ELABORATION OF THE DUTCH OLYMPIC APPROACH

Design of decision support instruments for multiple Olympic urban decision arenas

J.W. (Johan) Zonderland

Master Thesis | November 2010

Colophon

(1) RESEARCH DETAILS

Primary title:	Elaboration of the Dutch Olympic approach
Secondary title:	Design of decision support instruments for multiple Olympic urban decision arenas
Key words:	Decision-making, Urban area development, Olympic Games, National spatial policy, Urban spatial policy, Preference measurement, Lineair optimization

(2) AUTHOR DETAILS

Student:	J.W. (Johan) Zonderland
Student number:	1222007
Address:	Jacoba van Beierenlaan 17
	2613 HV DELFT
Phone:	+31 6 15130358
E-mail:	j.w.zonderland@student.tudelft.nl
	johansurft@hotmail.com

(3) UNIVERSITY DETAILS

University:	Delft University of Technology
Faculty:	Faculty of Architecture
Department:	Real Estate & Housing
Laboratory:	Urban Area Development
Address:	Julianalaan 134
	2628 BL DELFT
Phone:	+31 15 2785159
E-mail:	reh-bk@tudelft.nl
Website:	www.re-h.bk.tudelft.nl

(4) GRADUATION COMPANY

Company:	Accommodatie Regisseurs
Address:	Lage Gouwe 2a
	2801 LG Gouda
Phone:	+31 18 2526 692
E-mail:	info@accommodatieregisseurs.nl
Website:	www.accommodatieregisseurs.nl

(5) GRADUATION COMMITTEE

First supervisor:	ir. E.W.T.M (Erwin) Heurkens
E-mail:	e.w.t.m.heurkens@tudelft.nl
Second supervisor:	ir. P. (Peter) Barendse
E-mail:	p.barendse@tudelft.nl
Third supervisor:	ir. B. (Bas) Keuper
E-mail:	bas.keuper@accommodatieregisseurs.nl
Commissioner:	ir. F.R. (Frank) Schnater
E-mail:	f.r.schnater@tudelft.nl

Preface

In order to finalize the master Real Estate & Housing at the faculty of Architecture of the Delft University of Technology, this report has been reproduced. The subject of research is the decision-making concerning complex urban area development projects, specific for the organization of the Olympic Games of 2028 in the Netherlands.

That subject originated after visiting the 2008 Beijing Games, where I was impressed by the spatial opportunities accompanied with the organization of the Olympic Games. Afterwards, I heard the Netherlands were also purposing a possible Olympic candidature, so that the motive for my master thesis could be established. On the basis of the expertise offered by the Urban Area Development laboratory, where more often decision support instruments are being designed, the the research subject has been demarcated. The elaboration of the Dutch Olympic approach, which will be facilitated through the design of decision support instruments for multiple Olympic urban decision arenas, will hopefully deliver input for further thoughts and creativity for new insights.

From the Delft University of Technology I would like to thank Erwin Heurkens as my first supervisor and Peter Barendse as my second supervisor, for guiding me along the process of designing multiple decision support instruments. Erwin continuously attempted triggering and helping me to structure the complexity of the Olympic assignment. Peter supported me with the technical part of designing the instruments. In my words of thanks, I also have to mention my third supervisor, Bas Keuper, for giving me the opportunity graduating at the company Accommodatie Regisseurs. Furthermore, I want to thank the students who helped me out testing the functionality of the preference measurement model, which were Sander van de Belt, Rogier Claassen, Dirk Jan Remmerswaal and Matthijs Zaadnoordijk.

In addition, I want to thank my parents, brothers and my sister for their unconditional support and understanding during my study years. I would also like to thank my dear girlfriend Andrea, for experiencing the intensity of the graduation process with me; her support helped me through the occasionally difficult stages in that process. Finally I would like to thank my fellow students for the pleasant coffee breaks, my friends and housemates for the necessary distractions and my soccer teammates for accepting my absence during some of the trainings and matches in the past semester.

Johan Zonderland
November 4th 2010, Delft

Abstract 1/3

(1) INTRODUCTION

With the Olympic Plan 2028, the Netherlands launched their dream to organize the Olympic Games of 2028. It must be mentioned that in the context of the Olympic Plan 2028, the path towards the Olympic Games of 2028, which concerns the overall improvement of the Netherlands, is more important than the organization of the Games itself. Using the Games as leverage for positive long-term effects, became an important motive for applicant cities, since the Games enhances fundamental structural changes for cities and regions such as new office accommodation, improvements in telecommunications, gentrification of parts of the city, first class tourist facilities and an international airport (Preuss, 2004).

Because the proportions of Dutch cities are too limited to accommodate the Olympic Games, the Olympic Plan 2028 should be approached as a national project, wherein both the national (top-down) and urban (bottom-up) interests should be considered. Decision-making concerning the spatial content of the Olympic Plan 2028, where both national interests and urban interests are taken into consideration, however, is a time-consuming process. Therefore, the following research question has been formulated:

Are there possibilities to manage the complex decision-making process in the initiatory phase, for the sustainable realization of the Olympic Games of 2028 in the Netherlands whereby both national and urban long-term spatial objectives will be achieved, so that the decision-making process can be accelerated?

On the basis of the Olympic Plan 2028, in this report, the foundation for a new way of spatial planning has been elaborated. That new way of spatial planning is termed the Dutch Olympic approach, wherein both national (top-down) as urban interests (bottom-up) are considered simultaneously. However, the feature of the initiative phase as the stage in Urban Area Development (UAD) processes where complexity is most substantial (Bruil, et. al, 2004) combined with the feature of a decreasing manageability in the contemporary practice of UAD processes (Van Loon et. al, 2008), changed the task of steering and managing the development of urban areas. According to Van Loon et. al (2008), one of the methodological-technological and instrumental answers to the decreasing manageability could be the help of digital systems, which in this report is referred to as decision support instruments.

The purpose of this thesis, for that reason, would be the design of multiple decision support instruments, which facilitate the decision-making of the Dutch Olympic UAD process, so that there can be steered on the content of decision-making. The design of these instruments, eventually, should contribute to an improved and accelerated decision-making process for the realization of the Olympic Plan 2028.

(2) OLYMPIC GAMES

The contents of decision-making for the national and urban spatial planning layer have been established on the basis of Olympic developments and trends. Relevant issues on a national scale level consider the mutual attuning between multiple departments of the central government. Relevant issues to be discussed in the on an urban scale level would consider assessing the possibilities for the development of the Olympic functions in a potential host city. The possibilities for the development of Olympic functions is determined by the spatial preconditions that potential urban areas would offer (spatial features and mobility features), the objectives that decision makers purpose to achieve through the realization of the Olympic Plan 2028 (integration of the Olympic spatial content into the urban development strategy), and the willingness of the market parties to develop the spatial content of the Olympic Plan 2028 (financial-economic feasibility).

(3) ANALYSIS

In order to establish adequate content and to determine the technical requirements for the decision support instruments, three analyzes have been executed. The first analysis was about the distinction of possible Olympic development strategies and moreover about the determination of their strategic characteristics.

Abstract 2/3

These strategies have been established through the determination of differences between Olympic candidate cities in the following variables: (1) distribution of their competition venues (sports and venues), (2) the development of their Olympic village (Olympic village) and (3) their infrastructural adjustments (transport). Based on these variables, subsequently, the possible strategic approaches for the spatial organization of the Olympic Games have been distinguished in four different types: Olympic Redevelopment, Olympic Urban Expansion, Strategic Olympic Clusters, and Olympic Venue Scattering.

The aim for the second analysis was to comprehend the spatial features and requirements of the Olympic program, which delivered functional units (in Ha) of the specific functions and the requirements for the allocation of the Olympic functions. The complete program encompasses competition venues (specific stadiums, indoor halls and sports complexes), the Olympic village, the IBC/MPC and the media accommodations (hotels, media village[s]).

The purpose for the third analysis was the determination of zones [Z1-Z20] and functions [F1-F21] for the allocation of the Olympic spatial content for the case Rotterdam 2028. With the choice for Rotterdam there is certainly not suggested that Rotterdam would be most suitable as Dutch Olympic host city. Other cities in the Netherlands, e.g. Amsterdam, also dispose adequate spatial preconditions which will be needed for the organization of the Olympic Games. The zones for the case Rotterdam 2028 have been determined on the basis of the Rotterdam urban development strategy, wherein thirteen VIP-areas have been assigned which would obtain higher priority than other UAD projects. It must be mentioned that the determination of these zones, is the interpretation of the urban systems engineer (author JZ). The accuracy of these interpretations could be increased by the involvement of the municipality Rotterdam in the determination of zones, which hasn't been the case. Based on the Olympic status quo (current status), the remaining Olympic program [F1-F21] to be developed for the case Rotterdam 2028 has been determined, so that the starting point for the decision-making on the urban spatial scale level could be established.

(4) DECISION SUPPORT INSTRUMENTS

Based on the theory of De Leeuw (2002), the Dutch Olympic approach could be considered as a series of decision arenas, where in each arena specific aspects of the spatial content will be discussed by actors with expertise concerning those specific aspects and, moreover, with an interest in the ultimate realization of the Olympic Plan 2028. De Leeuw outlined that the basis of steering is a 'controlling unit' (decision makers) that controls the 'controlled system' (spatial features Olympic Plan 2028). This configuration can be expanded by the introduction of the environment (initiative phase of the Dutch Olympic UAD process), wherein multiple arenas (both on a national as urban scale) can be distinguished.

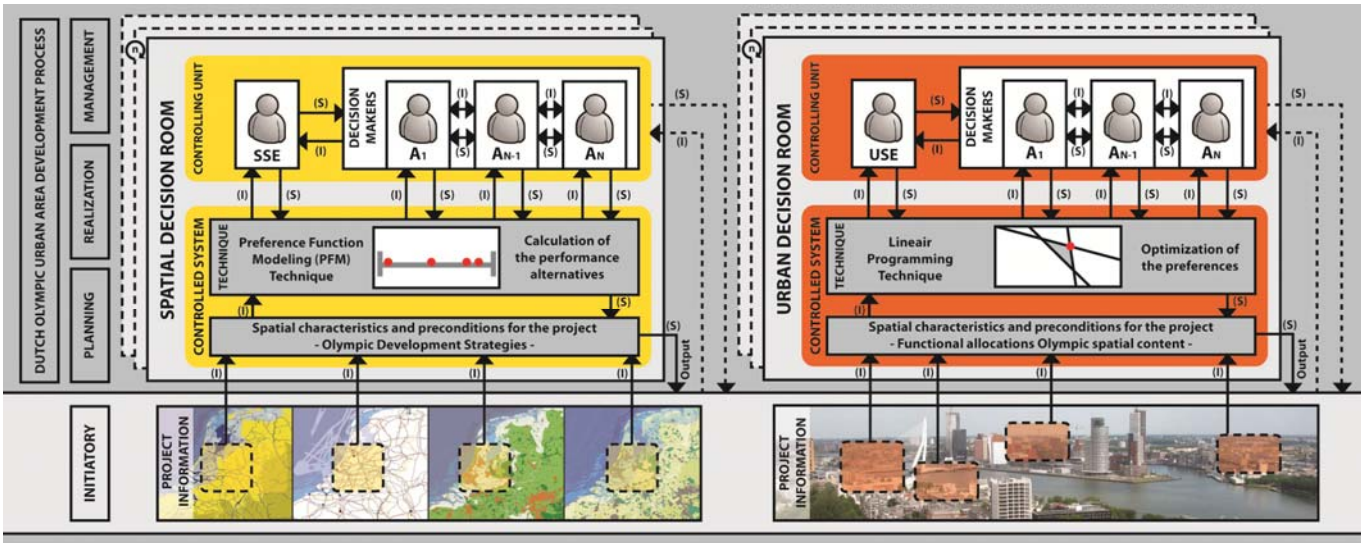


Figure 9.1: The CU/CS-configuration for both Olympic decision rooms (Source: Helmerhorst, 2007, adapted).

Abstract 3/3

Since the decision support instruments offer interactive support to planning and decision-making issues relating to future urban developments, it will be possible to steer on the content of the Olympic UAD process in decision arenas. In the Dutch Olympic approach two decision arenas are distinguished, the Spatial Decision Room (SDR) as the Urban Decision Room (UDR). The output of both decision arenas would be project information for the Dutch Olympic UAD process, in the configuration of preferences (support) for possible alternatives and the accompanying spatial preconditions for alternatives. The content of the SDR is about the spatial strategic characteristics of the organization of Olympic Games, the content of the UDR is about putting these spatial strategic characteristics into operation. This enables the opportunity to compare the differences between national and urban interests immediately, which ultimately could lead to an improved and accelerated decision-making process.

(5) CONCLUSION

With the design of multiple decision support instruments, it will be possible to steer on goal-orientated decision making in the initiatory phase of the process, both on a national as an urban spatial scale level, which could improve and accelerate the decision-making in these decision arenas. However, the detail level of the decision support instrument on the urban scale level should be attuned to the detail level of the output of the national scale level, so that the data of both decision arenas can be compared. For the implementation of decision support instruments in the Dutch Olympic UAD process, the following preconditions should be taken into account:

(1) The involvement of decision makers in the determination of relevant issues to be discussed in the decision arena;
(2) The involvement of decision makers in the design of the decision support instrument;
(3) Providing accurate technical circumstances for operating an decision arena (SDR/ UDR), which concerns the improvement of the 'user-friendliness' of the decision support instruments, the connection of computers to a network, and the projection of the output of the model on screens, and
(4) Adequate management of the systems engineer in the decision arena (SDR/ UDR), which is complex since the role of the systems engineer requires competences in terms of technology, content and social interaction (Van Loon et. al, 2008);

The SDR and UDR which have been discussed in this research would only demarcate de beginning of the decision-making process concerning Dutch Olympic UAD, towards the completion of the initiatory phase. In the initiatory phase also additional decision arenas would take place, wherein the remaining relevant aspects for the realization of the Olympic Plan 2028 would be discussed. For that reason, the various decision support instruments should be mutually related, which requires the management of the overall process. Based on the output of that overall process, eventually, the (spatial) possibilities for a Dutch Olympic candidature could be determined, wherein both national as urban interests have been taken into consideration.

(6) RECOMMENDATIONS

- If the support from decision makers represented in the SDR and UDR is established, this research would deliver important points of departure for further researches wherein the acceleration and improvement of the Dutch Olympic UAD process also is purposed.

- The decision makers should be involved in the design of the preference measurement model and the allocation model, since they will steer on the content of these instruments.

- The further elaboration of the Dutch Olympic approach is recommended, because after the completion of the SDR and UDR discussed in this report, in additional decision arenas the remaining relevant aspects for the realization of the Olympic Plan 2028 will have to be discussed.

