Site effects: assessing the fiscal, social and ecological costs of planned developments

Andrea Dittrich-Wesbuer*, Annette Krön and Alexander Mayr

ILS Research Institute for Regional and Urban Development, Germany

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To achieve a more sustainable urban development it is necessary that decision-makers and others are able to understand the impacts of planned projects. To support this understanding a significant number of ‘impact assessment tools’ have been developed to facilitate decision-making for urban development. However, many of these tools have a rather narrow scope when looking at assessment areas or spatial scope. On that background, the research project RegioProjektCheck set out to develop an impact analysis tool with a broadened scope. Although the ambitious objectives had to be modified for some subject areas, the toolbox created can be seen as a starting point for a new generation of impact assessment tools that enable an integrated assessment. A new approach has also been attempted with wide distribution of the toolbox, providing free use and further technical development to anyone.

Keywords: impact analysis; geographical information system (GIS); costs of sprawl; sustainable urban development; decision support system; impact assessment tool

Introduction

In most Western countries continuing urbanization has resulted in spatially expansive, discontinuous (sub)urban development, and urban development continues to become more decentralized and regional (Siedentop & Fina, 2012). With regard to a more sustainable urban development this trend is highly problematic. Furthermore, in many municipalities competition for undeveloped land is high and decision-makers need to take into account a number of potential impacts, consequences and conflicting uses when assessing and planning new urban development projects (Burchell, Downs, Seskin, & Moore, 2010). However, planning practitioners often only have certain information about their subject areas available, as responsibilities and competences are often fragmented within the public administration.

Especially in the context of current and foreseeable demographic changes, such as the ‘shrinkage’ and ‘ageing’ of cities and regions, valid information on the short- and long-term effects of urban development are highly relevant. To deliver this information, impact assessment tools that evaluate the effect of urban development have been developed. Over the last decades, multiple tools have been developed that differ in scope and utilization possibilities. For the most part, these tools focus on fiscal impacts, and there are only very few instruments or decision support systems that highlight and summarize financial, social and ecological effects of urban development in a similar way.

*Corresponding author. Email: andrea.dittrich-wesbuer@ils-forschung.de

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To enable planners to take a more integrated approach towards the appraisal of planned urban development and overcome the fragmented responsibilities, the research project RegioProjektCheck aimed to develop an impact analysis tool with a broadened scope. The tool has been produced in a German context. Nevertheless, the ideas and the concept behind the tool have relevance for other Western countries as well, as effects of urban development are similar on a broad level, particularly for social and ecological aspects. Furthermore, the process that has been undertaken in order to achieve a good acceptance and wide distribution of the tool is interesting for planners and academics in general.

This paper first considers the limitations of existing impact assessment tools with regard to a more sustainable development and how these can be overcome. In a second step, it examines through an implementation test whether the new toolbox RegioProjektCheck strengthens an integrated approach towards urban development assessment and whether it supports the assessment of inter-municipal effects. Furthermore, it examines whether the results are incorporated into planning and decision structures and if planning decision processes are influenced by the tool.

The paper is structured as follows. The second section gives an overview of the research background with a focus on the costs-of-sprawl debate and briefly outlines instruments and tools developed to assess impacts of specific urban development projects. Also a categorization of existing tools according to their underlying software or application and their benefits to users is presented. Subsequently, the newly developed impact analysis tool RegioProjektCheck that pursues a broad assessment scope is introduced. The third section describes the objectives, the technical realization as well as the results of an implementation test. The fourth section provides a comprehensive discussion and review of the tool. The article concludes with an outlook.

Costs and effects of urban development and their assessment

The costs-of-sprawl debate

The debate on the costs of urban sprawl covers the costs and effects of different kinds of urban development, with a focus on the comparison of compact development – or Smart Growth – and urban sprawl. An important starting point for the debate was the ‘The Costs of Sprawl’ study in 1974 (Real Estate Research Corporation (RERC), 1974). This study and many of the following analyses on the costs of sprawl examine hypothetical urban development scenarios (e.g. Burchell et al., 2002; Speir & Stephenson, 2002; Vision California, 2011), even though some evaluate existing urban development patterns (e.g. Carruthers & Ulfarsson, 2003).

