FROM SOFT TO HARD: A TWO ROUND WORKSHOP FORMAT TO DEVELOP CUSTOM TAILORED INDICATORS FOR SKETCH PLANNING SUPPORT SYSTEMS

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ABSTRACT

Planning support systems (PSS) have the goal to support urban planners with scenario analysis in early planning stages. They use simple simulation indicators that can roughly indicate how well a scenario matches with the objectives of a number of project stakeholders. Identifying such suitable indicators a-priori however is difficult because of the large range of objectives that might or might not be of importance during a certain planning stage. To allow for a better integration of PSSs with the needs of a specific planning exercise, we developed a method to develop custom tailored indicators with accompanying spatial variables. The core of the method consists of two consecutive workshops, that allow urban planners to develop, refine, and test indicators and spatial variables from a project stakeholder perspective. The developed indicators and spatial variables can then be used to custom tailor a PSS solution to specifically support the needs of the current planning stage. This paper describes the method and an exemplary application of the method during an urban planning project.

Keywords: sketch planning, urban planning, scenario analysis, simulation indicators, stakeholder objectives

1. INTRODUCTION

Planning support systems (PSS) are developed to help urban planners in the early idea generation phase for the transformation of an urban area. These tools usually allow for the simple modeling of scenarios and for the quick and easy evaluation of a certain modeled scenario. To support the evaluation of these scenarios, they also often provide simple indicators that can roughly indicate how well a scenario matches with the objectives of a number of project stakeholders. Defining such suitable indicators however is intrinsically difficult because of the large range of objectives that might or might not be of importance during a certain urban planning effort. It is hardly possible for developers of PSSs to understand all required indicators a-priori at time of programming. Additionally, developers can hardly define all possible spatial features that planners need or want to change during a specific planning exercise to develop different scenario variations. Because of these reasons the existing PSS tools hardly ever provide adequate scenario evaluation possibilities and, hence, their application in practical planning exercises has, by large, be very limited (Brommelstroet & Schrijnen, 2010).

To allow for a better integration of PSS tools with the needs of a specific planning exercise, we developed a method to develop custom tailored indicators and planning parameters for a specific phase of a distinct urban planning project. The core of the method consists of two consecutive workshops. These workshops allow urban planners involved in a specific planning effort to develop, refine, and test indicators and planning parameters based on the objectives of the most important stakeholders of the project. The developed indicators and planning parameters can then be used to custom tailor a sketch planning solution. Solutions developed in this way allow for the quick and easy generation of a large number of plan alternatives by changing the parameter values and the evaluation of these alternatives using the indicators. This report describes the method and an exemplary application of the method during an urban planning project.

2. PLANNING SUPPORT SYSTEMS

Planning support systems (PSS) are computer-based programs that systematically introduce relevant (spatial) information to support a specific planning decision making process (Brommelstroet & Schrijnen, 2010). In this sense, PSSs tend to be loose combination of different hardware, software, and process supporting tools (Geertman & Stillwell, 2004, Brommelstroet & Schrijnen, 2010) to

- acquire and management spatial data,
- represent this data using geographical objects and spatial relations,
- provide spatial analysis algorithms and optimization possibilities, and
- create map-based outputs of the calculation results of these algorithms.

For instance, a specific planning action within a planning department can use a PSS system that combines a transportation model, a cost-benefit analysis technique, several qualitative and visual analysis tools, and a geographical information system to support a traffic routing and planning task.

Studies show that the implementations of PSS in daily planning practice has been lagging and continues to lag, behind the expectations. Particularly in early planning phase such as visioning, storytelling, sketching and developing strategies the existing PSS have failed to support planners (Brommelstroet & Schrijnen, 2010). This is often related to the lack of communication between the PSS developers that in general focus on technical issues instead of on the potential PSS users (Brommelstroet & Schrijnen, 2010). The tools do not readily fit the changing needs of the planning profession since they are too generic, complex and incompatible with most of planning task, oriented towards technology rather than problems (Geertman & Stillwell, 2004). They are also incompatible with less formal and unstructured information needs and are focused to strict technical rationality (Brommelstroet & Schrijnen, 2010). To overcome, this problem Brommerlstroet and Schrijnen (2010) have suggested a closer collaboration between the developers of PSSs and urban planners. This paper presents, a method to allow for such a closer collaboration that allows for the custom tailored development of PSS tools. Before we introduce the method, the paper first briefly describes the research method we applied to develop the method.