Abbreviations

(1) STAKEHOLDERS

CORP1-2	Housing Corporation 1-2
DEV1-6	Commercial Developer 1-6
IOC	International Olympic Committee
OCOG	Organizing Committee Olympic Games
NOC*NSF	National Olympic Committee of the Netherlands (In Dutch: Nederlands Olympisch Comité*Nederlandse Sport Federatie)
VROM	Dutch department of Housing, Spatial Planning and the Environment (In Dutch: Ministerie van Volksgezondheid, Ruimtelijke Ordening en Milieubeheer)

(2) OLYMPIC DECISION ARENAS

CS	Controlled System
CU	Controlling Unit
ODS	Olympic Development Strategy
SDR	Spatial Decision Room
SSE	Spatial Systems Engineer
UDR	Urban Decision Room
USE	Urban Systems Engineer

(3) OLYMPIC SPATIAL CONTENT

COM	Commercial
IBC/MPC	International Broadcast Centre/Main Press Centre
INFR	Infrastructure
LEI	Leisure
MV	Media Village
MUN	Municipality
OV	Olympic Village
OVP	Olympic Village Plaza
OZ	Operational Zone
RES	Residential
RZ	Residential Zone
UAD	Urban Area Development

(4) DECISION SUPPORT INSTRUMENTS

A1-A4	Alternative 1-4
C1-C9	Criteria 1-9
DM1-DM4	Decision maker 1-4
DWU	Dwelling Unit
F1-F21	Function 1-21
GFA	Gross Floor Area
GSA	Gross Surface Area
MCDA	Multiple Criteria Decision Analysis
PFM	Preference Function Modeling
Z1-Z20	Zone 1-20

Content 1/4

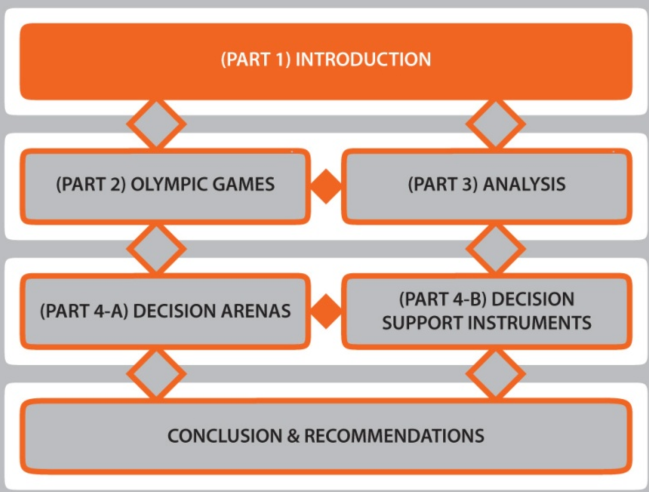
Content 2/4

Content 3/4

Content 4/4

PART 1

INTRODUCTION



Chapter 1: Research

1.1 Cause of the research

According to current president of the International Olympic Committee Jacques Rogge, organizing the Olympic Games, which he referred to as 'the world's most prestigious sports event', is a very challenging and complex task (IOC, 2005-A). He indicated that the Games to be a success relies on so many different factors, including strong and visionary leadership from the organizing committee, government support and involvement, the appropriate level of IOC leadership, good collaboration with all the stakeholders and much more besides. With the Olympic Plan 2028, the Netherlands launched their dream to organize the Olympic Games of 2028. It must be mentioned that in the context of the Olympic Plan 2028, the path towards the Olympic Games 2028, which concerns the overall improvement of the Netherlands, is more important than the organization of the Olympic Games itself. The Olympic Plan 2028, of which the first phase (research phase) started in 2006, therefore could be considered as the national dream of the Netherlands, to improve the sports structure of the Netherlands on the basis of the realization of eight ambitions, which might create the foundations for ultimate the organization of the Olympic Games in the Netherlands, so that the Netherlands might be able to transform towards a more sports-minded nation (Program Office OP 2028, 2009). The introduction of the Olympic Plan 2028, initiated an unstructured national debate, with both positive as negative contents, concerning the possible organization of the Olympic Games in the Netherlands.

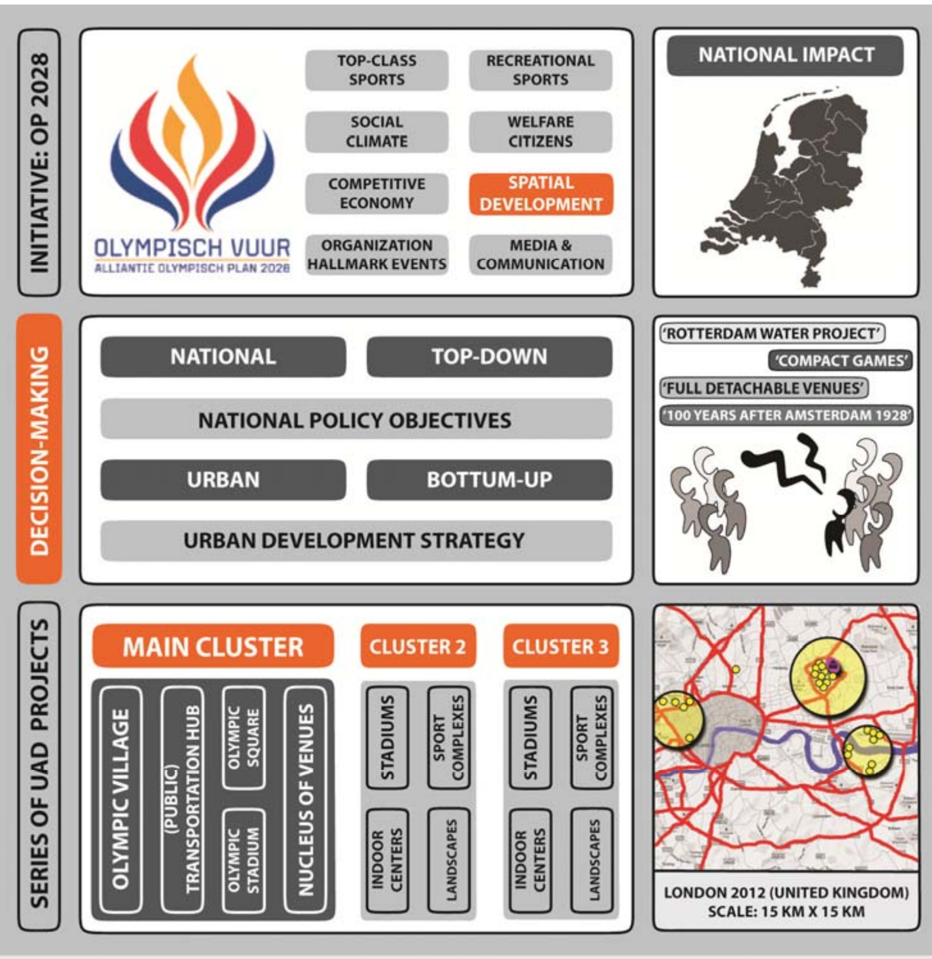


Figure 1.1: Schematic reproduction of the research cause.

Previous Olympic host cities showing that the greater part of Olympic activities will be organized within a surface area with dimensions of approximately 15 km x 15 km, which would be the size for example one of the wings of the Randstad agglomeration. This is the result of the requirements of the IOC, which determine that all sports competition take place in the host city's agglomeration, unless the IOC Executive Board authorizes the organization of certain events in other cities, sites or venues situated in the same country (IOC, 2007-A). Therefore, one of the contents of the national debate would be the choice for the ultimate Dutch Olympic candidate city, and as a consequence the choice for an urban agglomeration. The lead time for (juridical) procedures of the enormous spatial and infrastructural projects that are accompanied with the organisation of the Olympic Games, require at least 10-15 years (VROM et. al, 2008). For that reason, the national debate should be continued in decision arenas, where actually decisions will be made concerning the Olympic Plan 2028. The long path towards 2028, wherein the national debate will be continued in multiple Olympic decision arenas, is labeled as the 'Dutch Olympic approach', of which decision arenas about the Olympic spatial content will be elaborated in this master thesis, both on a national as a urban spatial scale level.

The decision-making on a national scale level is about national policy objectives in relation to the realization of the Olympic Plan 2028, which can be considered as a top-down approach. Nevertheless, the organization of the Olympic Games would eventually concern the development of a series of interconnecting urban areas; therefore the decision making on an urban scale level is also relevant. On that scale level, the main issue is the integration of the spatial content of the Olympic Plan 2028 into the urban development strategy of a potential candidate city, which could be considered as a bottom-up approach. In the start-up of the process towards the possible organization of the Olympic Games of 2028 in the Netherlands, therefore, the spatial content of the Olympic Plan 2028 should be considered both from a national perspective (top-down) as an urban perspective (bottom-up), which requires multiple decision arenas.

1.2 Problem statement

Hosting the Olympic Games is usually not the main goal for a city, region or country, since the Games only last for 16 days (26 days if you include the Paralympics as well). Significant motives associated with hosting the Games, is that of enhancing fundamental structural changes in cities and regions (Essex and Chalkley, 1999). According to Preuss (2004) a common objective of politicians is to promote their city as a 'global city', with the ambition to generate international investment. Preuss (2004) described that Olympic cities develop the spatial preconditions that are important to become a 'global city', such as new office accommodation, improvements in telecommunications, gentrification of parts of the city, first class tourist facilities and an international airport. Using the Games as leverage for positive long-term effects, therefore, became more important goals for a city region or country instead.

In 2008 the first spatial exploration for the possible Dutch organisation of Olympic Games was executed. The research team indicated that the proportions of Dutch cities are too limited to accommodate the Olympic Games, and for that reason the Olympic Games should be approached as a national project, where both the national (top-down) and urban (bottom-up) interests should be considered. Because of that, the research team indicated the slow (Dutch) urban area development processes, combined with the fixed timeframe, as the most crucial factor in the realization of the Olympic plan 2028, which leads to the following problem statement:

Decision-making concerning the spatial content of the Olympic Plan 2028, where both national interests (top-down) and urban interests (bottom-up) are taken into consideration, is a time-consuming process.

According to Preuss (2004), the economic dimension of the Games can neither be determined by a single figure nor by comparing several Games, depending as it does on the development level of the city, the size of the city and moreover the economic intention of the governments in relation to the organization of the Games. In other words, national, regional and urban governments are able to justify expenditures related to the Games on the basis of objectives, which they purpose to achieve through the organization of the Games. The interests of national and urban governments are taken into consideration when ultimately long-term objectives will be achieved through the organization of the Games. Therefore, in the process towards the possible organization of the Games, it is essential that the objectives from both spatial scale levels in relation to the organization of the Olympic Games are established.

1.3 Research question

As mentioned in paragraph 1.1, in the early stage of the process towards the possible organization of the Olympic Games of 2028 in the Netherlands, the spatial content of the Olympic Plan 2028 should be considered both from form a national perspective (top-down) as an urban perspective (bottom-up), which requires multiple decision arenas. In paragraph 1.2 is emphasized that this approach is time-consuming. Therefore can be concluded that the success of the completion of the Olympic Plan 2028 is closely related to the way in which the decision making process is managed. On the basis of that specification, the research question for this master thesis is has been formulated, which would be:

Are there possibilities to manage the complex decision-making process in the initiatory phase, for the sustainable realization of the Olympic Games of 2028 in the Netherlands whereby both national and urban long-term spatial objectives will be achieved, so that the decision-making process can be accelerated?

Some remarks on the research question are:
(1) With the 'complex decision-making process' there is referred to the multiplicity of actors will be involved in the Dutch Olympic UAD process, on multiple spatial scale levels, all with their individual interests (public or private) and roles;
(2) The term 'sustainable' refers to the the three-dimensional nature of sustainable spatial development: economic, social and environmental (Furrer, 2002). In this context, since the operating and infrastructure costs of the Games are in the billions, the economical dimension in relation to spatial objectives and spatial preconditions of potential Olympic urban areas, is of a significant importance in the initiatory phase;
(3) With the 'realization of the Olympic Games' is meant the development of the required Olympic spatial content, which consists of competition venues, the Olympic village and media accommodations and transportation infrastructures;
(4) With '2028' the dimension time is demarcated. Since the lead time for (juridical) procedures of these enormous spatial and infrastructural projects requires at least 10-15 years (VROM et. al, 2008), the deceleration through decision-making concerning the spatial content of the Olympic Games 2028, therefore, should be restricted to the minimum, and
(5) Eventually, the support from national and urban spatial planning layers will be determined by the extent to which politicians (on a national and urban scale) could achieve their spatial objectives through the organization of the Olympic Games in relation to the economical dimension of the Games.

1.4 Research objective

The initiative phase is the stage in UAD processes where complexity is most substantial (Bruil, et. al, 2004). Especially in the start-up of this phase, where there are many uncertainties as to the surroundings (context), where realization plans still haven't been determined (content), where a multiplicity of actors attempt to influence the process (actors), and where the relations between these actors are explored (means), the management of the decision-making is complex. Van Loon et al. (2008) mentioned that the decreasing manageability in the contemporary practice of UAD processes resulted in a change to the task of steering and managing the development of urban areas. One of the methodological-technological and instrumental answers to the decreasing manageability could be the help of digital systems, which hereafter are referred to as decision support instruments (Van Loon et. al, 2008).

Since the decision support instruments offer interactive support to planning and decision-making issues relating to future urban developments, it will be possible to steer on the content of the Olympic UAD process in decision arenas, both in the Spatial Decision Room (SDR) as the Urban Decision Room (UDR). This enables the opportunity to establish spatial preconditions on the national (SDR) as the urban (UDR) level, so that already in the start-up of the process the collective (SDR and UDR) support for the realization of the Olympic Plan 2028 can be determined. The objective of this thesis, for that reason, is related to the design of multiple decision support instruments. That objective, however, can be considered as a part of a larger system. According to De Leeuw (2002), a system is a collection of objects (elements) selected by the observer which are related in such a way that no elements or groups of elements can be isolated from the others. In order to comprehend the primary research objective, also the additional objectives for the particular systems within the initiatory phase of the Olympic UAD process, for which the decision support instruments will be designed, should be mentioned. First, the three segments of the system approach of De Leeuw (2002) will be clarified:

(1) A sub-system, which is limited to a certain part of the object collection, but does consider all relations within this part;
(2) A aspect-system, where not the whole object collection is considered, but only a part of the relations (it is limited to certain aspects), and
(3) A phase-system, which considers the system in a certain time in which the original system was defined.

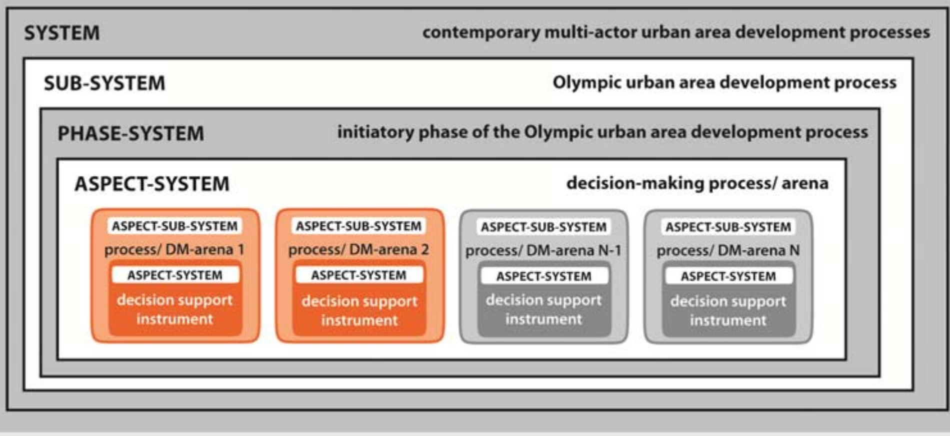


Figure 1.2: The system approach for decision support instruments (Source: Helmerhorst, 2007, adapted).