The studies mostly aim to generalize costs that occur from urban development and emphasize the macro-economic costs and costs to society rather than calculating the actual financial costs for a community. They frequently highlight the benefits of Smart Growth, but some argue that sprawl also has its advantages and Smart Growth its disadvantages (Burchell et al., 2002; Gaigné, Riou, & Thisse, 2012; Gordon & Richardson, 2001).

While the debate had its starting point in the United States, more recently there have also been studies on the costs of urban sprawl or urban development in additional countries, such as Australia (Centre for International Economics (CIE), 2010; SGS Economics, 2012; Trubka, Newman, & Bilsborough, 2007), Germany (Gutsche, 2006; Seiler, 2006; Siedentop, Schiller, Koziol, Walther, & Gutsche, 2006), Switzerland
(Ecoplan, 2000; Kemper & Gilgen, 2008; Suter, Müller, & Sommer, 2010) and Austria (Braumann, 1988; Doubek & Zanetti, 1999). However, some of those studies refer to the assessment of costs of specific development projects rather than the costs of certain general urban development types.

One result of the large number of costs-of-sprawl studies is the understanding that there are a number of different types of costs and impacts that are caused by urban development, which should be considered when trying to assess the effects of urban development. Broadly, it is possible to distinguish between economic/fiscal, ecological and social effects.

Infrastructure costs are a significant economic impact of urban development. This includes operating and maintenance costs, which have important long-term effects (Dittrich-Wesbuer & Osterhage, 2010; Siedentop et al., 2006; Trubka et al., 2007).

Ecological impacts are caused by the use of previously undeveloped land through urban development (Burchell et al., 2002; Livingston, Ridlington, & Baker, 2003). Further ecological effects are emissions and energy consumption from urban development.

Car dependency, transportation costs and accessibility can be seen as a social impact of urban development. Lower personal transportation costs and an improvement in accessibility, especially by modes other than the car, can benefit economically and physically disadvantaged people in particular and facilitate everyday life in general (Austroads, 2011; Ewing & Cervero, 2010).

**Tools to assess the effects of urban development projects**

The objective of costs-of-sprawl studies is to find out whether a certain type of urban development has more benefits for society and the environment. Yet, the assessment of specific projects is crucial for municipalities considering new urban development. From this requirement a different approach towards assessing the costs of urban development developed in the early 1970s. These tools or studies analyse real urban development projects and their concrete effects. Most of these approaches focus on fiscal impacts.

Fiscal impact studies are the best known and most widely distributed and developed approach for the assessment of costs and effects of urban development. In the United States they have been developed and undertaken since the early 1970s to analyse the operating costs of growth (Burchell et al., 1998). Most of these studies assess the overall effects for a municipality and take into account the costs as well as the revenues that occur through the development. Examples of fiscal impact studies and methods include: Cost of Community Services, the Input–Output-Model, the Fiscal Impact Model, the Per Capita Multiplier Method, the Service Standard Method, the Employment Anticipation Method, the MUNIES model and the FISCALS model (American Farmland Trust, 1993; Burchell, Listokin, & Dolphin, 1985; Burchell et al., 1998). Nowadays, a large variety of fiscal impact analysis methods in the United States are distributed as guide books, computer tools or consultancy services.

In Germany, methods to calculate fiscal effects of new urban areas also developed in the early 1970s (Dittrich-Wesbuer & Osterhage, 2010). However, the first studies mainly analysed site development costs, while later studies examined changes generated in municipal income. In the early 2000s, the first impact analyses were developed that considered income and costs together (Gutsche, 2003; Moeckel & Osterhage, 2003). This development was influenced by similar studies in Switzerland and Austria (Dittrich-Wesbuer & Osterhage, 2010).
The first software tools with a comprehensive view on (mostly municipal) expenditures and revenues of new urban development projects, the so-called ‘Kostenkalkulatoren’ (‘cost calculators’), were developed from the mid-2000s onwards, often supported by public funding and focusing on the reduction of land consumption and sustainable land management (Bock, Libbe, Preuß, Zwicker-Schwarm, & Hinzen, 2012; Difu, 2012).

Those cost calculators use project-specific data and local parameters in order to calculate the effects of a project and potentially alternative versions. The trend towards this type of standardized software was aided by the growing understanding and elaboration of information technology as well as the increasing use of computer applications within public administrations.

