Decision-Making on Olympic Urban Development
A multi-actor decision support tool

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Abstract: Subject of study is the possible organisation of the Olympic Games of 2028 in the Netherlands, as seen from an urban development viewpoint. The project focuses on the decision-making process in the initiative phase. Aim of the project is the development of a decision support tool for the complex, inter-disciplinary decision-making process which should result in an optimum interorganisational design. The methodology used to find the optimum choice is the combination of sub-solutions. Preference Measurement modelling based on a multi-criteria decision analysis is the technique employed. The group decision is a choice out of a number of Olympic urban development combinations, which is made in such a way that the preferred combination is the 'best' among the possible candidates for all relevant stakeholders.

1. INTRODUCTION

1.1 Problem Setting

The ongoing political discussions about the possibility of the future organisation of the Olympic Summer Games in the Netherlands, given the 'success' of the 2004 Athens Olympics, eventually resulted in an investigation proposal by the Dutch Olympic Committee (NOC*NSF) in March 2005. The most important conclusion was the announcement of 2028 as the most likely earliest possible year for organising the Dutch Olympics. This was underlined by several arguments.

Jos P. van Leeuwen and Harry J.P. Timmermans (eds.), Innovations in Design & Decision Support Systems in Architecture and Urban Planning, 251-262.

This paper describes the development of a decision support model for the design preparation of the Olympic urban facilities. The project's main question was as follows: "In what way can the complex decision-making process of the 2028 Dutch Olympic urban development be designed, such that it supports the stakeholders of the Olympic urban development project."

We will first clarify the problem with the use of three fields of expertise in which the project can be placed.

1.2 Integrated Urban Development

Urban development processes are no longer characterised by an unambiguous course. Changing social demands and needs necessitate adjustments to the built environment and spatial composition. The adjustments of urban areas refer to restructuring, renewal, transformation, and replacement of functions (Bruil, 2004). Consequently, Integrated Urban Development has become one of the focus points of our department.

Through urban development, essential shifts emerge in future economic, spatial, and social-cultural structures. More and more, urban managers are confronted with tuning and directing on different levels, development phases, policy sectors, and fields of expertise. Furthermore, tuning and directing often take place in complex decision-making processes in interorganisational networks. The current and future urban redevelopment tasks require a steering condition which unites different sorts of knowledge, insights, and skills (Bruil, 2004). It is this managerial context in which we can place the project's problem.

1.3 Olympic Games

2028. This seems lacking in ambition, but for the author this target only states the efforts necessary for a successful Dutch Olympic Games.

First of all there is not one universally suitable 'Olympic urban development product'. Studies made at different former and future Olympic urban developments show that the quantitative and qualitative aspects of Olympic facilities and locations have a wide variety. The product or development task is therefore complex. Sport stadiums for example can be newly built or renovated for the Olympic occasion alone. Then there is the post-Olympic usage of these buildings, the infrastructural and social-economic impact, and the best possible allocation of the Olympic facilities.

The most important requirement of the International Olympic Committee (IOC, 2003) is the accessibility of Olympic sites. To determine suitable Olympic cities, we made an accessibility study in which different means of transport and different levels of approach (national, conglomerate, regional) resulted in the Dutch possible solution of Amsterdam and/or Rotterdam, or the Randstad as metropolitan area (Van Susteren, 2005) as host cities.

Secondly, the decision-making process towards, during and after the urban development of the Olympic facilities is complex, not in the last place due to the size and the investment costs of the development. Numerous organisations and fields of expertise are involved, all with their own means, interests, and goals for the project.

1.4 Decision-Making Environment

Before entering the decision-making process on the Olympic urban development, one has to consider the context we are in now. The NOC*NSF is currently in the study phase of the project. A go or no-go decision has not yet been made. This project is aimed to be implemented in the initiative phase, which would take place around the year 2010.