In his Master Thesis 'Dynamic Actor Network Steering and Control', Helmerhorst (2007) described the position of a decision support instrument on the basis of the system approach of De Leeuw (2002). The system is defined as the contemporary multi-actor UAD processes. This system can be subdivided in specific urban development processes, where in this thesis the focus would be on the Olympic UAD process (sub system), which has been demarcated by the initiatory phase (phase system). For each decision arena (aspect-sub-system) of the initiative phase of the Dutch Olympic UAD process, a decision support instrument intends to facilitate and support of the 'decision-making process' by means of an interactive and through multiple actors steered (preferences and requirements) digital model. The decision support instrument shows a projection of relevant aspects of the initiatory phase of the Olympic UAD process. The aspect-system 'decision-making process' is a process in which various 'decision arenas' are incorporated (in this master thesis the SDR and the UDR). Within these aspect-sub-systems, the aspect-system 'decision support instrument' is the main focus point of this research which, therefore, is related to the primary objective. Based on the system approach of De Leeuw (2002), the objectives for this research project, for each system within the initiative phase of the Olympic UAD process will be determined:

(1) Primary objective: Design of multiple decision support instruments, which facilitate the decision-making of the Dutch Olympic UAD process.

(2) Additional objective: Steer on the content of decision-making in the concerning decision arenas by means of the decision support instruments.

(3) Additional objective: Improve and accelerate the decision-making process in the initiative phase of the Dutch Olympic UAD process.

(4) Additional objective: The 'in time' completion of the initiatory phase of the Dutch Olympic UAD process and, if the output of the decision arenas reflect sufficient support for the organization of the Olympic Games in the Netherlands, then also the 'optimal' realization of the Dutch Olympic UAD process.

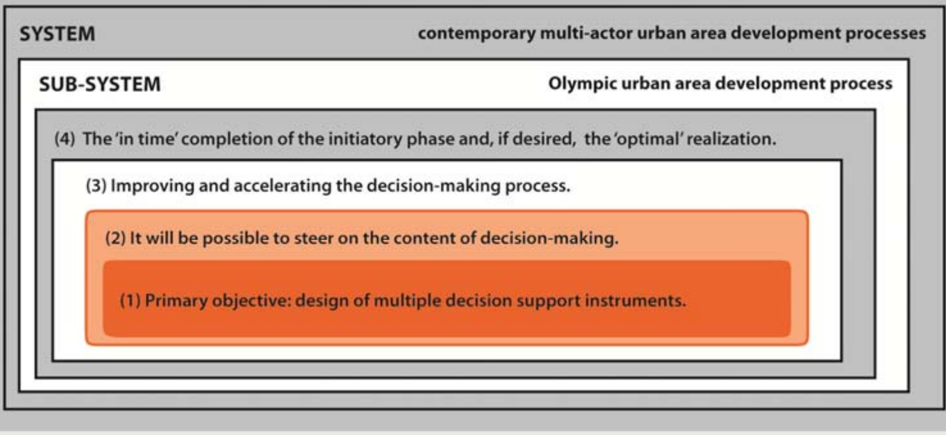


Figure 1.3: Primary and additional objectives on the basis of the system approach.

The bidding procedure for the Olympic Games of 2028 starts in 2019 (paragraph 5.5). Furthermore, in 2016 the Olympic alliance will assess the (spatial) possibilities for a Dutch Olympic candidature (paragraph 4.1). With the 'in time' completion of the initiatory phase of the Dutch Olympic UAD process, therefore, is meant somewhere before 2016. In the context of 'Open Design', which will be elaborated in the next paragraph, the 'optimal' realization of the Olympic Games would be the realization in which interests of all decision makers are reflected in an optimal manner (Binnekamp et. al, 2006).

1.5 Open Design

Open Design is a decision support method, developed by the chair of Computer Aided Design and Planning of the Delft University of Technology. According to Binnekamp et. al (2006), Open Design is made up of two ingredients, which are (1) a set of design related norms and values and (2) a set of decision-orientated mathematical models and associated computer programs. Another important aspect of Open Design is that the decision makers negotiate the input (norms and values) and the output (alternatives) of the decision support instrument (mathematical models).

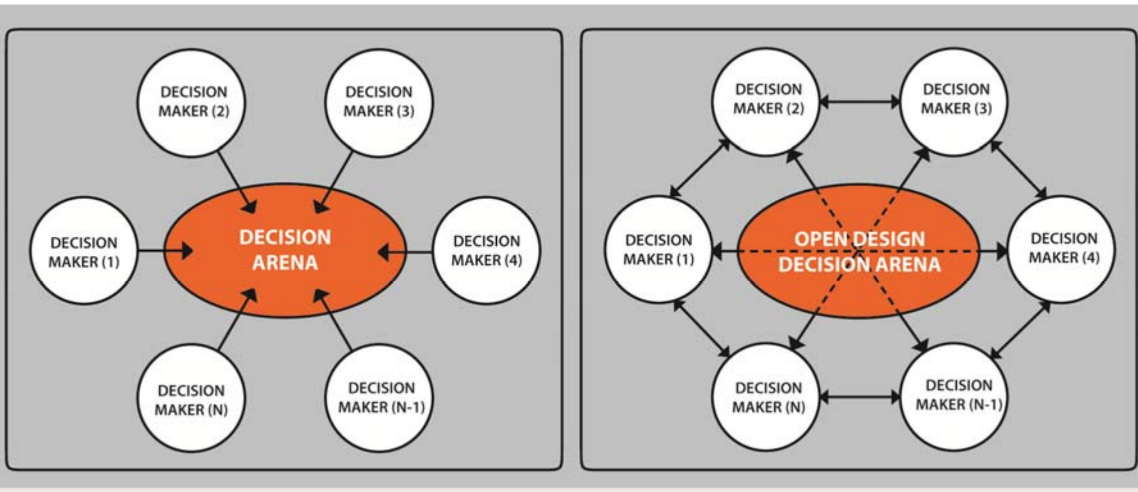


Figure 1.4: The Open Design-paradigm (Helmerhorst, 2007).

In his master thesis Helmerhorst (2007) illustrated the decision arena of the Open Design-paradigm. He described that in the concept of Open Design, any organization (which is represented by a decision maker) having an interest in the outcome of the design process can influence the design. Furthermore, the principle of an equally treatment of the decision makers in the decision arena is utilized, which means that powerless decision makers get the same 'rights' in the design process as powerful decision makers. As such, all decision makers collectively decide how the design will ultimately look, which in the context of the Olympic

Plan 2028 would concern the realization of the series of UAD projects. Because of that specific feature of Open Design, the decision support instruments for the SDR and the UDR have been developed on the foundations of Open Design.

1.6 Relevance of the research

In this paragraph the relevance of this research will be discussed, both from a scientific and a social perspective. The scientific relevance reflects the way in which the methodological-technological and instrumental approach that has been applied in this master thesis, might contribute to further development of theories. The social relevance of this master thesis indicates the importance of the research content in relation to the realization of the Olympic Plan 2028.

1.6.1 Scientific relevance

From the science field of Urban Area Development (UAD), this reserach will contribute to the applicability of methodological-technological and instrumental approaches for establishing spatial characteristics of (complex) UAD projects, in this case specific for the spatial content of the Olympic Plan 2028. The basis of these kinds of approaches is a set of design related norms and values, which are steered by the decision makers, possible alternatives concerning the spatial content of urban area development projects are established, so that spatial preconditions can be attached to these alternatives. Since the contents of the SDR and the UDR are different, in this research multiple decision support instruments have been designed.

1.6.2 Social relevance

The social relevance of this reserach would be the functionality of decision support instruments in the initiatory phase of UAD processes, in this case the UAD process of the realization of the Olympic Plan 2028. Because of this, already in the initiative phase spatial preconditions can be established concerning a series of (complex) UAD projects, which ultimately could be realized on diverse locations and in multifarious ways. The decision support instruments might improve decision making on the basis of the establishment of a relevant set of solutions (in the decision support instruments these are called alternatives), which enables the opportunity to steer on goal-orientated decision making in the initiatory phase of the process. Through the design of multiple decision support instruments, the spatial content of the Olympic Plan 2028 can be considered both from a national (top-down) as an urban (bottom-up) perspective. In decision arenas, relevant aspects of the spatial content of the Olympic Plan 2028 will be discussed by decision makers with expertise concerning these relevant aspects.

Eventually, through the use of the decision support models, the sub-processes in each decision arenas as well as the overall process might be improved. The improvement of the overall process is the result of the opportunity of cross-analyzing the relevant set of solutions over multiple arenas (top-down and bottom-up), so that the collective support for these solutions can be determined in an early stage of the UAD process. The content of this master thesis, therefore, might contribute to the decision making process concerning the spatial content of the Olympic Plan 2028.

1.7 Structure report

The chapters of this report have been subdivided into four parts, of which the mutual relation of these parts has been illustrated in figure 1.5. In order to comprehend the structure of this report, the positioning of chapters will be discussed in this paragraph. In part one, the context of this thesis will be discussed, which encompasses the introduction of the research (chapter one) and the theoretical framework (chapter two). The content of decision-making for the decision arenas that are elaborated in this master thesis, has been determined in part two, on the basis of Olympic developments and trends concerning the spatial content, both from an international (chapter 3), national (chapter 4) and an urban (chapter 5) perspective.

The spatial content for the realization of the Olympic Plan 2028 has been intensified in part 3, so that adequate features of the spatial content and technical requirements for the decision support instruments could be established. Part three, therefore, discusses the analyses that have been executed for this research. The first is about possible Olympic development strategies (chapter 6), the second is about features and requirements concerning the Olympic spatial content (chapter 7) and the third is about the status quo and the urban development strategy of a hypothetical Olympic candidate, which in this thesis is the case Rotterdam 2028 (chapter 8).

The information derived from part two and three, has been implemented in part four, where both the decision arenas (chapter 9) and the design of decision support instruments for those arenas (chapter 10 and 11) will be discussed. Subsequently, in the conclusion of this thesis, the functionality of the decision support instruments in the contemporary practice of the Dutch UAD process will be assessed.

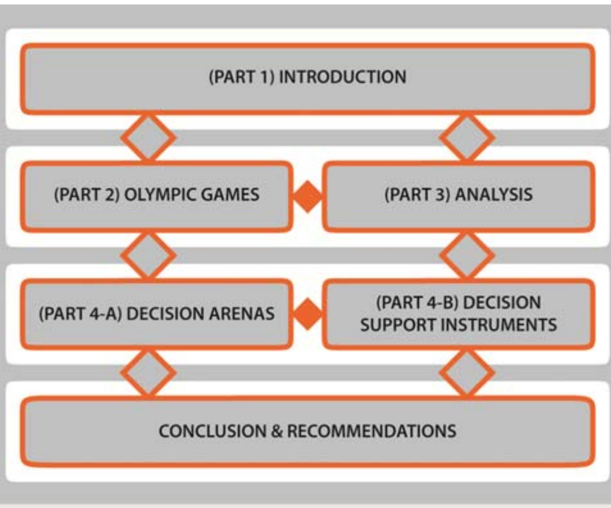


Figure 1.5: Schematic reproduction of the report structure.

Chapter 2: Scientific framework

In order to comprehend the content of this thesis, which is about the possibilities for the development of decision support instruments for UAD projects, in this chapter from the perspective of spatial planning (paragraph 2.1), urban area development (paragraph 2.2) and subsequently on the basis of a particular management approach (paragraph 2.3), the features of a decision support instrument that is used in the contemporary practice of urban area development, which is the Urban Decision Room (paragraph 2.5), will be explored. This scientific framework forms the basis of the content for this study: it has been employed for the positioning of the design of decision support instruments in the (complexity of the) contemporary practice of urban area development, the understanding of the Olympic spatial content, and for the establishment of decision arenas where the purposed instruments would possibly be put into operation.

2.1 Spatial planning

Spatial planning refers to the methods used by the public sector to influence the distribution of people and activities in spaces of various scales. According to Teisman (2001), spatial policy slowly changes from a policy that purposes controlling spatial planning, to a policy that purposes the development of high-quality areas. He mentioned that although the controlling of spatial planning through policy instruments, such as regional structure visions and the land use plans, is still in force, in spatial planning nowadays there is particularly spoken (in terms of strategic effort of public and private parties) about the ambition of the intensifying, mixture and transformation of urban areas.

These ambitions, which are joined in the term ‘plural use of areas’, can only be achieved through the adequate interaction of various actors that interfere in the process of spatial planning. Therefore, the new policy not only enlarges the role and responsibilities of the regional and local governments, it also paves the way for more involvement of citizens, private companies and actors in spatial planning (Vink and van der Burg, 2006). According to Teisman (2001), the success of achieving the ambitions of intensifying, mixture and transformation of urban areas depend for a large part on the quality of the decision making and the ability to of managing the process of decision making.

In order to manage these decision making processes concerning spatial planning, it is essential first to understand those in their full complexity and dynamics. As mentioned above, ‘plural use of areas’ could only be achieved through the adequate interaction of various actors that interfere in the process of spatial planning. Teisman (2001) made a distinction between three kinds of relations that actors will have to configure in order to complete these processes with valuable proposals:

(1) Interaction between governments;
(2) Interaction between citizens, directors and professionals, and
(3) Partnerships between public and private parties.

With the first kind of interaction Teisman meant the stimulation of the (limited) relations between the different governmental levels (national, regional, municipal), where also on each level various bodies are operating. Motifs for increasing the interaction between citizens, directors and professionals arise from (1) the need for an enlargement of support from citizens for a policy, (2) the aspire to an integrated policy, (3) the need for an enlargement of problem-solving ability through extra knowledge, expertise and creativity and (4) the need for the increase the quality through extra knowledge, expertise and creativity. The development of partnerships between public and private parties is essential in the ambition of achieving the ‘plural use of areas’, which will only be realized if that partnership would deliver surplus value for all actors involved.

2.2 Urban area development

Cities must continuously adapt to new social demands and needs, and therefore are constantly in transformation. Van‘t Verlaat (2007) described that if these cities wish to continue functioning successfully in the future, an active attitude is required. Urban management must be used to anticipate these (future) demands and needs. More often, in the Netherlands an integrated perspective for urban management (or spatial planning) is utilized, which is referred to as integrated urban area development (VROM et. al, 2009).

In a publication from the Real Estate & Housing-department of the University of Technology Delft, the increased interaction and the complexity of the contemporary practice of urban area (re)development has been discussed on the basis of a case study. In that publication urban area development (UAD) is defined as the active intervention by local authorities and other organizations in the physical environment (Bruil et. al, 2004). The authors of that publication indicated these spatial interventions concern restructuring (post-war residential areas, shopping centers, urban districts), renewal (former port areas, obsolete business areas), transformations (railway areas, campus areas, city centers) or the alteration of functions (living, working, education, shopping, infrastructure, etc.) in urban areas.