Overall, a number of software tools now exist in Germany, with some commonalities but also differences in focus and level of detail (Preuß & Floeting, 2009). Most of the approaches concentrate on residential areas and the related infrastructure costs and municipal revenues (Dittrich-Wesbuer & Osterhage, 2010). Tools examining commercial and industrial areas exist, but are scarce.

A similar development of software tools to the one described in the United States and Germany has taken place in other countries as well, including Switzerland, Austria and South Africa (Mayr & Brauckmann, 2013).

**A categorization of impact assessment tools**

Depending on their specific purposes and intentions, tools to assess the impact of urban development projects are based on different concepts and differ in their application. The crucial decision when developing such a tool is between the ease of use and the precision of results. Generally, the precision of results positively correlates with both the complexity of the tool and its difficulty of use and comprehension. Conversely, the easier the tool is to use and understand, the less precise the results are likely to be, as the tool needs to be less complex. Therefore, the general objective and intended user base of a tool need to be carefully considered, as often the precision of results is dependent on the time and money available to the user or customer. Also, a tool targeted at professionals can be more complex than one targeted at the general public.

Further factors that need to be decided when developing a tool include the spatial scope (individual project, local level or regional level), the scope of land uses considered (e.g. residential, industrial, commercial) as well as the scope of assessment areas (e.g. municipal revenues, infrastructure costs, transportation costs, ecological impacts, etc.) (Mayr & Brauckmann, 2013).

This section offers a categorization of existing impact assessment tools according to their underlying software or application. It describes their respective characteristics as well as to what extent they respond to the factors mentioned above. This categorization and assessment is undertaken from the viewpoint of users, such as public servants or private persons. Table 1 summarizes the discussion.

Online tools are generally aimed at a broad audience and easy to use. They often create results in a few minutes and are more suitable to give an impression of general relationships than a specific and exact impact assessment. These tools are often used for a playful introduction into the topic. Their advantages are that they produce results quickly, have low data requirements, the user needs nearly no prior knowledge and they have low costs, as the tools are usually free of charge. Disadvantages of online tools are that the results are very general, the scope of assessment areas is often limited as mainly
fiscal impacts are considered, and many of the tools concentrate on residential projects only. Examples of online tools include the Folgekostensimulator (see www.was-kostet-mein-baugebiet.de) and the ‘Healthy Growth’ or ‘This View of Density’ calculator (see http://vault.sierraclub.org/sprawl/density/).

Excel-based tools are a bit more complex than online tools and tend to be aimed at experts rather than the general public. More data need to be entered by the user and the tools require more prior knowledge. In return the results are more detailed. Nevertheless, it is often still possible to understand how results are calculated, as the tools are still built in a relatively simple manner. Examples of Excel-based tools include the Sustainable Housing Calculator (see http://www.sustainabledevelopmentnetwork.com/training01.php#housing), Energieausweis für Siedlungen (see http://www.energieausweis-siedlungen.at/), the Fiscal Impact Tool (see http://www.federalreserve.gov/boarddocs/press/other/2004/20040112/default.htm) and fokosBW (see www.fokosbw.de).

Tools that use particular software (e.g. geographical information system (GIS) software) are usually quite complex. They commonly produce very detailed analyses and precise results. These tools can point out relationships between different impact areas and can be used to assess strategies. However, to achieve those detailed outcomes, more complex data need to be entered and relatively high prior knowledge is needed to operate the tool, meaning it can only be used by experts. In equal measure, the installation effort, user friendliness and the costs for using the tools are usually higher than for the other tools. Examples of software tools include the RGB-Simulator (see https://www.hslu.ch/de-ch/wirtschaft/ueber-uns/institute/ibr/kompetenzen/regionaloekonomie/rgb-simulator/) and LEANkom (see www.lean2.de).