3. DEVELOPMENT APPROACH

To develop the here presented method for establishing custom tailored parameters and indicators for the development of PSSs, we applied a bottom-up research effort. More specifically, we use the ethnographic-action research cycle as described in Hartmann et al. (2009). The approach enables researchers to observe the behavior of insiders and activities within a culture, while it also allows them to be become insider by being involved in the activities that take place within this culture. In our situation, we worked closely together with a number of urban planners at municipalities and with four urban planning consultancy companies. Together with these practitioners we iteratively develop the method and implemented it on real-life project for calibration and validation. This paper describes the final method as developed of today in the next section and provides an illustrative example of its calibration and validation on a project in the following section.

4. WORKSHOP FORMAT

The proposed method relies mainly on two consecutive workshops with planners and some of the most important stakeholders. As an input for the overall process and a starting point for the first workshop, a detailed stakeholder analysis of all important parties involved in the project and their objectives needs to be conducted. The first workshop then starts with a short summary of the stakeholder analysis results. This summary should acknowledge the most important project stakeholders and their objectives. Based on this summary the first collaborative task in the workshop is it then to identify the four to five most important stakeholder objectives that can be feasibly addressed in the current state of the planning activities. The chosen objectives form the basis for the indicators to be developed with the method. It is important to take great care during the discussions in this step to (a) prioritize the most important objectives that (b) can be addressed in the current stage of the planning activities.

After the identification of the main objectives, the method proposes a series of sessions applying adequate brainstorming techniques to jointly identify the main drivers behind the identified objectives. While brainstorming the participants should try to identify ways of how to plan for a satisfactory implementation of each of the objectives in an urban plan. After a long list of possibilities to implement the objectives has been identified, in a next step, the method proposes that the workshop participants prioritize the most important drivers from the list of possibilities to achieve the objectives. Based on the prioritized drivers, the final step in the first workshop is then a sketch planning exercises, during which the participants sketch possible physical planning scenarios to realize the objectives using a previously printed out map of the area to be developed.

After the workshop the identified objectives can be used to develop a first set of indicators. To this end, the prioritized drivers together with the sketch plans of the workshop participants can be transferred into a first set of mathematical relations between possible spatial variations indicated in the sketch plans and the prioritized drivers. In this way, a first set of indicators, planning parameters, and formulas to calculate indicator values from the parameters can be developed. During this step generally accepted simulation and forecasting techniques should be used that need to be identified through an in depth literature study. During this step it is also important to explore the possibility to appropriate previously developed indicator calculation methods.