The partnership between public and private actors is an important condition for urban area development, since public and private interests intersect (VROM et. al, 2009). Moreover, in his Master City Developer thesis, Van Randeraat (2008) mentioned that the core of the complexity of urban area development lies in the multitude and diversity of actors and the interaction between those actors through various spatial scale levels. In order to comprehend the complexity of urban area development, Van't Verlaat (2007) distinguished, besides the already mentioned multitude of actors, five additional 'ingredients' of urban area development. With the determination of six 'ingredients', also the integrated character of urban area development is emphasized, the complete summary of 'ingredients' would be (Van't Verlaat, 2007):

(1) Context
(2) Content;
(3) Actors;
(4) Means;
(5) Process, and
(6) Process management.

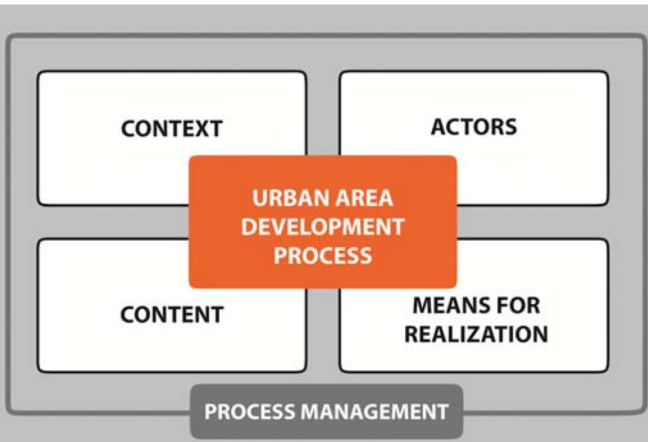


Figure 2.1: Schematic overview urban area development (Source: Van't Verlaat, 2007).

According to Van't Verlaat (2007), the context is determined by the contemporary developments (economic, social, geographical, etc.) and conditions (juridical administrative, technical, financial, political, etc.) in which these urban area developments take place. The content of urban area development focuses on creating spatial constellations wherein various functions (living, working, education, shopping, etc.) can be developed. The content of UAD moreover is focused on the relation of physical aspects of these functions with the technical, juridical, political, economical, demographical, ecological, social and cultural aspects. The actors are the multiplicity of parties that are involved in the urban area development, on multiple spatial scale levels, all with their individual interests (public or private) and roles. Without sufficient means, such as are financial means, available land, land policy instruments, knowledge and skills, UAD does not lead to the desired result. All of the above mentioned elements converge in the process of urban area development, which via adequate process management, must lead to the desired result.

2.3 Management approach

In 2002 De Leeuw published his book about the management of the primary process, strategies and organizations (In Dutch: Bedrijfskundig Management van het primaire process, strategie en organisatie). In that publication De Leeuw illustrated a conceptual system approach for controlling, steering and the processing of information. In that system approach, management is summarized as any type of controlled influence (steering). According to De Leeuw (2002), a system can be managed if, in the current environment and under the established goals, it is possible to find an effective steering intervention. Steering concerns all different ways of conducted (goal-orientated) influencing, which can be analyzed through representations and models (on the basis of the system approach). The situations that require management, in the process of UAD that are discussed in this study, have been illustrated on the basis of De Leeuw his system approach.

The success of management is closely related to the steering competence of the CU and the controllability of the CS. In order to achieve a conducted (goal-oriented) steering intervention, first the decision problem needs to be defined. De Leeuw (2002) described three necessary elements for the determination of the situation that will have to be managed:

(1) Specification of the goal (output);
(2) Specification of the system that has to be controlled (CS);
(3) Specification of the environmental characteristics (contextual influences).

De Leeuw outlined that the basis of steering is a controlling unit (CU) that controls the controlled system (CS). This configuration can be expanded by the introduction of the environment, in which the steering situation occurs. To be able to control, information from the controlled system and the environment is needed. Meta-controlling takes place if the CU is controlled by another CU and therefore would also become a CS; meta-controlling could be described as the controlling of the CU.

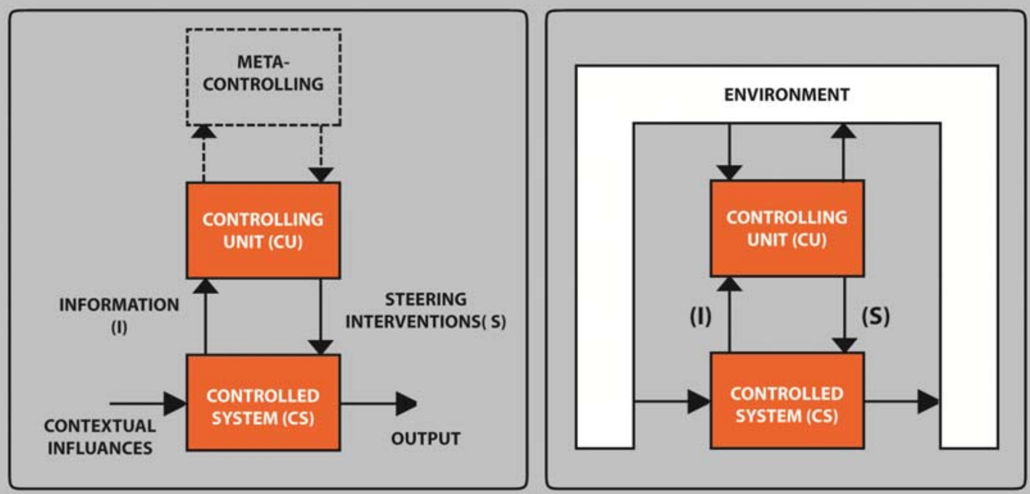


Figure 2.2: The CU/CS configuration (Source: De Leeuw, 2002, adapted).

The controlling unit (CU) could undertake steering interventions for both the controlled system (internal steering) and environment (external steering). De Leeuw (2002) distinguishes six kinds of management, which together constitute the sum of management measures. For each steering situation, there has to be decided which (combination of) management measures (steering mix) are required so that the concerning 'problem' can be tackled, these six management approaches are:

(1) Internal routine management, which is the manipulation with the steering variables (S);
(2) Internal adaptive management, which is the modification of the structure in the CU;
(3) Internal strategic (goal) management, which is the modification of the steering goals;

(4) External routine management would be the case if the environment is considered as the CU. Therefore in this way of steering, the structure and the goals of the CU are not influenced;
(5) External adaptive steering, which would be the aim for influencing the structure of the environment, so that the circumstances for the system will be improved;
(6) External strategic (goal) steering, which is the influencing of the goals in the environment.

The management approach of De Leeuw (2002) can be described as conceptual system approach, which allows conceptions to be transformed into representations and models for analyses and designs. In that approach, a system can be explored in multiple aggregation levels, which are mutually related. The black box is the lowest aggregation level (sub-system) in a consideration, and the interest is only focused on the relations of that sub-system with its environment, which are the input and output, and the relations between them. How these black boxes operate internal is less important, only the external relations with the other black boxes are relevant. The choice for an aggregation level, therefore, determines whether individuals, groups, departments or a whole organization is represented in a decision arena.

2.4 Pluricentric perspective

During the past decade, parties involved with urban area development projects, have been faced with changes in the way building designs and urban land-use plans are made and decisions relating to them are reached. Van Loon et. al (2008) described that various authors in the field of the decision-making process in the integrated development of urban areas, relate these to more structural societal changes, which are connected to an increasing complexity of societal decision-making and an enlargement of the social and economic dynamics in our highly-developed society. Van Loon et. al (2008) also indicated that the traditional, often hierarchical planning and decision-making methodology in urban area development has shifted to pluricentric decision arenas with multi-actor interaction planning, in which the mutual interdependency between the actors and the participating organizations, the uncertainty of the final outcome and ever-changing partnerships have resulted in a change in the steering role of the government, which used to be central in a hierarchical planning system, now being 'shared' with the other participating parties. The pluricentric perspective will also be the starting point for the decision arenas that have been established in this research. In order to understand the content of this thesis, a glossary of the most important terminology concerning pluricentric decision making have been illustrated in figure 2.4.

RESEARCH OBJECT	CONCEPT	DEFINITION
Unit of operation.	Actor.	Unit that will take up a identifiable position as a organization that can be influenced.
Context of operation.	Networks.	Patterns of relations between actors on policy fields, characterized by asymmetry.
Field of operation.	Policy arena.	Activated part of a network, containing mutual influancing positions that aim for interaction, interven-tion and stimulus.
Relation between the units of opetation.	Mutual interdependen-cies.	Necessity for interaction, arising from the possession of means in relation with stated objectives.
Structure of policy arena.	Positions, roles and role play.	A play with actors with dissimilar interests and specialisms.

Figure 9.2: Characteristics of scale of measurement (Source: Van Oel, 2007)

In his book 'Complex Decision making' (In Dutch: Complexe besluitvorming), Teisman (1998) outlined the pluricentric perspective on the basis of four characteristics, which are (1) the structure of policy arenas, (2) the policy in these arenas, (3) the policy making processes which lead to a policy and (4) the deployment of means. For the content of this thesis, it might be more suitable to replace the word 'policy' in the outlined characteristics below with 'decision(s)', since this thesis is about the decision making concerning the spatial content, rather than policy:

(1) In the pluricentric perspective, the policy arena adapts the structure of a network with mutual dependant actors. Actors will not achieve anything without common decision making;
(2) In the pluricentric perspective, there is supposed that policy is neither the merit of a central actor nor separate local actors. Not the intentions of these actors, but the result of the collective decision making forms the subject of decision making;
(3) In the pluricentric perspective, policy making is a multiplicity of sub-decisions concerning a specific subject. These sub-decisions will be made by one single actor, sometimes collective with the other actors. These different sub-decisions of actors influence each other mutual;
(4) In the pluricentric perspective, the subdivision of means causes such dependencies that various actors will have to mobilize their means in order to serve the common interest. Besides authority and financial means, also information, political support and legitimacy are essential.

2.5 Urban Decision Room

The facilitation of adequate interaction of various actors that are involved in the process of spatial planning (paragraph 2.1), the complexity of the contemporary practice of urban area (re)development (paragraph 2.2), the management perspective of De Leeuw (paragraph 2.3) and the pluricentric perspective in decision arenas (paragraph 2.4), converge in the Urban Decision Room (UDR). In a publication from the Real Estate & Housing-department of the University of Technology Delft, the development of the UDR as the new design and planning method has been outlined on the basis of an experiment for the urban redevelopment area Heijsehaven, which is a part of the Stadshavens area Rotterdam (Van Loon et. al, 2008). In this paragraph, the features the UDR will be discussed, so that the possibilities for the design of decision support instruments can be explored.

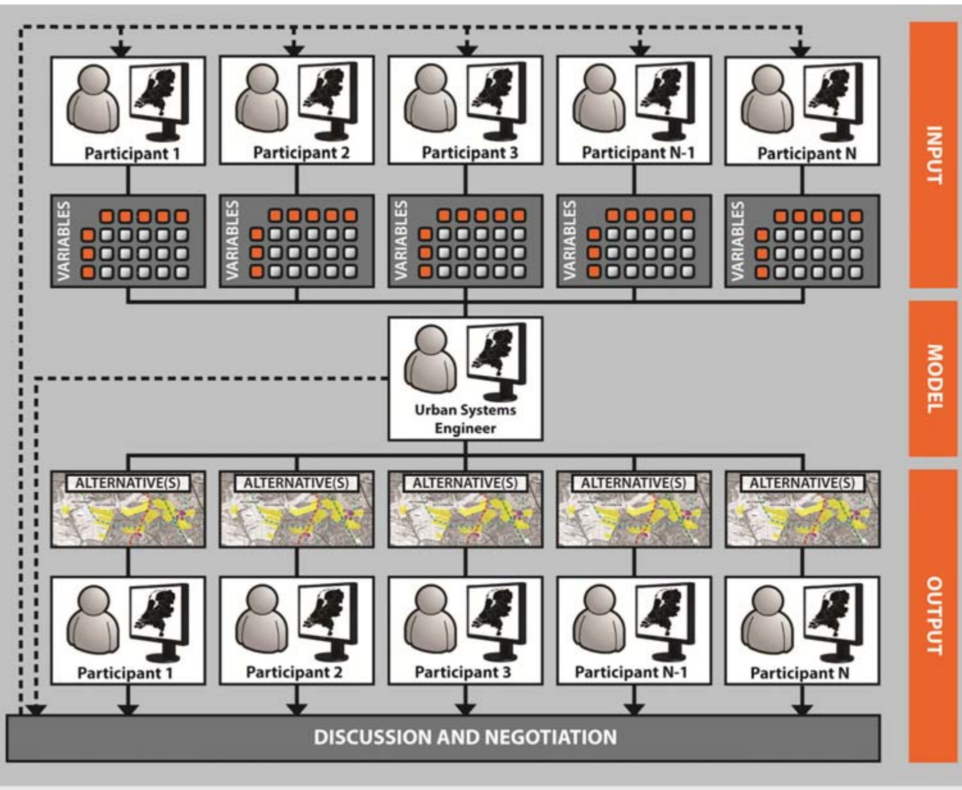


Figure 2.5: Diagrammatical representation of the UDR system (Source: Van Loon et. al, 2007)

According to the authors of that publication, which are Van Loon, Heurkens and Bronkhorst, an UDR basically is an interactive computer simulation system, a so called decision support instrument, which can be used simultaneously by more than one actor to simulate alternative outcomes of complex planning decisions. The model includes a decision-based representation of multi-actor urban design issues as well as a numerical/geometrical representation of the urban objects under consideration. The computational structure of a UDR consists of a network of a number of computers, each connected to the others, as well as to a central computer. The actors provide sub-solutions based on their own perspective to the 'decision problem at hand', as well as proposals for combinations of these sub-solutions, all as part of the route towards a joint plan. A repeated series of interactive planning proposals and decisions finally makes it possible to reach a group solution. During the process, the intermediate stages, options, and infeasibilities are projected in a visible way (using the central computer) on to screens readable to everyone. This enables the participants to see the information that they need, to enter into interactive discussions with the other parties, and to negotiate in order to come to a solution.

The five basic features used for the UDR-system are summarized below; subsequently the highlights of these features will be discussed briefly. For the complete inventory of the UDR-system features, the publication 'The Urban Decision Room' should be consulted; the five basic features of the UDR-system are (Van Loon et. al, 2008):

(1) The end-means system feature for representation of the relations in an interactive decision-making multi-actor network;
(2) The group optimization system feature for modeling the common dynamic solution space;
(3) The equal collaboration system feature for structuring mutual interdependencies;
(4) The pluricentric system feature for structuring the multi-actor decision-making process, and
(5) The methodological individualistic system feature for structuring an actor-driven operations process.

On the basis of the first feature, about using an end-means system, a direct link is made in the UDR system between the visions (possible, various, conflicting, etc.) and goals of the actors involved in relation to the substantial urban planning variables, the resources that are available (or can be made available) for them, and the exchange of visions on the solution and the associated negotiation process. This technological system linking of content and process-related aspects is one of the most important features of the UDR system and offers the opportunity of working interactively with the substantial urban planning relationships in complex area development projects. The actors are individual goal oriented and behave normatively (goal=norm). However, within this multi-actor network, the actors interact, propose individually based as well as group-based alternative sub-solutions and plans, and reach decisions either collaboratively, or in competition with each other. As a group they are goal searching.