As the description of the tools shows, different types of tools serve different purposes with regard to communication and dissemination of results, precision of results, ease of use, prior knowledge and costs of use. The type of tool a user chooses will depend on the reason they are interested in the results, their skill level, and how much money and time they have or are willing to spend. A local government is likely to be more interested in more precise results, and may or may not have the time and/or money to use the more complex tools or to commission a consultant. A private person, in contrast, is more likely to be interested in a broad overview, and probably not willing to spend much time and money on an analysis. As it is not possible to achieve precise results with low efforts of time, money and data entry, the different tools will appeal to different user groups, depending on their priorities and constraints.
Overall, the tools are a useful instrument for municipalities wanting to assess the effects of specific urban developments. However, many of the existing tools mainly concentrate on the fiscal effects of developments, and, while fiscal arguments are crucial for the assessment of new urban developments, decision-makers in a municipality also need to know the ecological and social effects of specific developments. These effects are generally not considered by tools and approaches for impact assessment. Furthermore, the tools and studies mostly concentrate on the effects on the municipality in which the new project is located. They do not consider impacts on neighbouring municipalities or the overall region, which may be important for a decision against or for the project.

RegioProjektCheck as a new approach to impact analysis

As discussed in the previous sections, the effects and costs of urban development have occupied planners and academics for a few decades now and a multitude of tools has been developed to support decision-makers assessing the impacts of urban development projects. The tools and assessments have improved with the evolution of software and technical opportunities and their broader dissemination within planning practice. With further software and technical developments, additional possibilities open up to improve and advance impact assessment tools. This is why the opportunity was seen to integrate several assessment areas into one assessment tool in order to assist planners with an integrated approach towards impact assessment.

The toolbox RegioProjektCheck was created by a team of experts from universities, private consultants and research institutes with experience in the development of impact analysis tools. Based on this experience and some of the shortcomings of existing tools, the key objective for the project was to support a more integrated approach towards impact assessment, which takes into account not only fiscal costs but also social and ecological impacts of a development. Further central objectives included encouragement of an inter-municipal or regional view of impacts, as many effects do not stop at municipal borders, and consideration of tool implementation from the beginning of its development through the involvement of practitioners. This also included thinking about low-cost and simple ways of distribution. Furthermore, because in Germany most of the tools concentrate on the impact of residential development, it was seen as important to broaden the scope to commercial, industrial and retail developments.

Assessment areas of RegioProjektCheck

According to the objective of supporting a more integrated approach, RegioProjektCheck includes a number of assessment areas to model important economic, social and ecological impacts of urban development. The assessment areas have been developed from the insights of the costs-of-sprawl studies as well as the authors’ own experience and feedback from practitioners involved in the project. Additionally, the tool can model housing (residential), business (industrial and commercial) and retail land uses in order to offer a broader scope than most of the German impact assessment tools. Figure 1 shows the assessment areas and land uses that can be assessed with RegioProjektCheck.

RegioProjektCheck considers fiscal impacts by modelling capital, recurrent and maintenance costs for the public sector (‘municipal infrastructure costs’) as well as changes in ‘municipal revenues’ resulting from taxes and other payments. The toolbox considers costs for transport infrastructure, water and sewerage infrastructure, noise...
protection, green space, and compensation areas that need to be created to mitigate for the open space lost through construction. Costs are presented for the municipality, investors and users, respectively, and divided into capital costs, operation and maintenance costs, as well as renovation costs.

The assessment areas concerned with ecological impacts include models for soil sealing, habitat fragmentation (‘land use change and ecological value’), energy consumption and greenhouse gas emissions (‘energy consumption’). ‘Transport effects’ are also subsumed under ecological impacts, even though they also have social and financial impacts. Land use change or land consumption is considered through the existing and planned soil function, landscape fragmentation, impact on protected areas and integration of the planned development into existing urban areas. Energy consumption and greenhouse gas emissions are modelled according to the planned land use, design and building structure. For better comparability, all emissions and consumption are converted to CO₂ equivalents and extrapolated to one year. For residential developments, the results are also represented as energy consumption and thermal output.

The assessment area ‘transport effects’ models the additional traffic generated by the new project. Traffic-inducing destinations, such as schools or employment hubs in the vicinity, are identified in order to model potential traffic flows. The results show the load changes for different roads and road sections.

