenpolitische Entscheidungen mit Augenmaß. Die Konkurrenz um neue Einwohner und die weitere Neuausweisung von Wohnbauflächen erscheint daher immer seltener als geeignete Lösung. Notwendig ist vielmehr eine Siedlungsentwicklung, die die kurz-, mittel- und langfristigen Kosten technischer und sozialer Infrastrukturen stärker in den Blick nimmt. Mehr Kostenwahrheit kann dazu beitragen, einer aus ökologischer, ökonomischer und sozialer Sicht problematischen Zersiedelung entgegenzuwirken. Ausreichende Siedlungs- und Nutzerdichten bzw. Auslastungsgrade sind notwendig, um die Rentabilität von Infrastrukturen für öffentliche und private Haushalte langfristig zu sichern. Vielerorts sind die Infrastrukturen an eine sich verändernde Altersstruktur und perspektivisch sinkende Einwohnerzahlen anzupassen. Für die Bewältigung dieser Herausforderungen ist eine systematische Analyse von Einnahmen und Ausgaben im Zusammenhang mit Baugebietsausweisungen erforderlich. Städtebauliche Kalkulationen, fiskalische Wirkungsanalysen und Werkzeuge zur Kosten-Nutzen-Betrachtung können die Kommunen dabei unterstützen.

Schlagwörter: Demografie, Kosten-Nutzen-Betrachtung, Kostentransparenz, Infrastruktur, fiskalische Wirkungsanalyse, Baulandausweisung



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Phone/Telefon: +49(0)30/39001-0, Fax/Telefax: +49(0)30/39001-100

E-Mail: difu@difu.de • Internet: <http://www.difu.de>

Author/Autor: Dipl.-Ing. agr. Thomas Preuß

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