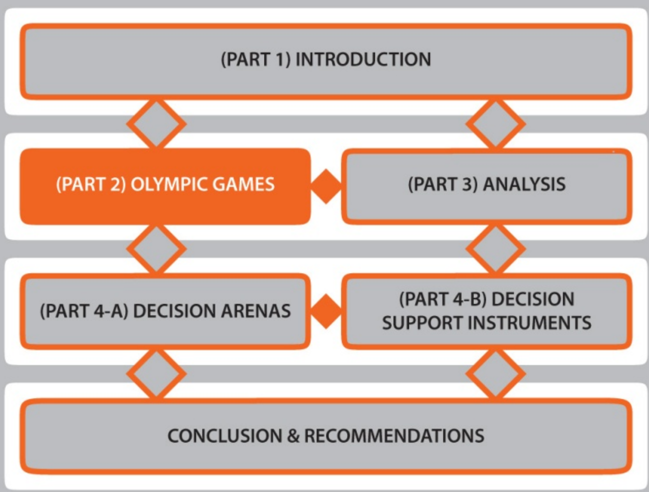
The second feature describes that with the UDR system, it will be possible to define and model a common solution space. The modeling of the common solution space is intended to give the actors insight into the feasibility of their own plans, given the boundaries of this space. The plans should in any case fall within these boundaries. The actors then, as part of the planning and negotiating process, look for the most optimal combinations of all their sub-solutions.

The first and second system features suppose that actors, or groups of actors, work together as equal partners in planning teams or urban planning projects. The reason for that is because private and public parties work increasingly closely together and have become mutually interdependent (Van Loon, 1998; Wigmans, 1998, 2003; Teisman, 2001). When situations occur in which an equal collaboration is not desired, the matrix can be structured in such a way that a hierarchy between actors comes about.

Van Loon and Heurkens (2008) indicated that urban planning is nowadays no longer a hierarchical and centrally driven affair, but more a non-hierarchical process. The mutual dependency that goes along with the inter-organizational and interactive nature in planning and design practice requires a scientific approach aimed at cohesion and interlinking disciplines. According to De Leeuw (2002), the form of management of the processes of negotiating and agreeing between actors where there is no explicit hierarchical leader, is also known as intrinsic management. In terms of the system approach (CU/CS-configuration), this would be the case if the CU and the CS partial converge, and therefore can also be seen as a self-controlling system. The fourth feature describes that there is no central management, but a series of pluricentric influential processes.

Both the network of actors (system feature 1) and the pluricentric decision-making structure (system feature 4) function as actor-driven operations processes. The fifth feature describes that a process of this type, is based on the actors' perspective of operating individually. According to Van Loon and Heurkens (2008) this states that every individual has different kinds of considerations as far as his preferences and decisions are concerned: not only his own interests (economic or otherwise), but also altruism, solidarity, social norms, etc. It also states that every individual will form his preferred structure straight away, in other words during interactions with others. This also implies that in the case of individuals who have to decide something, it cannot be predetermined whether something that on paper could be considered a dilemma between them will actually turn out to be so in practice. Conversely, it means that an apparently problem-free issue may well turn out to be a dilemma in practice (Pellikaan, 1994).

PART 2
OLYMPIC GAMES



Chapter 3: International perspective

In this chapter the Olympic Games will be positioned in an international context, where the contemporary development of globalization (paragraph 3.1), the main changes in patterns of the Games (paragraph 3.2) and the relation between sustainable development and Olympic legacy (paragraph 3.3), will be discussed.

3.1 Globalization

The speed of changes in developments (social, economic, geographical, etc.) has recently increased, due to the fast emergence of information and communication technology; this has been in conjunction with an equally fast evolving process of globalization (Van't Verlaat, 2007). As a consequence a global network of connected knowledge centers, economic processes, financial services provision, logistic junctions and recreational, amusement and cultural activities originated, which is often spoken of as the 'network society'.

Sociologist Manuel Castells (1996) described the changing concept of territory. Spaces are not only determined by their places, but also by their position and function within infinite networks, he calls this phenomenon the 'space of flows'. On the other hand he mentioned the 'space of places', which refers to the place-bound sense of authenticity of places, such as local and cultural characteristics. Because of the constantly moving information streams and means (flows), the urban context (places) became inferior (Heurkens, 2005). In the choice for a Dutch Olympic host city, therefore, criteria such as the history and image of a city (and their urban areas) became of a minor importance. Instead, flows of spaces, which are determined by the (current/ desired) position of these urban areas in global, national and urban networks, should obtain primary focus in the start-up of the Olympic UAD process.

Figure 3.1: Global, national and urban networks (Source: Wall, 2009, adapted).

Van't Verlaat (2007) described that city-marketing aims at promoting a positive image for the city, and in a somewhat broader sense, to increase the use of the city by certain target groups, which can be achieved through the facilitation of an attractive city climate, for businesses as well as residents and visitors. It is important that these users are attracted to an area and that existing users are kept within the city or region. Economic competitiveness is defined as 'a city's ability of creating more wealth in a faster and better manner than other cities in the world' (GUCP, 2010). The greater mobility and freedom of choice among these city users, through the globalization, moreover caused an increase of economic competitiveness within and between countries/ regions/ cities. The three preconditions which traditionally have been considered vital for economic competitiveness are (GUCP, 2010):

(1) Providing adequate infrastructure: e.g. transportation, ICT, water & sanitation, etc.;
(2) Improving public services: e.g. education, health, public security, housing, etc., and
(3) Reducing the cost of doing business: e.g., fast processing of new business licenses, tax incentives, labor laws, economic zones with special privileges, etc.

The organization of the Olympic Games enhances Olympic host cities and their regions with fundamental structural changes and therefore creates the possibility for contributing to the improvement of the first two preconditions for economic competiveness, as described above. According to Furrer (2002), the pursuit of hallmark events is an important strategy utilized by entrepreneurial governments to promote economic growth and to secure global investment. With city-marketing in Olympic perspective, therefore not only the world's attention during the Games, but also the improvement of the city's climate (residential and business) after the Games is meant, which both contribute to strengthen the city's economic competiveness.

3.2 New phase in Olympic UAD

Essex and Chalkley (2003) described several Olympic phases which, although they are a generalized model from which individual Games have sometimes deviated, describe the main patterns and changes of the spatial developments that are accompanied with the organization of the Games. Until the 1960s, as Olympic Games were relatively small-scale events, the organization of the Games involved only modest infrastructural investments, apart from the construction of sports venues themselves. Since 1960, the Games have involved large-scale urban transformations, which have acted as 'tools' of regional development. The notion of post-Olympic use of facilities and infrastructure nowadays appears as a significant criterion in the bidding process. According to Essex and Chalkley (2003), a new phase in the history of Olympic-related development might be heralded, wherein the issues of infrastructure and legacy became significant. In the process towards this new phase, four important moments are highlighted:

1994 Designation of 'environment', besides sport and culture, as the third Olympic pillar;
1999 Adoption of Agenda 21 of the Olympic Movement;
2002 Introduction of a new paragraph in Olympic Charter concerning Olympic legacy, and
2012 The (possible) start of a new phase for Olympic UAD.

In 1994 the IOC added `environment' as the third Olympic pillar to the existing pillars of sport and culture, and the Centennial Olympic Congress officially added the following to the Olympic Charter (IOC, 2007-B): 'the Olympic Games are held in conditions which demonstrate a responsible concern for environmental issues and encourage the Olympic Movement to demonstrate a responsible concern for environmental issues, takes measures to reflect such concern in its activities and educates all those connected with the Olympic Movement as to the importance of sustainable development'. This growing importance of sustainable development, subsequently, resulted in the implementation of the Olympic Movement Agenda 21. Agenda 21 establishes an action program, allowing members of the Olympic Movement to play an active part in promoting sustainable development, particularly in relation to sports activities. Concrete recommendations are given in the area of environmental sustainability such as the use of fewer non-renewable resources, the adoption of energy-saving solutions, the use of fewer dangerous products and the release of fewer pollutants into the air, water and soil, as well as the need for an environmental impact assessment to be conducted before and after the event. After the IOC Session in Mexico in 2002, a new paragraph in the Olympic Charter was included: rule 2.13 (IOC, 2007-B) states that the IOC should take measures to promote a positive legacy from the Olympic Games to the host city and the host country, including a reasonable control of the size and cost of the Olympic Games. In that new paragraph, all three fundamentals for sustainable urban development (figure 3.2) have been expressed for the first time. Since then, the IOC designated Olympic legacy as a priority in the staging of future Games, which should be reflecting in the candidature files of the Olympic candidate cities. According to Essex and Chalkley (2003), the introduction of Olympic legacy (possible) caused the demarcation of a new phase in the history of Olympic-related development.

3.3 Olympic legacy

In the context of long-term effects that are emanated through the development of Olympic facilities and infrastructure, often the term legacy is used. In his master thesis about legacy development, Bakker (2009) described the term legacy as 'the created movement and impact through the Olympic Games, which is turned into long-term benefits on a social, economical and environmental scale'. With these three scales he referred to the three-dimensional nature of sustainable urban development, which has been illustrated in figure 3.2. According to Furrer (2002), with sustainable development is meant the way of socio-economic development that would be financially balanced, socially equitable, and ethically responsible integrated in the long-term ecological balance of the natural environment. Furrer (2002) also states that the high concentration implied by the Games in time (a two-week event), in space (one host city only) and in investment (the operating and infrastructure costs of the Games are in the billions) seems largely to contradict the concepts of sustainable development, which encompasses the dispersion and sharing of environmental, social and economic impacts across time and space for the benefit of all. The Olympic Study Commission (IOC, 2003-B), therefore, emphasized Olympic cities maximizing temporary installations over permanent construction, especially where legacy requirements are lower than Games requirements.

Figure 3.2: A model of sustainable development (Source: IUCN, 2010, adapted).

During a symposium about Olympic legacy, the IOC (IOC, 2003-A) discussed the effects of the many aspects and dimensions legacy. In the conclusion and recommendations of that symposium, apart from its performance in terms of sustainable development, also a tangible part and intangible part of legacy was distinguished. Tangible aspects of Olympic legacy are architecture, urban planning and sports infrastructures. Intangible aspects are for example the production of ideas and cultural values, education, voluntarism, new sport practioners, experience and know-how (IOC, 2003-A). These intangible legacies also act as a motor for the tangible ones to develop a long-term legacy. Based on the input of the symposium, one of their recommendations for future OCOG's and bid cities was to establish post-Olympic planning, taking into consideration legacy in the context of sustainable development in all phases of the UAD process.

3.4 Conclusion

The greater mobility and freedom of choice among city users, through the worldwide globalization, caused an increase of economic competitiveness within and between countries, regions and cities. Economic competitiveness is defined as 'a city's ability of creating more wealth in a faster and better manner than other cities in the world' (GUCP, 2010). According to Furrer (2002), the pursuit of hallmark events is an important strategy utilized by entrepreneurial governments to promote economic growth and to secure global investment. In addition, when mentioning economic competiveness in the Olympic context, also the world's attention during the Games should be considered.

With the implementation of a new paragraph in the Olympic Charter, which states that the IOC should take measures to promote a positive legacy from the Olympic Games to the host city and the host country, including a reasonable control of the size and cost of the Olympic Games, all three fundamentals for sustainable urban development are expressed for the first time. Additionally, the Olympic Study Commission (IOC, 2003-B) emphasized that Olympic cities should maximize temporary installations over permanent construction especially where legacy requirements are lower than Games requirements, which is primarily related to the financial-economic dimension of sustainable development and should obtain primary focus in the start-up of the Olympic UAD process.

According to Essex and Chalkley (2003), as a result of the implementation of a new paragraph in the Olympic Charter, a new phase in the history of Olympic-related development might be heralded, wherein the issues of infrastructure and legacy became significant. Since the growing importance of Olympic legacy after 2002, this has been the main selection criterion for the analysis of Olympic candidate/host cities; therefore in chapter 6 and 7 the candidate cities of 2008, 2012 and 2016 have been analyzed.

Chapter 4: National perspective

The social relevance of the design of decision support instruments for multiple Olympic urban decision arenas will be expressed in this chapter: not only the Dutch ambition for organizing the Olympic Games (paragraph 4.1), but also the complexity of the issues of decision making concerning the spatial content of the Olympic Plan 2028 (paragraphs 4.2, 4.3 and 4.4), will be illustrated.

4.1 Olympic Plan 2028

The Olympic Plan 2028 is the mission to contribute with sports, in all possible ways, to improvement of the Netherlands so that the positive effects now and in the future will be noticeable, with the organization of the Olympic and Paralympic Games of 2028 in the Netherlands as inspiring perspective and possible result (Program Office OP 2028, 2009). The first phase of the Olympic plan initiated in 2006, with formulating ambitions and acquiring the national support by means of a public debate. According to the Program Office OP 2028 (2009), the Olympic Plan 2028 is a chain of interconnecting subprojects, which have all been centralized around eight ambitions concerning (1) the improvement of top-class sports, (2) enlarging the recreational sports, (3) the improvement social climate, (4) the improvement of the welfare of citizens, (5) the strengthening of the economical competitiveness, (6) the improvement of the spatial preconditions, (7) an increase of the organization of hallmark events and (8) the increased attention of media and communication for sports. A plan that purposes the overall improvement of the Netherlands to 'Olympic standards', where so many different aspects are interfacing and a plan with such a large impact on society, requires the cooperation of an alliance, in which parties are represented that are involved in the society, both with public as private interests. As mentioned earlier, the first phase of the Olympic Plan 2028 was initiated in 2006. The second phase started in 2009, where the realization of the ambitions obtains the primary focus. After that phase, which would be completed in 2016, there will be decided whether or not a Dutch Olympic bid for the Olympic and Paralympics Games of 2028 would be promising.

4.2 Spatial explorations for the Dutch Olympic Games

In 2008 the Dutch ministry of Housing, Spatial Planning & the Environment (in Dutch: VROM) published their first spatial exploration for the possible Dutch organisation of Olympic Games in the 'Schetsboek - Ruimte voor Olympische Plannen' (VROM et. al, 2008). This publication was the result of a four-session during workshop, where a research group of around the 60 professionals from the Dutch urban development and real estate development working fields were assembled. They indicated that the spatial preconditions that the Netherlands currently offer, primarily determine the objectives which will be purposed to achieve, through the realization of the Games. In the starting point for the approach of the exploration of possible spatial 'principals', therefore, a wide orientation in the determination of possible objectives has been considered.