The project's aim is to decide where, and in what spatial cohesion, the Olympic facilities could be allocated to three locations in one of the two cities. The actors involved are the provincial government, the local government, the municipal development agency, and the sport federation NOC*NSF. These actors are policy-makers within the fields of urban planning and sports infrastructure. These experts work together to achieve the optimum group design for the Dutch Olympic urban development. The decision made is the determination of the preferable situation for the Olympic urban development.

2. BASIC PREMISE: INTERORGANISATIONAL DESIGN

2.1 Individual versus Collective Optimum

Integrated Urban Development asks for tuning and steering in complex decision-making processes in interorganisational networks. Activated parts of networks are called policy arenas (Teisman, 1998). Within these arenas we find different actors, or individuals, or representatives of different types of organisations. I shall assume that, in the decision-making process on the Olympic urban development, each actor individually and constantly strives to improve his part of the design, and thus to achieve his individual optimum. The project team as a whole will also continually strive to achieve the best group result possible. This is referred to as the optimum interorganisational design (Van Loon, 1998), the final product of the decision-making process.

2.2 Optimum Interorganisational Design

The final product of the decision-making should be an optimum design. There are widely varying interpretations and definitions to be found in the literature. The optimum interorganisational design solution can be found within the planning conception category, concerning the optimum choice. This conception is an elaboration of one aspect of the design conception: the optimum combination of sub-solutions. Planners refer to the optimum choice from alternative possibilities. The optimum interorganisational design then can be defined as:

> … the design which has been selected by an explicitly defined procedure from alternatives which fall within mathematically defined constraints accepted by those involved. (Van Loon, 1998).

The methodology used to find the optimum choice, or most preferable combination of sub-solutions, is founded in Open Design theory (Van Gunsteren & Van Loon, 2000). This methodology tackles the combinatory explosion, which emerges in complex and interdisciplinary decision-making processes, such as the Olympic urban development.

In Open Design three groups of methods are developed:

1. the means of combination of sub-solutions;
2. the means of the production of design information;
3. the means of the quantification of design decisions.

In this project the combination of sub-solutions is applied.

3. METHOD: COMBINATION OF SUB-SOLUTIONS

3.1 Structuring the Combination Process

In design methodology, the structuring of the combination process and the limiting of the number of sub-solutions are generally done on a hierarchic basis: one of the parties involved determines the number of sub-solutions which may be designed and the sequence of the combinations. Architects have introduced a process sequence into design based on the combination of sub-solutions (Hamel, 1990). The analysis-synthesis work structure of the architectural engineer is shown in *Figure 1*.

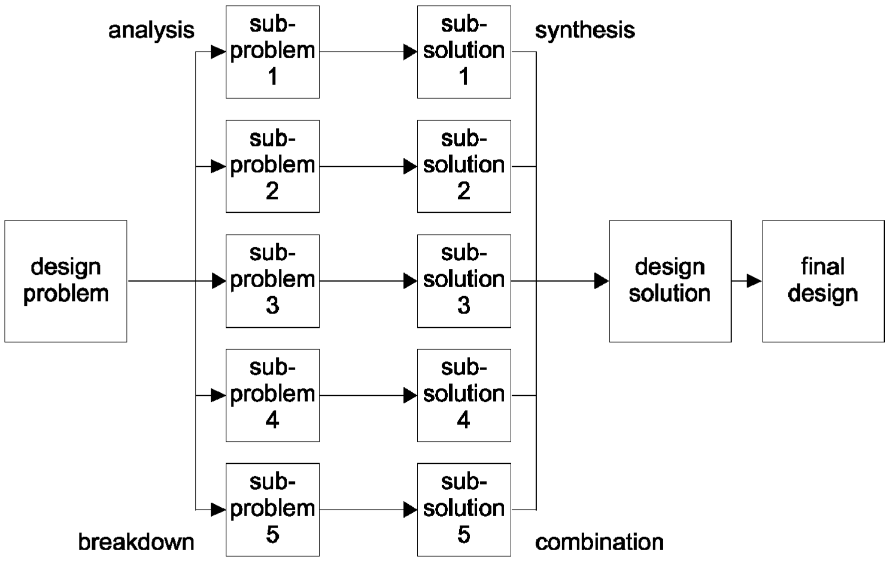

Figure 1. The architectural engineer's analysis-synthesis work structure.