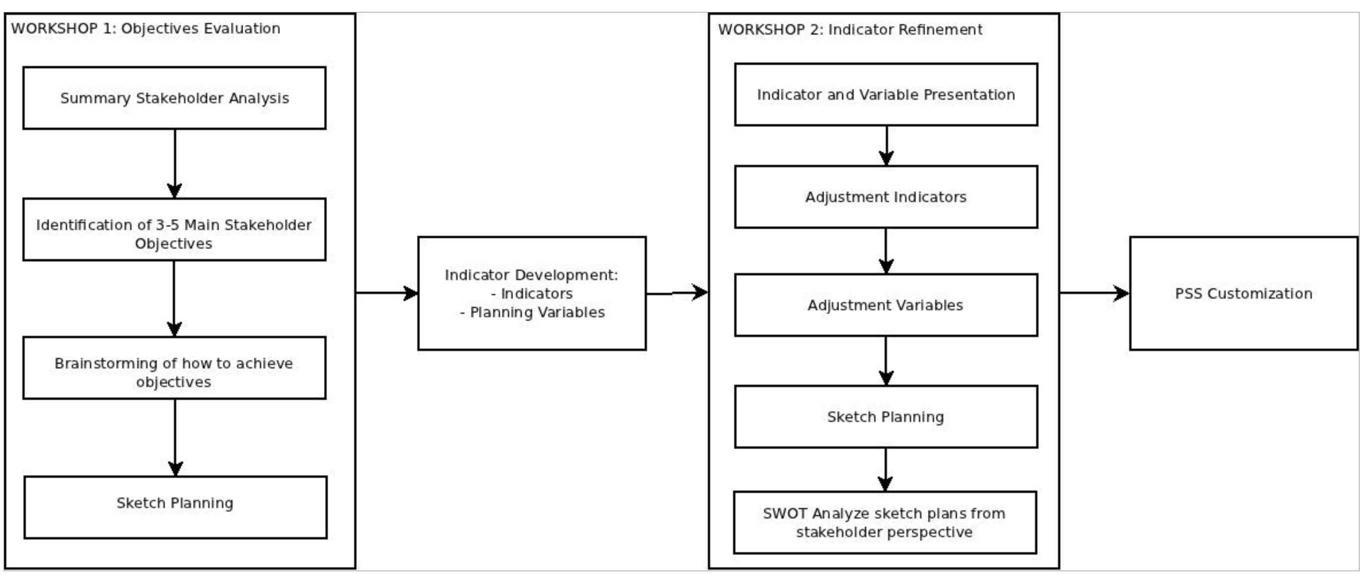


Figure 1: The dual workshop format to develop custom tailored sketch planning indicators and parameters

The goal of the second workshop is it to discuss the developed parameters and indicators. To this end, the workshop presents the developed parameters and indicators to the participants and discusses their value to support sketch planning exercises for the project in its current stage. During this workshop all suggestions of the participants should be traced thoroughly and later used to adjust the parameters. Because the discussion of the parameters often triggers useful planning thoughts, the participants should also conduct another manual sketch planning exercise on a previously prepared map of the area. As a last validation of the usefulness of the developed parameters and indicators, the two best solutions of this sketch planning exercise should then be chosen and discussed. For this discussion the proposed method suggest to use a formal strength, weakness, opportunity, and threat (SWOT) analysis of the two plans. However, to understand whether the parameters and indicators match the current stakeholder context that formed the basis for the development of the indicators so far, this SWOT analysis should be carried out from the perspective of the main stakeholder identified during the first workshop.

5. ILLUSTRATIVE IMPLEMENTATION

5.1 The two workshops

We implemented the workshop format together with the two municipalities of Winterswijk, The Netherlands and Vreden, Germany in their efforts to develop a cross-border joint industry terrain. After conducting a detailed stakeholder analysis of the situation concerning the cross-border terrain, we organized the first workshop together with two representatives from the municipality of Vreden and four representatives from the municipality of Winterswijk.

Following the presented method we started the workshop with summarizing the results of the stakeholder analysis. From the results it became apparent that the most important stakeholders of the project had the objectives to

1. establish a good traffic connection to the industry terrain,
2. develop the cross-border industry terrain as energetically sustainable as possible,
3. allow for cross-border knowledge exchange between companies in Germany and the Netherlands, and
4. open up new markets in the Netherlands, Germany, and the world for companies on both sides of the border.

Based on these four main objectives, we then conducted a brainstorming session with the workshop participants. In this workshop session, we asked everybody to come up with ways of how to satisfy the previously identified objectives. We organized this brainstorming session by grouping the participants into teams of two and then give each team 5 minutes to develop possibilities for each of the objectives. After these five minutes, each team moved on to the next objective to add to the ideas of the previous groups. We finished the brainstorming exercise, after each team had added their idea for each of the stakeholder objectives. In this way, we established a long list of possibilities to satisfy each of the main objectives.

To narrow down the developed possibilities we then jointly prioritized the five most important possibilities for each of the four objectives. The prioritized final possibilities that were identified during the workshop to satisfy the objectives are summarized in Table 1.

As a last step in this workshop, we then asked groups of two planners to jointly sketch a possible physical solution for each of the objectives using the developed prioritized possibilities. Again we conducted this exercise in teams of two people. It was the task of each team to provide a sketch plan that maximizes one of the main objectives. After each team had developed a solution, we then asked each of the teams to sketch a solution for a second objective. To this end, we asked the teams to try to come up with a solution that is as different as possible from the previous solution. In the end, eight different sketch plans were developed, which provided two possible physical solutions for each of the objectives.