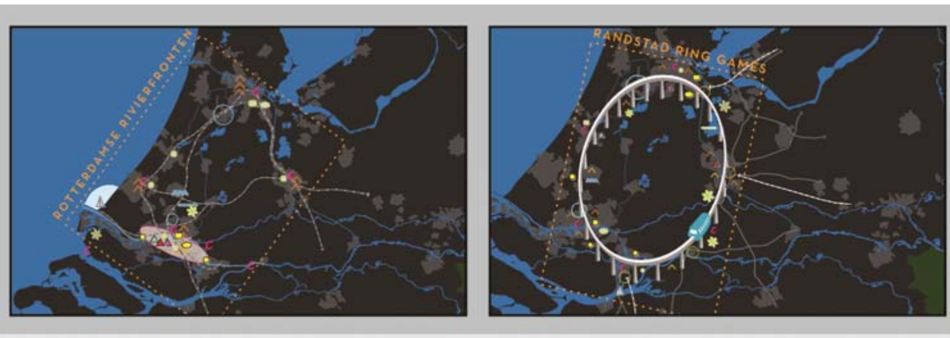


Figure 4.1: Olympic spatial explorations in the Netherlands (Source: VROM et. al, 2008).

The (possible) objective of emphasizing the Dutch (national) profile has been positioned opposed to the (possible) objective of introducing a new international image, and the (possible) objective of achieving a large economical efficiency has been has been opposed to the (possible) objective of organizing a event for the Dutch society. Within this frame of possible objectives and on the basis of different themes, subsequently, the possible spatial 'principals' have been explored. Each model (principle) shows the required spatial preconditions, illustrates where the most important accommodations will be located, explains how the mobility is organized, discusses where the Olympic village will be allocated, estimates what the existing accommodations (in 2028) would be and the indicates possibilities for a sustainable legacy. The research team concluded that, if both national as urban interests are considered and the decision making process wouldn't be decelerated, the Netherlands actually would offer the adequate spatial preconditions required for the organization of the Games.

4.3 Spatial preconditions candidate cities

In 2005 Heurkens completed his master thesis about the development of a multi actor decision-making model for the spatial development of the Olympic Games of 2028 in the Netherlands. The final result of that thesis contains a proposal for the management of the start-up of the Olympic UAD process for the cities of Amsterdam and Rotterdam. An essential spatial precondition mentioned in that report was that, based on current attainability features and future exploitation possibilities, the centre of Olympic activities for the Dutch Games would probably be in the one of these wings of the Randstad agglomeration, which is illustrated in figure 4.2. In that report, moreover, the general spatial preconditions for potential Olympic candidate cities have been indicated, which are (Heurkens, 2005):

(1) The precondition of a diversity of public transport systems (railway, subway, light-rail);
(2) The precondition of sufficient market support for the development of sports accommodations and congress centres (considering the post-Olympic use of these functions);
(3) The precondition of sufficient accommodation possibilities (hotels);
(4) The precondition of adequate international infrastructural connections (airport and high-speed rail connections), and
(5) The precondition of developing the Olympic urban areas with a large legacy purpose.

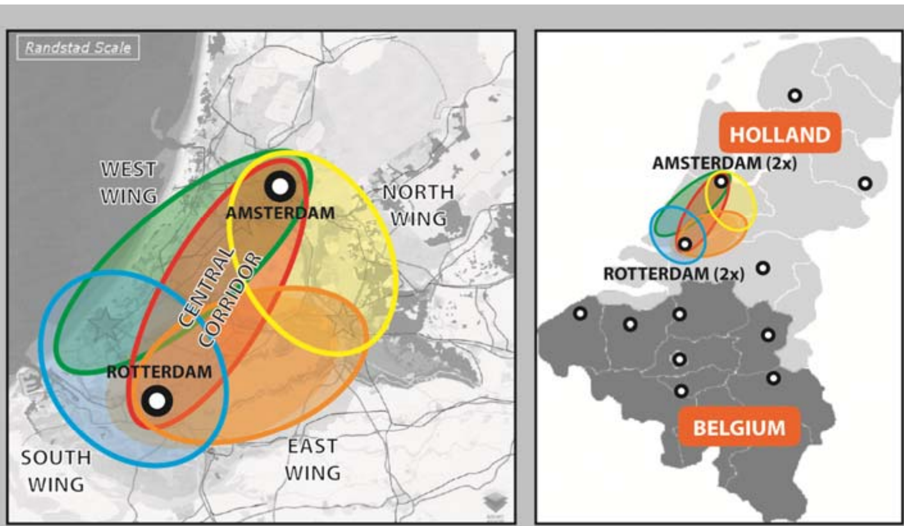


Figure 4.2: Subdivision of 'wings' in the Randstad-agglomeration (Source: Heurkens, 2005)
Figure 4.3: Differences in scale between the FIFA World Cup and the Olympic Games

4.4 FIFA World Cup

In April 2010, the Dutch administration stated their (financial) support for the organization of the FIFA World Cup in 2018 (or 2022), which would be a cooperation between the Netherlands and Belgium, and for that reason is also referred to as the 'Holland-Belgium bid' (Klink, 2010). The Dutch administration would finance a part of the expenditures related to the improvement of transport infrastructure the expansions of facilities (soccer stadiums). Although the scale of both events are different (figure 4.3), the support for the FIFA World Cup has been an important decision in the process towards overall improvement of the Netherlands to 'Olympic standards'. One of the ambitions described in the Olympic Plan 2028 would be the improvement of the image of the Netherlands, as a nation that is capable of organization hallmark events, such as the FIFA World Cup (Program Office OP 2028, 2009). The FIFA (2009), which is the international football association, emphasized that the infrastructure and facilities in the host country must be of the highest quality in order to fulfil the FIFA-requirements. Approximately 12 stadiums with minimum capacities of between 40.000 for group matches and 80.000 for the opening match and final are required, to host the FIFA World Cup. In addition, the very highest standards of TV broadcasting, information and telecommunications technology, transport and accommodation are an absolute must. To conclude, the FIFA World Cup could contribute to the improvement of the image of the Netherlands as a nation that is capable of organization hallmark events, as well as to the development or expansion of transport infrastructure and sports accommodations.

4.5 Conclusion

The Olympic Plan 2028 is the mission to contribute with sports, in all possible ways, to improvement of the Netherlands so that the positive effects now and in the future will be noticeable, with the organization of the Olympic and Paralympic Games of 2028 in the Netherlands as inspiring perspective and possible result, (Program Office OP 2028, 2009). The FIFA World Cup might contribute to achieve that ultimate result, through the improvement of the image of the Netherlands as a nation that is capable of organization hallmark events, as well as to the development or expansion of transport infrastructure and sports accommodations.

In 2008, VROM concluded that, if both national as urban interests are considered and the decision making process wouldn't be decelerated, the Netherlands actually would offer the adequate spatial preconditions required for the organization of the Games. The general spatial preconditions for potential Olympic candidate cities, which are also relevant issues to be discussed in the SDR and the UDR, concern sufficient public transport systems, the market support, the accommodation possibilities, the international infrastructural connections and the possibilities for the development of Olympic urban areas with a large legacy purpose (Heurkens, 2005).

Chapter 5: Urban perspective

In this chapter, the integrated character of Olympic UAD will be illustrated by means of the six 'ingredients' of urban development that have determined by Van't Verlaat (2007), which are the context (paragraph 5.1), content (paragraph 5.2), actors (paragraph 5.3), means (paragraph 5.4), process (paragraph 5.5) and process management (paragraph 5.6).

5.1 Context

Depending on the social developments (paragraph 5.1.1), the policy context (paragraph 5.1.2) and various other peripheral conditions, the spatial interventions (physical and functional mutations) for UAD are specified.

5.1.1 Social developments

Social developments are an integral part of the context, insofar as they are relevant for the UAD. An example of social-cultural developments in relation to the Olympic Plan 2028 would be the mission to contribute with sports, in all possible ways, which leads to the reinforced demand for (high class) sports accommodations. Another example of social developments in relation to the Olympic Plan 2028 would be the deterioration of the diversity and quality of the supply of residents in obsolete residential areas, which could be countered through the redevelopment and transformation of these areas with the development of the Olympic village. Robert and Sykes (2000) described urban regeneration and urban renewal in Olympic Cities, as a comprehensive integrated vision which leads to the resolution of urban problems and which seeks to bring about lasting change in the social, economic, physical and environmental condition of an area that has been the subject of change.

5.1.2 Political context

Until July 2008, when the Dutch new Spatial Planning Act (VROM, 2010) came into force, steering of the central government of the Netherlands on the spatial planning occurred top-down, by means of 'Central Spatial Planning Decisions' (Dutch: 'Planologische Kernbeslissingen'), an example of such a policy document is the National Spatial Strategy (Dutch: 'Nota Ruimte'). Since the introduction of the new Spatial Planning Act, governments are planning their spatial policy more collaborative. Nowadays, they steer through the publications of integrated Structural Visions, which are policy documents that are established through a joined contribution from national, provincial and municipal authorities. The National Spatial Strategy, which is established in 2006, contains the government's views on the spatial development of the Netherlands and the most important objectives associated with that development (VROM, 2006). The strategy represents the contribution of national spatial planning to a strong economy, a safe and livable society and an attractive country. For the determination of the criteria for the preference measurement model (chapter 10), the National Spatial Strategy 2006 has been consulted.

Central Spatial Planning Decisions form the foundations for the elaboration of urban development strategies. The choices and priorities in the urban development strategy of e.g. Rotterdam, regarding the strengthening of the international position of the Randstad agglomeration, are in strong coherence with the decisions that the central government of the Netherlands made in the National Spatial Strategy 2006 (Municipality Rotterdam, 2007). The urban development strategy of Rotterdam, which is called the 'Stadsvisie Rotterdam', describes the urban vision of the city of Rotterdam until 2030 (Municipality Rotterdam, 2007). It contains a survey of concrete plans the local authorities intend to carry out. In chapter 11, the incorporation of the 'Stadsvisie Rotterdam' into the allocation model, will be discussed further. To conclude, the intended spatial policy at city level creates a particularly important point of departure concerning the urban development for a specific urban area. Therefore, in the start-up of the process, it is important to explore the possibilities for the integration of the Olympic content in the urban development strategy for the potential Olympic host city.

5.2 Content

The size of the Games has become such that many emerging countries do not have or cannot afford the infrastructure to host such an event. The IOC Olympic Games Study Commission (IOC, 2003-B) recognized the need to review the scale of the event.

According to the commission, during their research, the Games already reached a critical size, where the Games could discourage many cities from bidding to host the Games. Therefore, the IOC decided to limit the number of sports, events and participating athletes, a decision which should allow better control of the size and cost of staging the Games (Furrer, 2002). In their comparative analysis of host cities, Essex and Chalkley (1999) emphasized that not all cities are suitable to host the Games, which depends primarily on the amount of investment needed to bring the city infrastructure up to Olympic standards and whether such investments are in line with the city's needs and its long-term urban development plans.

Ultimately, the OCOG's are responsible for the coordination and realization of the spatial content, required for the organisation of the Olympic Games. The IOC-requirements are described in several Technical Manuals (2005-C, 2007-A) and the Olympic Charter (IOC-2007-B). These documents are translated into criteria in the Candidate Procedure and Questionnaire File, and are need to be filled in by candidate cities during the bidding process: Olympic candidates elaborate their Olympic vision for the organisation of the Olympic Games in political, environmental, legal, commercial, financial, spatial, and operational terms (IOC 2001, 2005-B & 2009-A). The IOC-questionnaire distinguishes, among other things, four subcategories, which are:

(1) Training and competition venues (specific stadiums, complexes, indoor halls and landscapes);
(2) The Olympic village (accommodating athletes and team officials);
(3) The Olympic accommodations (media villages, hotels & alternative accommodations), and
(4) The IBC/MPC (International Broadcast Centre/Main Press Centre, providing facilities for media).

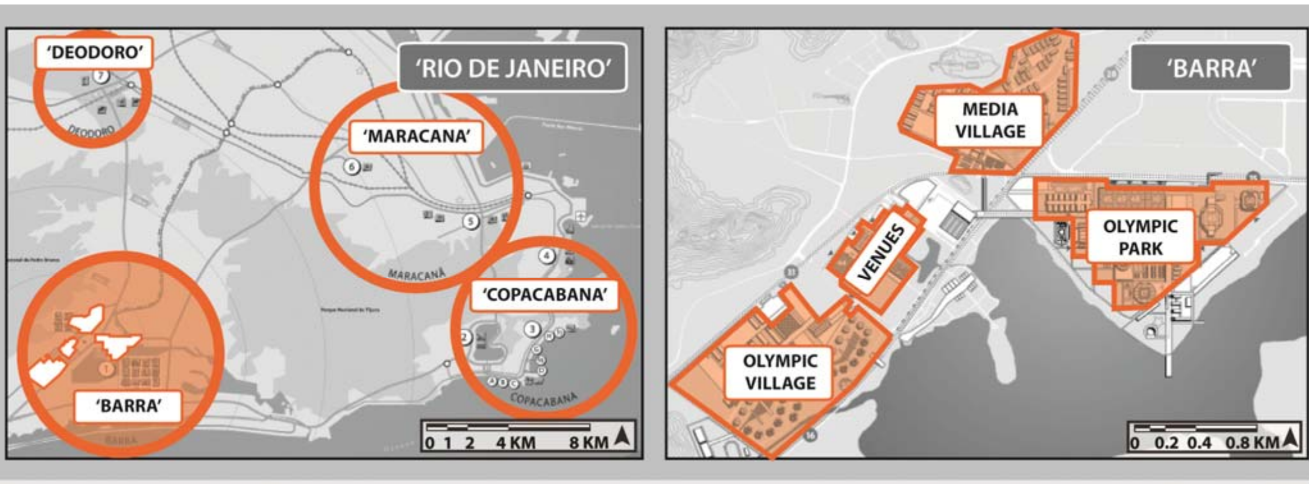


Figure 5.1: Complete venue distribution (left) & the 'Barra'-cluster (right) Rio de Janeiro 2016 Games (Source: ROCOG, 2009, adapted).

In the questionnaire also the mobility preconditions concerning the transportation of Olympic athletes and Olympic spectators between those Olympic venues are being discussed. For the IOC Candidature Acceptance Working Group, the location of the Olympic village in relation to the competition venues is crucial. Therefore the village often is developed near (or in) the Olympic Park. The working group 'prefers' that the Olympic Village is allocated close to the main Olympic stadium or a nucleus of competition venues, they require a maximum travelling distance of 50 km or traveling time of 1 hour (IOC, 2007-A). Huijsmans (2005) described in her Master Thesis 'The Olympic Games in the Delta Metropolis' (Dutch: De Olympische Spelen in de Deltametropool) the following categories of competition venues:

(1) Specific stadiums (Olympic Stadium, Football Stadiums, Velodrome, etc.);
(2) Complexes (Hockey complex, Tennis complex, Aquatics complex, etc.);
(3) Indoor halls (Gymnastics, Basketball, Volleyball, Handball, Judo, etc.), and
(4) Landscapes (Equestrian, Rowing, Marathon, Sailing, etc.).

The development of Olympic sports venues concerns the preparation of 31-35 competition venues. Previous Olympic Games often showed the mismatch between the Olympic requirements and the host city's long-term needs: these cities are ending up with venues that are not being used. The suitability of venue distribution and concentration, therefore, must be given high priority in the conceptualization of an event the size of an Olympic Games in order to guarantee that future needs of the city residents are met (Furrer, 2002).