Applied to this project, the process is as follows.

1. The gathering of information:
   The first step in the design process is to study the commission. This provides information on what is desired, in the form of design specifications. Literature references such as the IOC Candidature Acceptance Procedure, The Metropolitan Debate and the Rise of the Network Society are used to determine the design problem. The final problem is the design of the decision-making process on the preferable Olympic urban development situation in all its components.
2. Breaking the commission into its constituent parts:
   As there is never one solution to a design problem, the commission is split up into a series of smaller problems which can be solved individually. The first sub-problem is the determination of the possible Dutch Olympic candidate cities. The second sub-problem is the determination of the possible Olympic locations within these cities. The third problem is the determination of the possible Olympic urban developments.
3. Designing different solutions for these smaller problems:
   Decisions are taken on how these smaller problems are to be solved. The first problem is solved by an attainability study on four cities in

the Randstad. Amsterdam and Rotterdam proved to be the two most likely Dutch Olympic candidate cities. For each of these cities, three locations are marked as sub-solutions to host the Olympic facilities. A case study on past and future Olympic sites resulted in three types of sites, with three types of clustered functions: Olympic Village, Olympic Park, and Media Village. These sub-solutions are combined into a solution space.

4. The combination of sub-solutions:
   At this stage sub-solutions are merged to form a solution space. The sequence in which the sub-solutions are combined plays an important role. This is done by the development of a specific multi-actor decision-support tool for the Olympic urban development in the Netherlands in 2028, in which the different sub-solutions are incorporated.
5. Designing the product:
   The combination phase produces a solution space which fulfils all the requirements, but the solution must still be translated into design. This design contains the most preferable combination of sub-solutions on the most preferable locations in an Olympic candidate city. This is done with the use of the preference measurement technique, explained in further detail in the next chapter.

3.2 Interorganisational Optimisation of the Combinations of Sub-solutions

To apply the method we made the following assumptions. In the first place we have assumed that all the Olympic urban functions have to be newly developed, despite existing infrastructure, stadiums, housing, and commercial buildings. We also have assumed that there are no limitations regarding financial means, the involved actors should have enough opportunities to invest in the Olympic urban development. Furthermore, we have assumed that the selected sites have enough capacity for the Olympic urban development. Based on these assumptions the total permitted solution space is defined. A formal representation of the total solution space, from which the optimal interorganisational design can be made, is shown in *Figure 2.* Since the method is a combination of sub-solutions, and in this study all the combinations are feasible, the solution space contains all possibilities.

In general, the boundaries of the solution space feature implicitly in the combination method. Its limits and form are not defined. It is only possible to derive the boundaries 'retroactively', after each step in the combination process, from the 'position' of and the 'link' between the sub-solutions. In technical terms, the sub-solutions are 'points' in a solution space that has not been delineated beforehand, and is therefore always vague in outline.

As we have assumed that all the combinations are feasible, this retroactive aspect is not applicable in this study, as the boundaries are defined quite explicitly. This is expressed in *Figure 2*.

The study tries to find the preferable solutions within the feasible solution space. To do so we apply the Preference Measurement method.

4. PREFERENCE MEASUREMENT

4.1 Method

Scepticism about the usefulness of computer modelling in architecture and urban planning is often based on the argument that soft variables like beauty cannot be measured. This is actually a misconception. The beauty itself can indeed not be measured, but the preference of stakeholders for one design in comparison with other designs can be established without much difficulty. Preference Measurement can be seen as the key to incorporating soft variables (Binnekamp, Van Gunsteren, Van Loon, 2005).

To measure preference correctly, measurements have to be taken relative to two arbitrarily chosen reference points. What is measured is the ratio of difference. This operation is independent of the chosen origin (zero-point) and selected unit of measurement.