With regard to social impacts, the ‘accessibility’ of essential services (e.g. kindergartens, schools, general practitioners, medical centres, food markets) and middle- and higher-order centres is assessed for residential projects. Additional destinations or services can also be added by the user. Accessibility is represented as distances and travel time equivalents on foot, by bicycle and by car, and for middle- and higher-order centres by public transport. Furthermore, the quality of public transport connections
(frequency, number and distance of stops etc.) is presented. For industrial and commercial areas, the potential types of jobs for that development are also illustrated.

The accessibility of retail areas is closely connected to the ‘locational competition of supermarkets’, which of course also entails economic aspects. The accessibility of retail projects is shown as changes in the spatial distance between residences and the nearest food product market as well as changes in the average distance for grocery shopping based on actual shopping behaviour (Anders, 2014). For the locational competition of supermarkets, the changes in local spending patterns caused by a new supermarket and the related loss in sales for existing supermarkets are modelled. The focus was put on food markets, as detailed data were available from a Germany-wide telephone survey of about 4000 households regarding their shopping transactions. This offered the opportunity to develop a comprehensive model for these transactions, whereas a broader view on local spending patterns would have meant a less detailed model with less robust data (for more detail, see Anders, 2014).

It has to be emphasized that RegioProjektCheck is not an assessment tool in the sense that it gives an overall assessment of a project and rates it as a ‘good’ or ‘poor’ project. At first it was attempted to present the results in the form of such an assessment, especially as this was also desired from practitioners. However, it soon became clear that such an overall normative assessment was not possible as this assessment depends on the overall situation in a municipality or region. For example, the same increase in traffic caused by a project will impact different communities differently. Therefore, it was decided that RegioProjektCheck will be an information tool which supports decision-makers by demonstrating and visualizing the impacts of planned projects, but that they will need to assess the modelling results themselves.

**Technical specifics of RegioProjektCheck**

When the project started, the type of tool to be developed had not been decided. It was known that the tool would be aimed at the early stages of planning in order to support decision-makers at the point when a project can still be changed and plans can still be adjusted. As this requires more detailed results, it was obvious that an online tool would not be suitable for the task, but whether the tool would become an Excel-based tool or use specific software was worked out during the project. Through consultation with practitioners the choice fell on a tool based in GIS software, as in many municipalities in Germany GIS software is used for planning. At the time the decision was made, no suitable open source GIS software existed. Therefore, the tool is based on ArcGIS, which is the most widely used GIS software by German municipalities, but also means that an understanding of the software is necessary in order to use it. RegioProjektCheck is realized via a set of toolboxes within ArcGIS. It offers different toolboxes for the different assessment areas, which can be used optionally in a modular system.

Information is entered through ArcGIS windows. Essential information to be entered includes the exact location and size of the project area as well as the planned and existing use. Further information depends on the type of project and the selected assessment area. Necessary information for residential areas is, for example, the number and type of dwellings, whereas for retail projects the size of the sales area needs to be specified. Additionally, some of the necessary information is automatically obtained by retrieving data from publicly available databases. For other data general values are provided, which can be changed according to the local situation as the users are able to modify
single parameters. By changing some data users can test variations of projects and different basic conditions.

Results can be exported into MS Excel so that they can be interpreted by people without any knowledge of GIS software. The output is produced separately for each assessment area. It includes an explanatory text for each assessment area, parameters used, maps, illustrations, graphs as well as the raw data. This means that either the provided graphs can be used or the results can be followed up and interpreted to produce additional graphs.

As discussed previously, there is a necessary compromise between the effort (time, work, money) and the level of detail or precision of results: more detailed results are linked to a high level of effort and complexity. One important objective in the development of RegioProjektCheck was to minimize the amount of data that need to be entered by the user, while still enabling results that are precise enough to inform planners meaningfully about the impacts of the project. Therefore, as much data as possible are drawn directly from diverse statistical databases, such as from the German Federal Bureau of Statistics, the statistics department of the Federal Employment Agency, etc. (Mayr & Brauckmann, 2013). This has the additional advantage that it is relatively easy to keep the data current. Many of these datasets are updated automatically when starting a new project calculation.