5.3 Actors

According to Van't Verlaat (2007), UAD is not just a content-related compilation of various elements, but it is also the playfield of a multiplicity of actors who influence the processes involved in UAD. Many actors are involved in UAD, with very diverse interests, specialisms and roles, which add significantly to the complexity of UAD. According to Bruil (2004), actors that are involved in UAD could be divided based on their difference in spatial scale levels. She described that some actors are more orientated on the use of areas and buildings (mainly private sector) and that other actors approach the UAD primarily from the perspective of their policy (public sector). If we translate the subdivision of Bruil (2004) into the content of this thesis, we define the first group as the decision makers that are involved in the determination of the market quality (future exploitation). The second group actors are the decision makers that are involved in the translation of policy objectives into spatial planning.

5.3.1 Market quality

Since the Games only last for 26 days, in the context of UAD, the use of Olympic venues after the Games is significant. Van't Verlaat (2005) described that 'market quality' refers to the degree in which the area answers to the demands and desires that are imposed by the future users of the area. Through the globalization, as described in paragraph 3.1, the importance of the market quality is increasing, because of the growing economic competitiveness between areas, cities and regions.

Important actors in the determination of the market quality of UADs are developers, investors, housing corporations and municipalities. Private project developers create projects for the market, at their own expense and risk. Their role mostly concerns the developments of buildings and thus relatively short-term financial risks. According to Van't Verlaat (2007), within the domain of developers, there can be identified many variants, including a range of combinations with investors, builders, and banks. Moreover, the developers tend to specialize in a certain sector, such as housing developers, retail developers. Other important actors are the investors, of which their aim is to gain a solid return on their long-term investment. Their investment in real estate is only one element within the overall framework of their core business, which are activities concerning the management of e.g. pension or insurance funds.

In recent years, the role of the corporations has drastically changed because of the self-dependency of corporations (Van't Verlaat, 2007). This caused a shift in the national housing strategy, from a traditional government steered (public) towards the current market steered house-construction (private). As a result of that, corporations became semi-public parties in UAD, and therefore must also increasingly focus on the feasibility of their plans. This 'new' approach of the corporations corresponds with the aim of determining the market quality of the Olympic spatial content, which in the case of corporations concerns the market quality for the development of residents (Olympic and media villages).

5.3.2 Spatial and urban policy

The role of governments (national, provincial and urban) in the Olympic UAD process concerns the translation of a spatial policy and an urban policy into characteristics for spatial planning. The relevance of their involvement lies, besides serving the public interest, in the financial involvement of national, provincial and municipal governments in large scale UAD projects. According to Van't Verlaat (2007), higher authorities, such as national and provincial governments, can moreover be involved financially in actual area developments, for example in the case of larger area developments with a supra-local interest. This may occur if subsidies are granted, which is especially common for the so called 'key-projects', such as e.g. the organization of the Olympic Games. If multiple ministries are involved, then extra attention is demanded in the form of mutual attuning.

The municipality's responsibility in the UAD process concerns the determination of the spatial boundaries (based on their urban development strategy) and moreover their financial involvement. Additionally, in a further stage of the process they will also have an important role in juridical aspect of the UAD process. According to Van't Verlaat (2007), the municipality has a role to play in public law (zoning plans, building permits, etc), subsequently the municipality can also play an important part in private law, when an approach for municipal land development is pursued (also called active land policy).

5.4 Means

In the UAD context, means often relate to finances, but it could also refer to other production factors such as manpower, knowledge, land and proper land policy instruments, which can be used to realize the development of an urban area. Hallmark events, such as the Olympic Games and the FIFA World Cup, have often provided an opportunity to mobilize substantial public and private investments (Furrer, 2002).

The OCOG budget is composed by revenues, gathered through the sale of broadcast rights, sponsorship, ticketing and licensing, meaning that the strictly operating costs during the Games are thus provided for (IOC, 2005), which according to Zimbalist (2010) now reaches averages in the between the 4 and 5 billion US-dollars. Zimbalist also indicated that the OCOG budget covers the operating costs of hosting the games, including e.g. the opening and award ceremonies, transportation of the athletes to the various venues, entertainment, a telecommunications/broadcasting center and security. But there is also a potential downside, resulting from possible cost overruns, poor land use, inadequate planning, and underutilized facilities, since many facilities built especially for the Games go un- or underutilized after the event. Due the growth of the event, the greater part of previous Olympic Games showed a major liability afterwards. The Barcelona Olympics left the central Spanish government $4 billion in debt, and the city and provincial governments an additional $2.1 billion in the red. In Athens, public investment exceeded $10 billion, and in Beijing, more than $40 billion (Zimbalist, 2010).

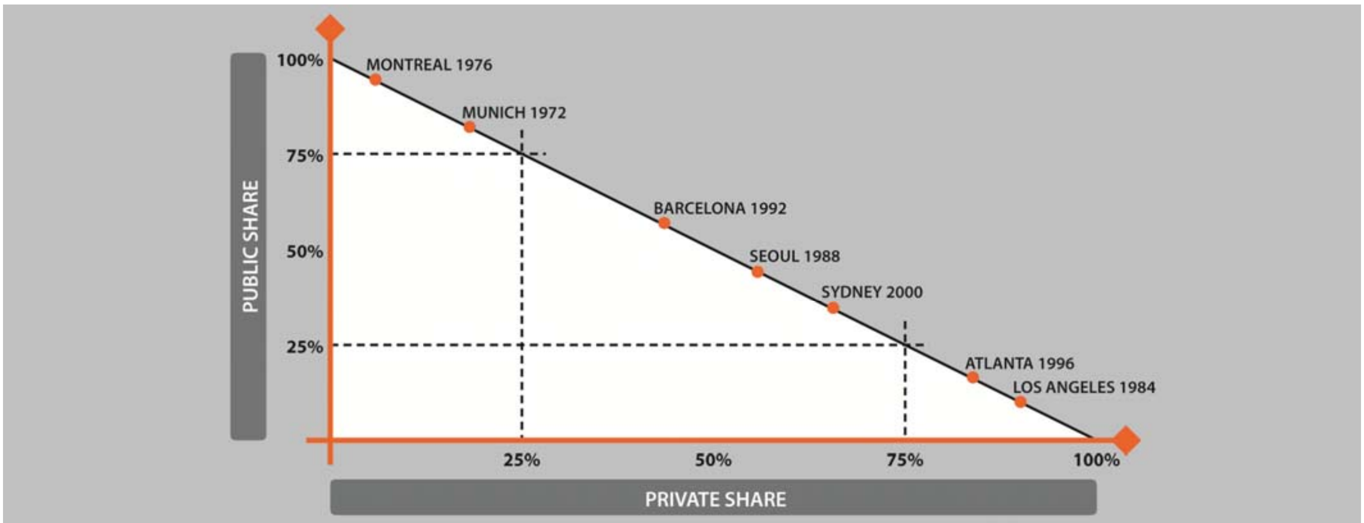


Figure 5.2: Public and private investments in Olympic Summer Games (Source: Preuss, 2004).

In his book 'The Economics of Staging the Olympics', Preuss (2004) analyses the most important issues surrounding the hosting of the Olympics, and its wider economic effects on the basis of a comparison of previous Games (1972 – 2008). He indicated that there are four bodies that can be involved in the financing of the Games: (1) Governments of the host countries, (2) Region/ province/ federal state, (3) City/ community and (4) The private sector economy. These different bodies are the basis for the diagram in figure 5.2. All means provided by the government, the province and the city are accumulated, forming the public share in the financing of the Olympic Games, all means that originate from privately owned corporations form the private share (Preuss, 2004). Figure 5.2 reveals that the financing of the Munich 1972 and Montreal 1976 Games was public, that of Seoul 1988, Barcelona 1992 and Sydney 2000 was mixed and that of Los Angeles 1984 and Atlanta was private. The Los Angeles OCOG generated a modest surplus of just over $300 million, through less money spent on construction and the selling of sponsorships to corporations, which caused a reset of the Olympic financial model for less public and more private financing (commercializing of the Games). According to Boersma, (2009), for the Los Angeles 1984 Games, already 17 of the required 23 already existed; therefore, only 6 competition venues had to be constructed, of which the Aquatics complex (by McDonalds) and the Velodrome (by 7-Eleven) were completely financed by the private sector.

Where costs between host cities will differ is with regards to what facilities and infrastructure already exists and what needs to be developed (IOC, 2005-A). These facilities include the construction and upgrading of the competition venues, accommodations for athletes and visitors and facilities for the media. Furthermore, the extent to which an OCOG will have to invoke financial resources, and the proportions between the public and private share of those financial resources, is determined by the public goals (for example urban revitalization or better public transport systems) that the government, the province and the city purpose to achieve through the realization of the Olympic Games.

5.5 Process

The context, content, actors and means converge all in the process, which evolves through various phases: from initiatory and urban planning towards realization, followed by a management phase, and again (sometimes many decennia later, sometimes significantly earlier) followed by redevelopment, after which the process repeats itself.

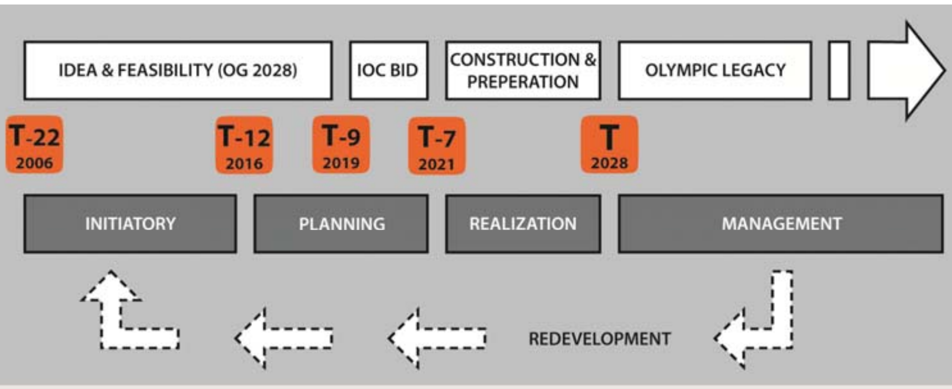


Figure 5.3: Phasing the Olympics economic activities (Source: Preuss, 2004) and the Olympic UAD.

5.5.1 Phasing of the Olympic Games

In figure 5.3, two parallel phasing schemes are reproduced. The one above describes the phasing of the Olympics based on economic activities (Preuss, 2004), and the one below is based on the UAD process. According to Preuss (2004), the UAD process of a project with the size of the Games should be set in a time span of at least 20 year. The IOC-bid phase (2 years) and the construction and realization phase (7 years) are fixed. The idea & feasibility phase could take much longer. The Netherlands for instance, initiated their 'Olympic Plan 2028' in 2006. Often cities had to bid twice before they won, which would mean that they had to get through the IOC bid phase more than one time. The IOC bid phase is split in two stages and takes nearly two years. According to Preuss (2004) the first year is called the 'applicant stage' which is used by the IOC to evaluate the physical structure of cities. The second year is called the 'candidature stage' and is a rather political phase, which ends with a secret ballot of the Olympic city by all IOC members. Seven years before the Games, the IOC will announce the host city for the concerning edition. This means after that, there are only seven years left for construction and preparation of the organization of the Games.

As discussed earlier, examples showing host cities ending up with venues and urban areas that are not being used, which indicates the discrepancy between the IOC requirements and the local needs. According to Furrer (2002), therefore, the suitability of the venue distribution competition venues and other accommodations (Olympic & Media villages) must be given high priority, starting in the initiatory phase (idea and feasibility).

5.5.2 Completion of the initiative phase

Another interesting aspect about the phasing scheme is the initiative phase of the UAD process, which should be completed during the idea & feasibility phase. In the case of the Olympic Plan 2028 that would be in 2016, when the Olympic alliance will assess the (spatial) possibilities for a Dutch Olympic candidature. According to Van't Verlaat (2007), the decision-making in the initiative phase involve the determination of the ambition of the UAD. The ambition level is, among other influences, the result of the context and the positioning of the urban area, as it is desired in the future. Therefore, after the completion of the initiative phase, it is imperative also to determine the Olympic development locations and to establish an estimate of the development program (ambition).

5.6 Process management

According to Van't Verlaat (2007) process management is closely linked to the way in which decision-making takes place. The chosen form of decision-making can sometimes be a restraining factor on UAD, which becomes even more significant when area developments posses a higher level of integration of functions and therefore interests. As indicated in the previous paragraphs, in the context of the Olympic Plan 2028, with the multiplicity of interests, this would certainly be the case. But how is it possible to manage such a complex process, in which the interests of so many actors are involved?

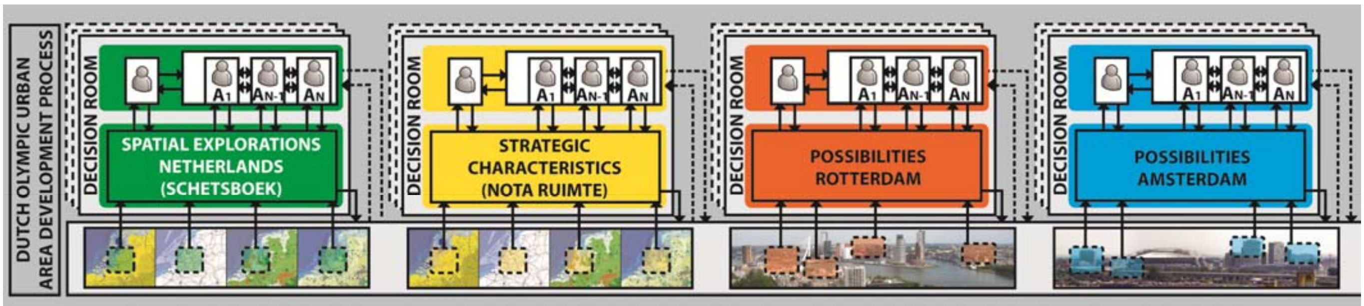


Figure 5.4: Olympic decision arenas for the realization of the Olympic Plan 2028.

The management approach of De Leeuw (2002) has been the basis for structuring the complex decision making process concerning the realization of the Olympic Plan 2028. De Leeuw outlined that the basis of steering is a controlling unit (decision makers) that controls the controlled system (spatial features Olympic Plan 2028). This configuration can be expanded by the introduction of the environment (initiative phase of the Dutch Olympic UAD process), in which the steering situations occur. In this research, therefore, the management of the Olympic UAD process could be considered as a series of decision arenas, where in each arena specific aspects of the spatial content will be discussed by actors with expertise concerning those specific aspects and, moreover, with an interest in the ultimate realization of the Olympic Plan 2028. In this approach, the (spatial) possibilities for a Dutch Olympic candidature will be established on the basis of the output of various decision arenas. The essential content to be discussed in the Olympic decision arenas has been derived from previous chapters and is summarized below, both for the national (N1-N3) as the urban (U1-U3) spatial scale level:

(N-1) By means of Central Spatial Planning Decisions (e.g. 'Nota Ruimte'), it is possible to steer top-down on spatial planning (paragraph 5.1.2);
(N-2) Higher authorities, such as national and provincial governments, can be involved financially in actual area developments, for example in the case of larger area developments with a supra-local interest (5.3.2);
(N-3) If multiple ministries are involved, then extra attention is demanded in the form of mutual attuning (5.3.2).
(U-1) Olympic cities should maximize temporary installations over permanent construction especially where legacy requirements are lower than Games requirements, which is primarily related to the financial-economic dimension of sustainable development (paragraph 3.3);
(U-2) The preconditions that potential Olympic candidate cities should offer regard public transport systems, market support, accommodation possibilities, international infrastructural connections and the possibilities for the development of Olympic urban areas with a large legacy purpose (paragraph 4.3), and
(U-3) Where costs between host cities will differ is with regards to what facilities and infrastructure already exists, and the public goals that the government/ province/ city purpose to achieve through the realization of the Olympic Games (paragraph 5.4).