Table 1: Brainstorming outcomes during the first workshop: Possibilities to optimize indicators

Traffic	**Market Possibilities**	**Sustainability**	**Knowledge Exchange**
Connection between A31 and N18	Use European Union Laws	Park management	Cross-border exchange
Logistic Center	Chinese Market	Sustainable Materials	International consultancies
Digital Highway	Park Management	Sun Energy	Realize competencies on both sides of the border
	Markets as Products	Energetic input-output balance	Best of both worlds
	Who is investing and who is benefiting?	Waste management	Entry point to the terrain

After this workshop, we started developing indicators and planning parameters from the collected information of the first workshop. At the outset of this development process, we decided to not consider the traffic connection objective as an indicator for the final sketch planning solution. The main reason was that the planning of a traffic connection is a regional problem, while the other planning problems are related to a problem that only requires a planning exercise on a much more local scale. To understand how to best realize the objectives of knowledge exchange, sustainability, and market possibilities, it is important to plan the functions on the industry terrain itself. To plan for the traffic connection, planners would need to account for the greater surrounding area.

In a first development step, we observed the solutions that were depicted in the sketch plan to identify the possible planning parameters. From this analysis it became obvious that all sketch plans basically depicted buildings and their functions. Hence, we decided to use these two parameters as the underlying planning parameters for the sketch planning tool. We then used the developed sketch plans to identify a first set of possible functions for companies that could settle on the to be planned industry terrain. These functions included: Machinery, transport equipment and machinery, metaling industries, construction and products, printing, chemicals, and leather and products.

In a next step, we then developed the indicators and their calculation algorithms. To this end, we analyzed the different objectives in line with the prioritized possibilities to achieve them (Table 1). Unfortunately, the prioritized possibilities developed in this workshop did not yet lend us a good support to understand how to best develop quantitative indicators that describe the objectives well. Hence, we decided to only take the high level objectives as a basis. We then developed indicators that could calculate the different values for the market possibilities and sustainability using generally established economic industry indexes according to different industry types. We also used a matrix of economic indexes for knowledge exchange between different industry types to develop the indicator for the knowledge exchange. All in all, we developed four indicators: sustainability, Dutch market possibilities, German market possibilities, world market possibilities, and knowledge exchange.

After finalizing this first parameter and indicator development, we conducted the second workshop during which we fed back and discussed the developed indicators with the planners from the two municipalities. We first evaluated the different indicators we developed. During this first part of the workshop, the participants did not suggest any changes and it was decided to use the initially developed indicator calculations. In a next step, we then discussed the different planning parameters with the workshop participants in three breakout groups. During the break-out sessions, workshop participants envisioned a number of additional possible industry functions that could be located on the terrain.

We then again divided the workshop participants in groups of two to develop possible sketch plans for physical configurations of the terrain that try to balance and maximize the different objectives with each

other. We chose the two best plans for a consecutive analysis of the strengths, weaknesses, opportunities, and threats (SWOT) of the two best solutions. This SWOT analysis was again done in three breakout groups, whereby each group had the assignment to conduct the SWOT analysis from the viewpoint of an important stakeholder. This final sketch planning and SWOT analysis provided us with a good "reality check" about the usefulness of the developed parameters and indicators.
After this workshop, we then implemented a custom tailored PSS tool to allow planners to sketch buildings and change the functions of these buildings according to the list of identified industry functions. We also implemented the developed algorithms to allow for the easy evaluation of the different scenarios. The final PSS tool is described in the next section.

5.2 The Developed Sketch Planning Solution

As described in the research method section, we used the inputs from the two workshops to develop a PSS tool. To this end, we used the Adobe flash action script programming language. The planning area covered by this custom tailored application comprises the cross border region extending from the existing industrial terrain Gaxel in Vreden (Figure 1).

Figure 1: The overall area represented in the PSS to support sketch planning exercises.

