StrateGis 3DSS
Collaborative 3D decision support for urban development

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ABSTRACT

Urban development projects can be complex, involving many stakeholders and experts. To support communication, mutual understanding and to avoid sub-optimal decision making, Strategis has developed a collaborative working method which is highly facilitated by a Multi-dimensional decision support tool. This paper focuses on this multi-dimensional decision support system (DSS).
The approach is based upon the powerful combination of a 3D geometry based design model Google Sketchup™ and propriety software plugins incorporating semantic annotations of geometry, calculation models and databases. The system's is user friendly and very intuitive because it is based on simple dragging & dropping of spatial objects, such as buildings and infrastructure, into a 3d environment. The spatial impacts are determined automatically from a strong financial point of view and gradually evolving into a total impact assessment system for sustainability, following the People, Planet, Profit approach.

AUTHOR KEYWORDS

Urban development, land planning, real estate development, interactive 3D drawing & assessment.

INTRODUCTION

Urban Development is becoming increasingly complex. Partly because of the intrinsic complexity of urban areas, but also because of the numerous stakeholders involved, all with their specific interests (Mayer 2005). New and changing legislation further enhances complexity.
The shear complexity of urban development assignments contributes to the delay (or worse) of projects, lack of public support en sub-optimal end results. To put it in other terms, the value creation is far from optimal; resulting in either to expensive projects or sub-standard quality.

One of the most (if not the most) important element in the decision making process is the financial impact of a project on the stakeholders involved. Financial modeling for urban- and real estate development however can be extremely non-transparent and complicated. Financial modeling is mostly a back-office affair, and is often performed in an iterative process. Financial assessments are therefore static and almost by definition outdated.
There are a number of disadvantages to this way of working. Firstly, decision making takes a lot of time, since after each change of the plan the financial modelers have to redo their work. Secondly, it is a non-transparent way of working, which favors the stakeholders with more knowledge, resources or better negotiating skills (a look at the "Quote 500 list" illustrates this). A third disadvantage is that it isn't very communicative because the lacking relationship with the spatial impacts.

To cope with the problems described above, several approaches are possible, ranging from procesmanagement tools to monodisciplinary substantive modeling (Schevers 2004). Earlier research (Mayer 2005, Seijdel 2006) has shown the potential of combining substantive modeling with process management principles. Other ingredients for successful DSS are interactive and visually appealing interfaces (Dullemond, 2007), degree of integration, transparency, flexibility, speed, communication and authority (Geurt and Joldersma, 2001).

Building on these criteria, the StrateGis approach has been developed. With this approach, urban (re)development plans can be drawn up interactively, together with all the stakeholders. The financial impacts for each stakeholder are calculated instantaneously. It is a commercial continuation of a line of several geographical information systems (GIS), 3D-models and DSS co-developed by TNO Delft until 2006. The latest development has been a shift from traditional GIS-based models to a programmable 3D platform based on Google Sketchup™, resulting in what best can be described as an interactive 3D GIS environment or 3D decision support system (3DSS).

ABOUT THE STRATEGIS APPROACH

The StrateGis approach in its most recent manifestation is a mixture of process elements, such as stakeholder interviews and substantive back-office model preparation, culminating in a number of interactive design sessions. A number of activities can be distinguished:

Goal definition and scoping
Using interviews with the relevant project partners, the underlying goals, scope and constraints of an assignment are determined. The nature of an assignment can vary heavily: from a creative brainstorm with lots of freedom and little constraints to meticulous design process with formal constraints, including political sensitivities. The design of both the model and process are adapted for each specific situation.

3D model with semantic annotations
Each urban development plan starts from the present situation, influencing the (re)development possibilities. For example acquiring existing real estate, contaminated soil can influence the costs heavily. Therefore the StrateGis approach starts with a 3D-model of the area, in which all objects of interests such as buildings, roads and green areas are annotated with the relevant information such as financial and environmental data (Figure 1)

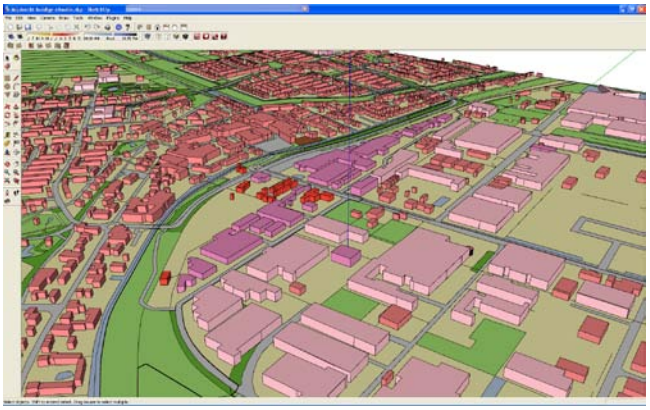

Figure 1 screenshot of the existing situation

In the preparatory phase, specialist and substantive experts (e.g. financial experts) are required to validate, and if needed supplement, the underlying calculation models and databases. If more then one organization is involved, this exercise is repeated for each of them. Depending on the type of process, the calculation models and databases have to be more or less representative, complete and accurate.
The StrateGis 3DSS comes with a large database with hundreds of pre-defined spatial objects and default calculation models for land- and real estate planning.