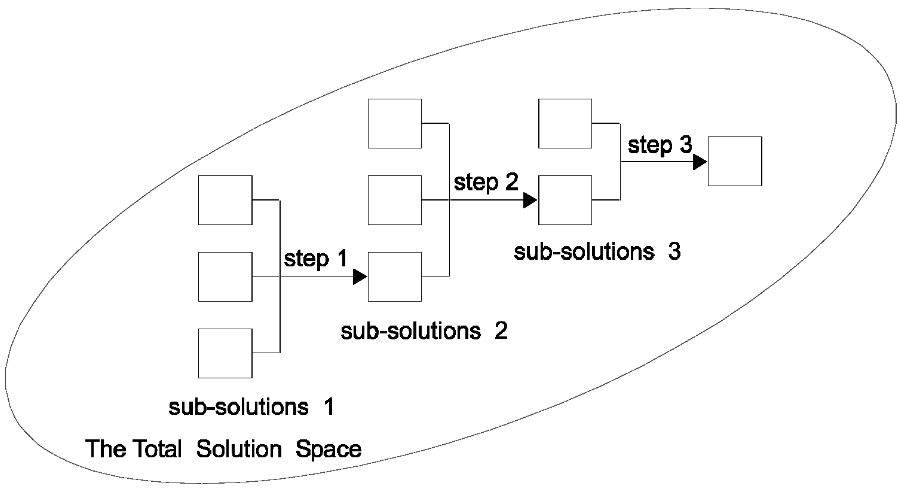

Figure 2. Sub-solutions inside the permitted solution space.

The method can be used for a great variety of choices or decisions. It is particularly useful in extremely complex cases involving many alternatives and many criteria. An example of such a case is the decision-making of the possible future Olympic urban development in the Netherlands.

For the Olympic urban development, a multi-criteria model is used to determine the preferences of the relevant actors within the Olympic policy arena. The preferences for the types of locations and way of developing these locations (with Olympic functions) are measured. This type of decision-making, finally resulting in an optimum interorganisational design, lends itself to an approach whereby different alternative solutions of Olympic urban development per candidate city are generated. Among them is the optimum interorganisational design or choice.

4.2 Modelling

Preference is modelled with the use of a multi-criteria decision analysis model. The decision is a choice out of a number of alternatives, and the choice is made in such a way that the preferred alternative is the 'best' among the possible candidates. The decision maker does not only have the task to judge the performance of the alternatives in question under each criterion, he/she also has to weigh the relative importance of the criteria in order to arrive at a global judgement (Lootsma, 1999).

The criteria are subdivided into location specific criteria and alternative specific criteria. The weighing of the relative importance of the criteria is done by giving priorities to criteria. This is done by entering values on a 5-point ordinal scale. Here, the value 1 means that the actor attaches no priority to a criterion, value 5 means that the actor gives the highest priority to a specific criterion.

The judgement of the performance of the locations and alternatives in question under each criterion is based on the scaling of preferences. This is done on a 0 to 10 interval scale. The value 1 corresponds with no preference; the value 10 corresponds with most ideal preference for a specific location or alternative.

This leaves us with the initial comparison of the locations and alternatives. The weighted sum function (criteria weights times preference values) gives us the opportunity to introduce a ratio scale. With the use of the quantitative measurement units, the ratios between scale positions are fixed, but only with the introduction of the ratio scale. The re-scaling results solely in an overall preference for the locations and alternatives per individual actor.

The next crucial step is the determination of the optimum individual design, in order to come up with an optimum collective design. Therefore we have to combine the preferences on locations and alternatives to end up with different solutions for Olympic urban developments per candidate city. Here the weighted sum of the scaled preferences of locations and alternatives results in all possible sub-solutions, all points within the total solution space. We refer to these as combinations.

Finally, this individual decision-making process results in a group decision-making process, with the use of the technical capabilities of the Preference model. The individual scaled preferences of the combinations are compared. We can again use the weighted sum for this. The power of individuals within the group (their weight) is set to be equal.

The decision-making process is shown in *Figure 3*.