**An implementation test**

One of the central objectives of the project was to take into account from the beginning the transfer of the results and the implementation of the developed toolbox in practice. To design the instrument according to the needs of municipal planning actors, the toolbox was developed with the involvement of planners, politicians and other relevant actors in two case study regions. Furthermore, the development and its intermediate steps were discussed with an advisory board consisting of further relevant actors outside the case study regions. In addition, to improve the toolbox and its transfer an implementation test was undertaken. The two initial case studies were the district Landkreis Harburg and the district Rheinisch-Bergischer Kreis. Three further case study regions were selected to test the toolbox in order to improve its implementation and test the plausibility of the results.

In the two main case study regions, semi-structured expert interviews were conducted with municipal and district/regional planners as well as politicians. The interviews were undertaken in order to gain an understanding of the practitioners’ attitudes and perceptions towards the tool, but also to understand better the processes of municipal planning and regional cooperation and their relation to the implementation of the tool. Additionally, workshops were conducted in all case study regions to present the toolbox and its application and results. These workshops offered the opportunity for feedback from the attending planners, politicians and other stakeholders.

Research questions of the test implementation were: (1) to what extent are the two objectives of an integrated approach and the consideration of regional effects achieved and accepted within the municipalities?; (2) how are the results incorporated into informal and formal planning and decision structures?; and (3) are planning decision processes influenced through the tool?

**Specific local interests**

The interviews revealed that local interests are – not surprisingly – often focused on areas that are seen as central for the community. For instance, fiscal aspects are often
seen as a crucial factor, as they are decisive for the feasibility of a project. Yet, other areas were also mentioned as essential: in some municipalities the locational competition of supermarkets is of particular interest, in others the accessibility of certain destinations. A reason for the stated importance of specific topics may lie in the influence of political discussions on planning. It seemed that many planners already anticipated resistance against or approval of certain topics by the local politicians and assessed these topics accordingly as (not) relevant.

**Surprising results for familiar topics**

Apart from the belief that some assessment areas are more central for their community, planners were also interested in areas that were deemed as outside their own expertise and in areas which are too complex to assess easily otherwise. For some assessment areas, such as transport effects or accessibility, it was estimated that the impacts are well known and that there would be no surprises. Therefore, they were seen as less important within the tool, but it was still considered useful to be able to show some data on these topics. The practice run showed, however, that for some of the ‘less interesting’ areas the presented results often raised awareness of some aspects previously unknown. In other words, there were some ‘Aha!’ experiences when results were presented.

**(No) assessment of alternative locations**

The analyses of different potential locations as well as different design versions of a project help to identify advantages and disadvantages between the different possibilities. While the interviewees appreciate this function, some also stated that in a number of cases alternative locations are not assessed at all. This is, for example, the case when no alternative locations are available within the boundaries of the municipality or when the trigger for an assessment is a concrete project proposal with a suggested location, use and design. Nevertheless, the interviewees still saw the assessment through RegioProjektCheck in these cases as useful because the results could still support the communication of the decision for the project. On the other hand, the municipal costs and revenues would still be important to decision-makers. The interview partners stated that, potentially, poor fiscal results could lead to the abandonment of a project. However, they saw it as unlikely that poor results in other assessment areas would influence the decision in these cases. This shows again that some planners already anticipate certain responses of local politicians.

**Regional use of RegioProjektCheck?**

The possibility to assess regional impacts was seen as useful for certain topics that were already discussed at a regional level in the respective case study area, such as an inter-municipal retail strategy. The implementation test showed that, overall, an interest in the regional impacts or the use of RegioProjektCheck on an inter-municipal level is more likely to take place when topics are already discussed at a regional level and/or when regional coordination structures already exist.

**Use of RegioProjektCheck in informal settings**

The application of RegioProjektCheck in the case studies is mainly for informal conversations, such as discussions at the planning office or in preparatory (political)
working groups. A reason for this is that RegioProjektCheck is used at a stage of planning where ideas are still tested. Nevertheless, after the informal discussion, results will be fed into more formal decision-making processes, such as the city council or community participation.

Results as ‘objective communication support’

Planners welcome RegioProjektCheck because of the opportunity to expand their own analyses and assessments. They expect that they can use the toolbox to support their work and justify decisions through objective arguments. This includes a desire to interpret the results internally, before feeding them into the further process. The perception is that the results need to be assessed professionally before the integration into official processes and decisions. The objectivity or neutrality of the tool is seen as useful for the communication with politicians, the community and other relevant actors.