5.3 Planning Parameters

Using the map of this area, we implemented functionality allowing users to create new companies and edit existing companies by allocating the by the workshop participants suggested industry types to buildings:

1. Machinery
2. Transport equipment and machinery
3. Metaling industries
4. Construction and products
5. Printing
6. Chemicals
7. Leather and products
8. Data center
9. Farm and food

10. Electronic / electric industrial equipment
11. Medical services

Additionally, to the industry type users can also allocate an energy balance to companies describing the required input energy of the building and possibly generated output energy. Companies can then be assigned to buildings on the area. Each building can host a number of different companies.

5.4 Indicators

Using the above described input parameters, the developed PSS tool calculates the following indicators:

1. *Sustainability*

The PSS tool calculates sustainability using each company's energy balance. The balance of each company is then simply added to the overall sustainability indicator for the whole area. Additionally, the sketch planning tool provides an overlay functions visualizing the energy balance for each of the buildings in the planning area (Figure 2).

Figure 2: Map overlay showing the energy balance per building.

2. *Knowledge exchange*

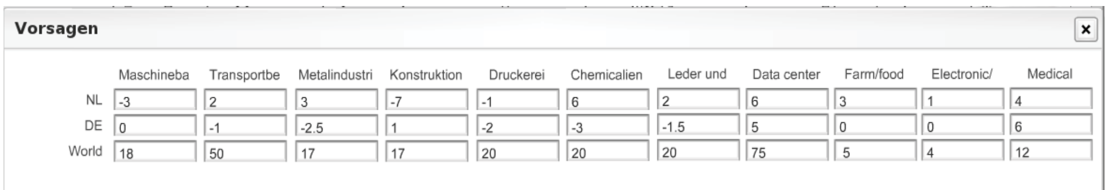
To calculate the possibilities for knowledge exchange between the companies allocated in the area, the sketch planning tool uses a knowledge exchange matrix (Figure 3) that we derived from a number of scientific publications about industry cluster building (Blin & Cohen 1977, Liyanage 1995, OECD 1999, Steinle & Schiele 2002). Using the values of the matrix the tool then adds up the knowledge exchange possibilities of each company in the area with all the others companies into the final knowledge exchange indicator for the whole area.

	Maschinebau	Transportbedarf und Masc	Metalindustrie	Konstruktion und Produkte	Druckerei	Chemicalien	Leder und Lederprodukter	Data center	Farm/food	Electronic/ electric industri	Medical services
Maschinebau		300	350	275	610	610	610	610	610	0	610
Transportbedarf und	300		350	300	610	610	610	610	610	300	610
Metalindustrie	350	350		350	610	610	610	610	610	350	610
Konstruktion und	275	300	350		610	590	590	610	610	275	610
Druckerei	610	610	610	610		590	590	590	590	610	590
Chemicalien	610	610	610	610	590		450	490	565	610	490
Leder und Lederprodukten	610	610	610	610	590	450		330	335	610	330
Data center	610	610	610	610	590	490	330		335	6	0
Farm/food	610	610	610	610	590	565	335	335		610	335
Electronic/ electric	0	300	350	275	610	610	610	610	610		610
Medical services	610	610	610	610	590	490	330	0	335	610	

Figure 3: Knowledge exchange matrix between different company types.

3. Market possibilities

The sketch planning tool splits up the different indicators for possible markets that can be reached by industry in the area according to the German, the Dutch, and the world market. For each market the tool then uses economic key indicators derived from industry studies from a number of Dutch, German, and European financial institutions and consultancy firms (Commerzbank 2011, Deutsche Bank 2011, ING 2009, Deloitte 2011, European Union 2011) for the expected development for each of these markets to derive a matrix describing the possibilities for each industry. The final market indicators simply adds up the expected market possibilities for each company allocated in the area.



	Maschineba	Transportbe	Metalindustri	Konstruktion	Druckerei	Chemicalien	Leder und	Data center	Farm/food	Electronic/	Medical
NL	-3	2	3	-7	-1	6	2	6	3	1	4
DE	0	-1	-2.5	1	-2	-3	-1.5	5	0	0	6
World	18	50	17	17	20	20	20	75	5	4	12

Figure 4: Matrix for German, Dutch, and world market predictions per industry type.