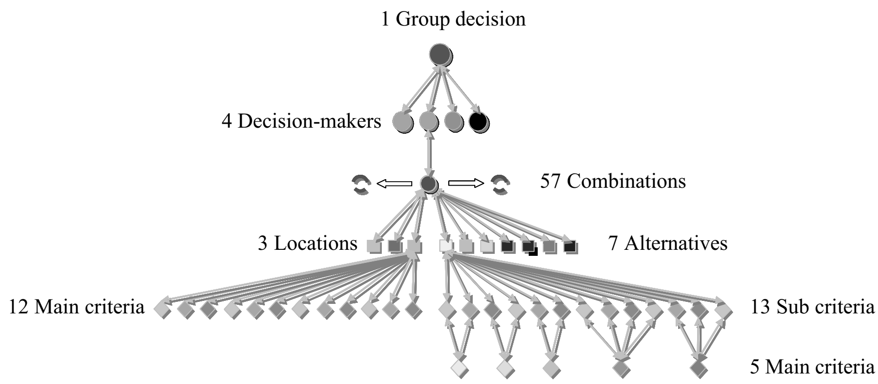

Figure 3. Structure of the decision-making process for a single city.

5. RESULTS

Several workshops with students were organised to come up with an optimum interorganisational design. The three combinations (out of 57 for Amsterdam) with the highest group preference are presented in Table 1.

Table 1. Preferred optimum interorganisational designs for Amsterdam.

Alternative	Combination	G. Preference	Location N	Location SW	Location SE
A04 & A08	M16	P = 0.99	OP & MV	OV	
A04 & A08	M19	P = 0.97		OP & MV	OV
A04 & A08	M21	P = 1,00		OV	OP & MV

The combinations M16, M19, and M21 are most ideal group preferences for the Amsterdam situations. They all belong to combinations which are converted from alternative 4 and 8, which means that the group is quite unanimously satisfied about the combined development of the Olympic Park and Media Village and the separate development of the Olympic Village on specific locations in Amsterdam.

The table can be translated into an optimum interorganisational design, the preferred Olympic urban development plan for Amsterdam is shown in *Figure 4*.

Figure 4. Combination 21: Optimum interorganisational design Amsterdam.

The overall scaled preference values indicate the exchange possibilities of the group's preferences. What if an individual actor is not really satisfied with the end result? Therefore, we can take a closer look at output scaled preferences of the individual actors for each of the three solutions. It might appear that three of the four actors show a high satisfaction on one combination but, one actor is lagging behind. In that case we are comparing the individual optima. With this analysis we can identify the coalitions and oppositions within the group of students. After confronting the different actors with this analysis, the negotiation phase takes place. The (dis) agreements on one specific solution can be tracked within the model's variables. The argumentation behind given preference values forms the base of the negotiation process. This could lead to an adjustment of the actor's goals, which could led to reviewing one's individual preference values, resulting in a repetition of the group decision-making process.

Once all individual stakeholders played by students agree on the crucial individual variables, the group of students identifies one solution to be the optimum interorganisational design. The choice on the most preferable

Olympic urban development is made. The first step in the decision-making process has been taken; the base for the next step is set.

6. CONCLUSIONS

The project's main question was as follows: "In what way can the complex decision-making process of the 2028 Dutch Olympic urban development be designed, such that it supports the stakeholders of the Olympic urban development project." To address this question we have designed a Preference Measurement model for the Olympic urban development process. In the initiative phase, this tool provides a quick scan of the agreements and disagreements of the different stakeholders on the complex product.

The most important characteristic of the decision-support tool is the possibility to incorporate soft variables, a characteristic that answers the common need for structure in the orientating phase. An architectural engineer, or process manager, could use this instrument to bring together the most relevant policy makers in order to determine the optimum interorganisational design. This design creates more effectiveness and transparency in the process. Furthermore, the tool monitors and compares different alternative solutions generated throughout the decision-making process. An earlier experiment in practice with this method was conducted by Feuth (2003). These studies suggest that this method can have practical value for decision making in complex planning projects.

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