Discussion and review of RegioProjektCheck

Two of the main objectives of RegioProjektCheck were to support a more integrated approach towards impact assessment, incorporating fiscal, social and ecological impacts, and to encourage a regional or inter-municipal view within impact assessment. This has been achieved within the tool, as it includes fiscal, social and ecological assessment areas and effects on neighbouring communities or a larger region can be calculated.

The interviews and workshops also showed that RegioProjektCheck is able to achieve its objectives, although some of them may need some reinforcement. It does improve decision-making through more information in the early planning stages, and it also supports a more integrated approach towards the appraisal of planned developments. However, while the modular structure has the advantage of making a comprehensive assessment easier, it also gives the opportunity to concentrate on or ignore certain assessment areas. Thus, a more integrated approach would be further supported by emphasizing the advantage of a comprehensive assessment to users and pointing out that the integrated approach does not mean much more work.

The tool also makes an inter-municipal or regional assessment possible. The case study regions showed that this function is used for topic areas that are already discussed on a regional level. However, they also showed that on a local level there is generally not much interest in regional effects. It seems that the regional approach needs to be initiated and supported through other programmes as well and that RegioProjektCheck can act to perform a regional assessment but cannot initiate those regional discussions or considerations.

In the development of the tool, some topics that were planned to be included into RegioProjektCheck had to be omitted because of methodological difficulties. For example, it was planned to include an assessment of the impact on land values. This proved to be difficult to generalize and present in a simple manner, as projects may be perceived differently in different regions or municipalities. Another area that was excluded at the end of the project was a model for multiplier effects, calculating (indirect) impacts on jobs or consumption. Even though this model worked well, the practice tests in the case study regions showed that the results were confusing in the sense that they were not directly comparable with the other fiscal results. Due to the methodology, the results would show the highest possible effect over several years. Even if this was explained,
there was a perceived risk that the numbers would raise unreasonable expectations and therefore it was decided to leave the multiplier effects out of the tool.

So what are the advantages and disadvantages of RegioProjektCheck in comparison with other tools? The main differences of RegioProjektCheck in comparison with other tools are its broad scope of assessment areas (fiscal, ecological and social impacts), the broad scope of land uses that can be assessed (residential, industrial and retail) as well as its broad spatial scope (assessment of local and regional impacts). There is no other type of tool that offers a broad scope in all these areas. As this lack of broad scope in other tools was perceived as a shortcoming, this was the main objective for the toolbox. However, there are also other characteristics that are important for users. These have been mentioned above. Naturally, RegioProjektCheck could not fulfil all these characteristics, particularly because of the dilemma between the ease of use and precision of results. However, the project endeavoured to respond to most of the characteristics; to what extent this has been achieved is discussed below.

With regard to low installation effort and high user friendliness, RegioProjektCheck can be assessed as doing relatively well. The tool needs to be installed for personal use, but if ArcGIS is already installed the installation is relatively easy. The effort of data entry for RegioProjektCheck is low to medium, as some specific data need to be entered, but for many areas the relevant data are already stored within the tool. Furthermore, for the majority of the data general parameters have been suggested, so that the tool can still be used, even if some values are not known locally.

According to the level of data known about a project at the early stage in the planning process, and depending on how much of the data have been adapted to the local situation, the results of RegioProjektCheck are relatively precise. They are not as precise as for software tools where a high amount of locally specific data are entered and a long time is taken to calculate the effects, but they are more precise than the results of relatively general online tools. The necessary prior knowledge for RegioProjektCheck can be assessed as medium, because while no expert knowledge of algorithms or calculation methods is needed, some knowledge about local data, the project and the GIS software is necessary.