After the calculations of the indicators, they are displayed in percentage of difference from the as-is condition of the current industrial terrain in Gaxel. The following figure (Figure 4) illustrates an example for the outputs of a calculation for the above described indicators.

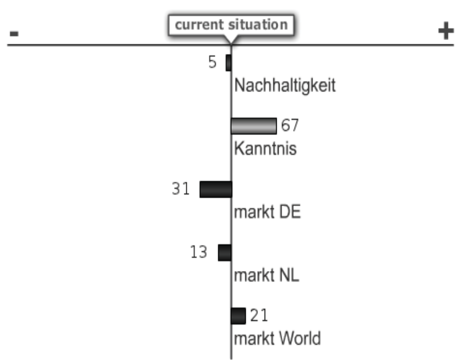


Figure 5: Example indicator calculation.

6. EVALUATION OF THE SOLUTION

After the planners from both municipalities had used the sketch planning tools without direct support from the development and workshop moderation team, we arranged a feedback and discussion meeting. During this meeting we ask the planners to critically evaluate the workshop format and the developed sketch planning tool. The outcomes from this evaluation meeting can be best described by the following points:

1. The participants agreed that the two workshops and the developed sketch planning tool were very helpful to get from the very abstract initial planning process for municipal projects to a clear problem description.

2. The participants also agreed that the possibilities to develop different scenarios and to clearly be able to test these scenarios helped to further their understanding about the planning possibilities for the project.
3. The focus on different stakeholder objectives based on a recently conducted stakeholder analysis helped to understand the important objectives for a specific planning stage. In so far, the workshops helped to understand what problems are important to address. This helped to focus the planning efforts as it is not possible to account for all objectives and stakeholder at a certain time.
4. One disadvantage of the developed sketch planning is that the calculation of the indicators was not easily traceable during the analysis of different scenario alternatives. This points to the necessity to use the sketch planning tool within workshops that are moderated by persons with a detailed knowledge about the different developed indicator calculations.
5. Another problem mentioned was that while the workshops and the development of the indicators were very helpful to make steps towards a better vision for the physical configuration of the industry terrain, the workshop effort was running in parallel and, hence, detached from the existing municipal planning processes. This points towards the necessity to integrate the development of sketch planning solutions from stakeholder objectives better with the existing planning processes.
6. A final problem that was raised and discussed was that the success of developing meaningful sketch planning applications using the two workshop format heavily depends on the accurate definition of the important stakeholders upfront.

7. CONCLUSION

In this report, we described a process to develop parameters and evaluation indicators for the development of custom tailored sketch planning tools for urban planning projects. The process allows for the custom tailored development of such tools accounting explicitly for the current stakeholder environment on a specific project. From this stakeholder context the presented process then prescribes to develop the planning parameters and indicators within two consecutive workshops.

An application of the presented method on a case projects showed the general applicability of the two workshop format. One problem, that could not be addressed was, however, to clearly derive different categories that can be used for the translation of the “soft” stakeholder objectives to the “hard” numerically calculated indicators. A brainstorming exercise with the goal to identify prioritized possibilities to fulfill soft objectives during the test case, did not result in outcomes that helped to develop the numerical calculation of indicators. This might have hindered the participants afterwards to easily understand the developed indicator calculations. Future development efforts need to tackle this problem by linking the indicator calculations closer to the suggested possibilities to address stakeholder objectives. It also seems as if the use of the developed sketch planning tool is most beneficial in a scenario planning workshop that is supported by a moderator with knowledge about the used indicator calculation methods. Another problem that surfaced during the implementation was the detachment of the workshops from the ongoing municipal processes. Future development efforts of this workshop format, hence, also need to develop ways to make the link between possible solutions for soft objectives clearer and integrate the proposed format more closely in municipal planning processes.

All in all, the test case showed that it was possible to develop a sketch planning tool that allowed planners to run scenario alternatives and to come to a better understanding of the planning problem at hand. The final feedback session with the participants of the test run of the described process showed an overall value of the proposed approach beyond developing the sketch planning tool itself. The planners that participated in the two workshops agreed that this approach had helped them to come to a much clearer picture about the project, even without using the sketch planning application.

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