HOW THE APPROACH IS EXECUTED

The StrateGis approach is based on interactive sessions. Depending on the goal of the assignment, these may have a different setup. The basic principle of the interactive sessions is ‘drag & drop’, meaning that pre-defined objects can be dragged from an object library to the 3D-model. A second way to define object is by using a parametric object designer. Each object has properties which can be edited using a User Interface. This enables users to demolish Existing objects, or to change properties of new objects.

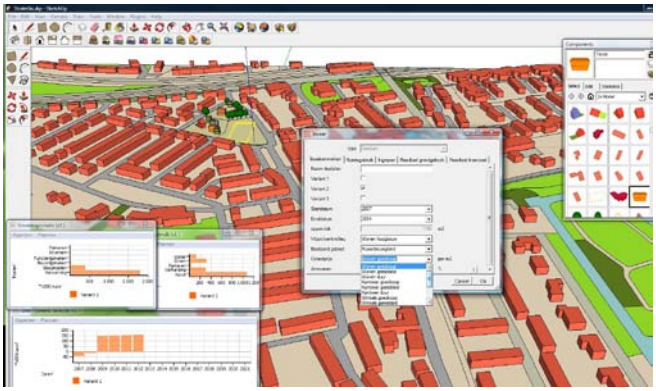

Figure 2 Interventions in the 3D-model result in recalculation of the impacts, which are directly displayed in the charts

An ideal hardware configuration consists of a powerful workstation PC, linked to a dual screen setup: one screen for the 3D-model and another for the result graphs. In some cases an electronic pen or an air mouse can be used for direct interaction with the screen. Group size ideally varies between 6 and 12 persons, with a maximum of 15.

Below a typical process design for a municipal development project is described.

0. Preparation: goal definition & scoping (interviews), construction of 3D base model and fine tuning.
1. Test session with experts. In these sessions the model is tested and validated, so that the persons involved get trust in the approach and the model. No real decisions are made in this session. The result is a validated model, accepted by the users.
2. Divergent sessions. Typically these are interactive ‘game like’ sessions to explore the possibilities, without to much consideration for constraints. These sessions result in multiple plans, preferably with a limited number of preferred plans. Plans consist of a spatial 3D-model, the corresponding financial report and a supporting text, reflecting the vision and rationale behind the plan. Up to 15 different plans can be designed in a single session.
3. Convergent sessions. In these sessions the preferred plans are interactively optimized further and screened with regards to other then financial constraints, such as legislation, public support and environmental issues. The MEDIA-model

described in the position paper by Van Bueren (2007) is used for this purpose. Ideally the end result is a financially and otherwise feasible plan, which can count on support from all the stakeholders involved. This plan can be the basis for political decision making as well as the assignment (program of requirements) for an architect.

Some additional remarks:

- During the entire process the impacts of decisions on key indicators such as project result, floor space index (FSI) and parking spaces, can be compared to the impacts of default urban typologies.
- The 3DSS is also suitable for multiple projects, in which case it can be used for consolidation or showing how profitable projects can finance unprofitable ones.
- In addition to the role as a DSS, the model can also be used to monitor the financial status of a project during the later stages (design and building).
- The DSS works with alternatives design solutions forcing stakeholders to think in alternatives and consequently results in a better exploration of the solution space.

INSIGHTS

The application of visually attractive 3D-models in combination with calculation models and databases has proven to be an effective means of supporting urban development processes.

Models such as the StrategGis 3DSS can help in managing complex urban development processes by: making the relevant information accessible through a user friendly 3D-interface; facilitating the rapid development of plans and scenario's and providing instant financial and other assessment of these plans and scenario's.

Some care is needed with regard to the application of the model. It is by no means a replacement of the traditional urban planner, architect or real estate financial expert. It is a tool which supports all these experts to work together and to link their expertise to the dynamics of decision making and negotiating processes.

It is our and others experience that by using tools such as these, decision making can be speeded up, public support can be enhanced and the quality of plans can be increased.

The simultaneous development of an intervenient decision support tool and a gaming tool has advantages. New features, software or scenario's can be introduced in the low-risk environment of a simulation game. On the other hand, experiences from applying the approach in actual urban development processes can be used to improve the gaming tool or widen its scope.

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AUTHOR INFORMATION

Anne Dullemond (MCD) and Robin Seijdel (corresponding author robin.seijdel@strategis.nl) are co-founders of the StrateGis Groep in Voorburg. Hans Schevers (PhD) is partner in this company.

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MORE INFORMATION ABOUT THE GAME

1. See www.strategis.nl
2. A demo movie is available at: http://www.strategis.nl