In summary, RegioProjektCheck is a tool that offers the opportunity to assess the impacts of a planned project in all three areas of sustainability for different land uses and on the local as well as the regional level and thus broadens the scope of impact assessment. It is not a tool that can be used by anyone without prior knowledge or a tool that delivers a playful introduction to the topic. If this is desired, online tools would

Table 2. Comparison of RegioProjektCheck with other impact analysis tools

| Tools                | Broad spatial scope | Broad scope of assessment areas and land uses | Low installation effort and high user friendliness | Low effort of data entry | High precision of results | Low prior knowledge |
|----------------------|---------------------|---------------------------------------------|---------------------------------------------------|--------------------------|---------------------------|---------------------|
| RegioProjektCheck    | ✓✓                  | ✓✓                                         | ✓                                                 | ✓                        | ✓                         | ✓✓                  |
| Online tools         | ✓✓                  | ✓✓                                         | ✓                                                 | ✓                        | ✓                         | ✓✓                  |
| Excel-based tools    | ✓✓                  | ✓✓                                         | ✓                                                 | ✓                        | ✓                         | ✓✓                  |
| Software tools       | ✓✓                  | ✓✓                                         |                                                   | ✓                        | ✓                         | ✓✓                  |

Note: ✓✓ = applicable; ✓ = partly applicable; = not applicable.
Source: Authors’ own illustration.
be a better choice. RegioProjektCheck also does not deliver very precise results. Yet, it delivers information on the impacts of different locations or versions of a project, thus giving the opportunity to decide about the ‘where’ and ‘how’ in the early stages of a project, when this can still be influenced. When more detailed and precise results are desired, software tools might be the better option. Table 2 presents RegioProjektCheck in comparison to the other types of impact analysis tools that have been discussed above.

Conclusions and outlook
The RegioProjektCheck project developed an impact assessment tool that offers a broad scope of assessment areas, broad scope of land uses as well as a broad spatial scope. As for all impact assessment tools, a decision had to be made between the complexity/precision of results and the ease of use/low effort. Therefore, RegioProjektCheck is not a tool that can be used by anyone or which delivers a playful introduction to the topic. It is a tool that delivers relatively precise information with a medium effort in work and time, and it offers the opportunity to assess different land uses, different assessment areas and local as well as regional effects. Therefore, for more precise results, software tools are a more fitting choice, but will also take longer and need more data.

The results of the first test application of RegioProjektCheck show that it supports a more integrated approach towards the appraisal of planned developments with its different assessment areas. Nevertheless, it is still possible for users to concentrate on certain assessment areas and ignore others. Yet, it could be seen that an integrated assessment of all areas is useful as unexpected results can change the assessment of a project. Therefore, users should be encouraged to calculate all assessment areas, rather than only some selected ones. To support this overall assessment will be one of the next steps in the further development.

Regarding the regional assessment, it appears that the discussion of regional topics and effects needs to be supported and strengthened through other measures and support structures. While the case study areas were interested in the regional assessments, this was generally only the case for topics that were already discussed on the regional level. RegioProjektCheck does not seem to be able to initiate those regional discussions or considerations as most local planners are focussed on their municipal area. Therefore, regional awareness needs to be initiated otherwise.

Regarding the process of the project, the cooperation with practitioners and the support of the advisory board were fruitful. For example, some topics were included because of discussions with practitioners, such as the assessment area of the locational competition of supermarkets. To improve the usability of such a tool and to ensure knowledge transfer, it is crucial to include potential users in the development. This provides the opportunity to move from the acceptance paradigm towards the participation paradigm and improves the quality and content of the tool. Similarly, a practice run with supporting implementation research also improves the tool clearly.

In order to distribute the tool widely and to provide the option to anyone interested to use the tool, different ways of using RegioProjektCheck and its results have been made possible. Firstly, it can be downloaded for free from the project website. A handbook explains technical and conceptual points and guides the user through the installation and application of the toolbox. Additionally, it is possible to receive support from the project partners. For interested users with knowledge in programming, the toolbox
has also been uploaded on the hosting service ‘github’. This offers the opportunity to advance RegioProjektCheck technically and conceptually. For organizations that do not have the resources, e.g. time, knowledge, GIS software, it is also possible to commission a project partner or other consultants offering this service with an expertise.

Naturally, improvements and modifications of the tool will be necessary as well as further research on its implementation. It will be necessary to evaluate the further use of RegioProjektCheck in other regions in order to understand implementation issues, but also how it is used. This can be followed up through contacting people who have downloaded the tool. Furthermore, it will need to be assessed whether people take up the opportunity to further develop the tool via github. Therefore time will tell how successful the tool is in its approach of supporting an integrated approach towards impact assessment. In any case the tool can be seen as a useful contribution to the evolution of impact assessment tools.

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