To conclude, the relevant issues in the SDR would be the determination of the strategic characteristics of the spatial content of the Olympic Plan 2028, on the basis of the purposed objectives of the central government, which are described in the 'Nota Ruimte'. Relevant issues to be discussed in the UDR would be the determination of spatial preconditions that potential urban areas would offer (spatial features and mobility features), the determination of objectives that decision makers purpose to achieve through the realization of the Olympic Plan 2028 (integration Olympic spatial content into the urban development strategy), and the determination of the willingness of the market parties to develop the spatial content of the Olympic Plan 2028 (financial-economic dimension of sustainable development).

5.7 Conclusion

The core of the complexity of UAD processes lies in the integration of the content, actors, content and means. In figure 5.5 the most important themes are determined for the context in which the Olympic Games would take place, the actors that would be involved in the process, the diversity and the large scale of the content of the Games and the required availability of the means, for realization of the Games. These themes will be further discussed in other paragraphs in this research.

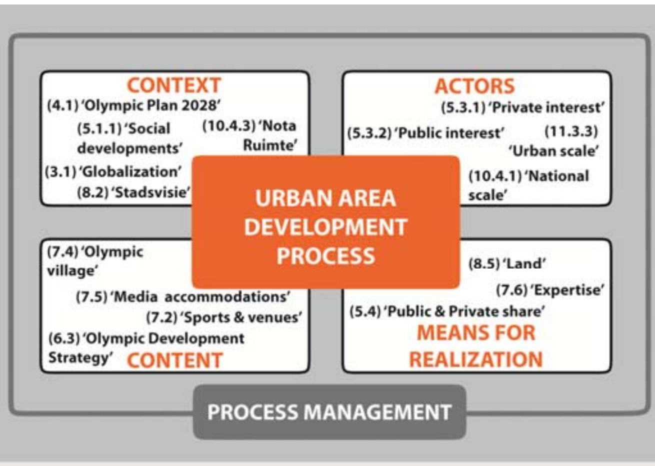
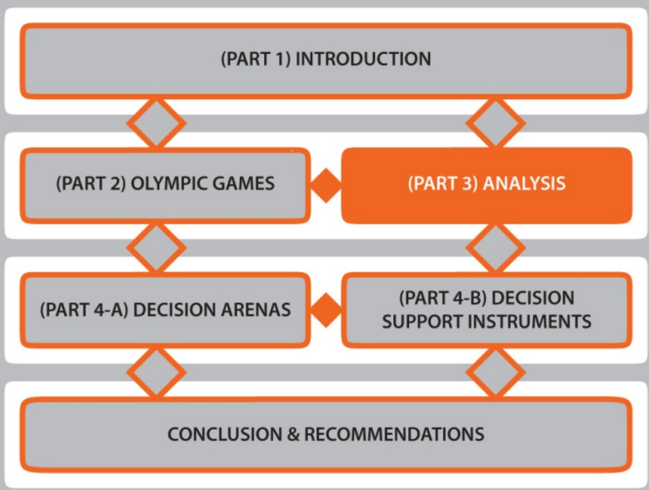


Figure 5.5: Urban area development in an Olympic perspective.

Based on the theory of De Leeuw (2002), in this thesis, the management of the Olympic UAD process could be considered as a series of decision arenas, where in each arena specific aspects of the spatial content will be discussed by actors with expertise concerning those specific aspects and, moreover, with an interest in the ultimate realization of the Olympic Plan 2028. Relevant issues on a national scale level would be the determination of the strategic characteristics of the spatial content of the Olympic Plan 2028, on the basis of the 'Nota Ruimte'. Relevant issues to be discussed on a urban scale level would be the determination of spatial preconditions that potential urban areas would offer, the determination of objectives that decision makers purpose to achieve through the realization of the Olympic Plan 2028, and the determination of the willingness of the market parties to develop the spatial content of the Olympic Plan 2028. In this approach, the (spatial) possibilities for a Dutch Olympic candidature will be established on the basis of the output of various decision arenas, both on a national as urban scale.

PART 3

ANALYSIS



Chapter 6: Olympic development strategies

6.1 Introduction

The analysis discussed in this chapter is about the distinction of Olympic development strategies and, moreover, about the determination of their strategic characteristics. Through the determination of these strategies and their characteristics, it will be possible for the decision makers in the SDR to comprehend the possible Olympic spatial objectives that underlie to these strategies. Because of the growing importance of Olympic legacy after 2002, which has already been discussed in chapter 3, only the strategic characteristics of the Olympic candidate cities of 2008, 2012 and 2016 have are analyzed. Twelve of the fourteen Olympic candidate cities of 2008, 2012 and 2016 have been studied in this analysis (four candidates in 2008, five candidates in 2012, and three candidates in 2016). Paris (2008 and 2012) and Madrid (2012 and 2016) both were involved in two candidature procedures; therefore their proposals have been studied only once.

6.2 Variables for typologies

Typologies, which in this analysis are the Olympic development strategies, consist of sets of categories created by the intersection of multiple variables. The strategic characteristics of the candidate cities have been analyzed based on three variables, which are the essential components in IOC-questionnaires for Olympic candidate cities; sports and venues, the Olympic village and transport (infrastructure). In figure 6.1, the full scheme of Olympic development strategies, including their strategic characteristics for the development of sports & venues, the Olympic village and transport (infrastructure) have been illustrated. In the next paragraphs each of the follwiing Olympic development strategy will be discussed:

ODS 1: Olympic Redevelopment;
ODS 2: Olympic Urban Expansion;
ODS 3: Strategic Olympic Clusters, and
ODS 4: Olympic Venue Scattering.

The strategies are divided in two categories, the urban and the regional approach. The difference between these two is related to the distribution of the competition venues: for the principles of ODS 1 and ODS 2, urban objectives have been guiding (redevelopment of an area or the development/expansion of a new/existing urban center). For ODS 3 and ODS 4, regional objectives were guiding (stimulate multiple promising areas in the region or improving the transportation between multiple clusters).

	URBAN APPROACH - MAIN CLUSTER Olympic development strategies with the maiority of Olympic activities in only one main cluster.		**REGIONAL APPROACH - MULTIPLE CLUSTERS** Olympic development strategies with a balanced dissemination of Olympic activities over multiple clusters.	
	ODS 1. OLYMPIC REDEVELOPMENT	**ODS 2. OLYMPIC URBAN EXPANSION**	**ODS 3. STRATEGIC OLYMPIC CLUSTERS**	**ODS 4. OLYMPIC VENUE SCATTERING**
OLYMPIC DEVELOPMENT STRATEGY (ODS)	Large scale integrated redevelopment with revitalization opportunities for the surrouding areas.	Large scale integrated urban development through the expansion of urban centers or the development of a new urban center.	A balanced dissemination of the Olympic program over multiple clusters, along major transport axes within the region, where strengthening of the already urban and infrastructural strong structures is the main focus.	A scattered development of Olympic functions over multiple clusters in and around the region. The use or redevelopment of existing competition venues could stimulate new impulses for promising areas in the region.
EXAMPLES & KEY WORDS	One main cluster - Integrated approach - Redevelopment - Rehabilitation whole area – New (public) transportation hub.	One main cluster - Integrated approach - Strategic move for expansion city – (often) Waterfront developments - High urban densities - Impulse for new transportation developments.	Multiple clusters - Strengthening of the already strong infrastructural and urban structures - Separate development of the Olympic village - Concentration of existing infrastructure.	Multiple clusters - Maximum utilization of existing sports venues – Rehabilitation of multiple (smaller) areas - Less compact organized - (relative) Low spatial impact - Impulse for new transportation developments.
	London 2012.	Beijing 2008, Osaka 2008, Toronto 2008, Tokyo 2016.	Istanbul 2008, New York 2012, Paris 2012, Chicago 2016.	Madrid 2012, Moscow 2012, Rio de Janeiro 2016.
SPORTS & VENUES	(1) Inner municipal area development of sports venues in the Olympic Park, integrated with the development of other Olympic functions. (2) The constructed number of permanent venues for London 2012 is only 3 (this indicates the high existing supply of competituion venues, and consequently the secure legacy use of the permanent constructed sports facilities).	(1) Inner municipal area development of sports venues in the Olympic Park, integrated with the development of other Olympic functions. (2) All four examples indicate a higher number of permanent constructed venues (average of 11), which would be caused by the pre-Olympic absence of competition venues in the Olympic Park.	(1) The development of competition venues in various clusters, both inner municipal as in the periphery, with an equal allocation of venues over these several (two or three) Olympic clusters. (2) Because of the strategic determination of the multiple clustering, there are very few singular venues.	(1) The development of competition venues in various clusters, both inner municipal as in the periphery. (2) The high ratio of the utilisation of pre-Olympic constructed sports venues (e.g. Moscow 2012 proposed upgrading 22 venues for the Olympic Games), results in a less compact organized Olympic Games.
OLYMPIC VILLAGE	(1) The development of the Olympic village in the Olympic Park. (2) Redevelopment/ transformation of a obsolete/ disused area.	(1) The development of the Olympic village in the Olympic Park. (2) The development of a new residential area in the urban center.	(1) Inner municipal seperated development of the Olympic village, on a well attainable location.	(1) Inner municipal development of the Olympic village, on a well attainable location.
TRANSPORT (INFRASTRUCTURE)	(1) Public transportation improvement to the Olympic Park, which could lead to the development of a public transportation hub (rehabilitation possibilities for the whole area).	(1) Through the (possible) isolated location of the Olympic Park, major transportation adjustments would be required, which could lead to new impulses for new transportation developments. Also, the high urban densities near these urban centers could be used as a common justification for the large required infrastructural investments.	(1) The improvement of transportation connections is focussed on the concentration of already existing infrastructure between the clusters of competition venues mutually and these clusters and the Olympic village.	(1) Because of the scattered allocation of clusters, it will be necesarry to improve the transportation between the clusters of competition venues. Therefore this type could stimulate the impulses for new infrastructural developments.

Figure 6.1: Features of the Olympic development strategies.

6.3 Olympic development strategies

On the basis of key-words and an explanation, each of the Olympic development strategies has been elaborated in this paragraph. The complete analysis of candidate cities of 2008, 2012 and 2016 has been elaborated in appendix 1.

6.3.1 Olympic Redevelopment

Redevelopment, transformation or revitalization usually occurs in obsolete residential areas and disused industrial zones. The integrated approach of ODS 1 'Olympic Redevelopment' generates a lot of potential for areas that could benefit from a large scale and thorough redevelopment by combining varieties of (Olympic) functions. Based on the example London 2012 can be concluded that an important condition for these large scale redevelopments is the incorporation of a new public transportation hub, which includes the development of new railway, subway and metro connections. Therefore, the integrated approach of ODS 1 'Olympic Redevelopment', combined with the incorporation of the public transportation hub, will also have a large (revitalization) impact on the surrounding areas.

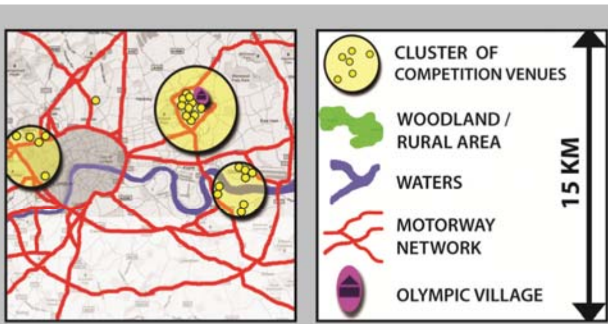


Figure 6.2: Scheme of distribution competition venues and the Olympic village for London 2012.

6.3.2 Olympic Urban Expansion

The development of undeveloped areas or the large scale expansion of a existing urban centers, make a integrated approach of the Olympic assignment possible, so that the varieties of Olympic functions easily can be combined in these areas. Based on the examples Beijing 2008, Osaka 2008, Toronto 2008, and Tokyo 2016 it seems that ODS 2 'Olympic Urban Expansion' developments often are used as a strategic move for the expansion of urban centers or the development of a (major) new urban center. The only development locations within the cities built-up area that could accommodate the enormous Olympic spatial pressure near the city centers, are waterfront areas (e.g. reclaimed islands and disused harbor sites). The presence of the surrounding water and the absence of a solid infrastructural connection often results in an isolated position of these waterfront areas. The high urban densities near urban centers are a common justification for the required infrastructural investments. Therefore, ODS 2 'Olympic Urban Expansion' might stimulate impulses for development of new transportation connections.

Figure 6.3: Scheme of distribution competition venues and the Olympic village for Beijing 2008, Osaka 2008, Toronto 2008 & Tokyo 2016.

6.3.3 Strategic Olympic Clusters

The compactness preference of the IOC, with a maximum travelling time of 60 minutes between the Olympic village and the competition venues, is the basis of ODS 3 'Strategic Olympic Clusters' development: several clusters of venues around the Olympic village, all strategic positioned along major transport axes in the city. The dispersion of the multiple clusters with this type of Olympic development could support the rehabilitation of multiple areas, so that more than one area within the host city could benefit from the organization of the Olympic Games. The (pre-Olympic) strong infrastructural connection between these clusters of competition venues mutually, and the connection with the Olympic village will be improved (post-Olympic), through the concentration of infrastructure. A prominent characteristic is that all examples, which are Istanbul 2008, New York 2012, Paris 2012, Chicago 2016, showed the separated development of the Olympic village. Therefore is assumed that in ODS 3 'Strategic Olympic Clusters' there are no competition venues integrated in the development of the Olympic village.

Figure 6.4: Scheme of distribution competition venues and the Olympic village for Istanbul 2008, New York 2012, Paris 2012 & Chicago 2016.

6.3.4 Olympic Venue Scattering

The common characteristic of ODS 4 'Olympic Venue Scattering' is the dispersed allocation of sports venues over several clusters. This Olympic development strategy results in the lowest number of venues that needs to be constructed for the OG, because the allocation of the clusters is primarily based on the already existing venues. Therefore ODS 4 'Olympic Venue Scattering' has least spatial impact on the host city, since this strategy results in relative low investments for the permanent construction of new venues. Above that, these kinds of Olympic Games are less compact organized, which would be favorable for the exploitation possibilities of these competition venues afterwards. Of all the four types ODS 4 'Olympic Venue Scattering' is the least distinctive. This ambiguous feature reflects in the following characteristics:

(1) This type regards both a balanced and unbalanced dispersion of competition venues over the several clusters.
(2) In this type clusters are allocated both inner municipal as in the periphery of the city.
(3) In this type the allocation of the Olympic village will occur both inside and outside one of the sports venue clusters.
(4) In this type the clusters are both along & far away from major transport axes in city.

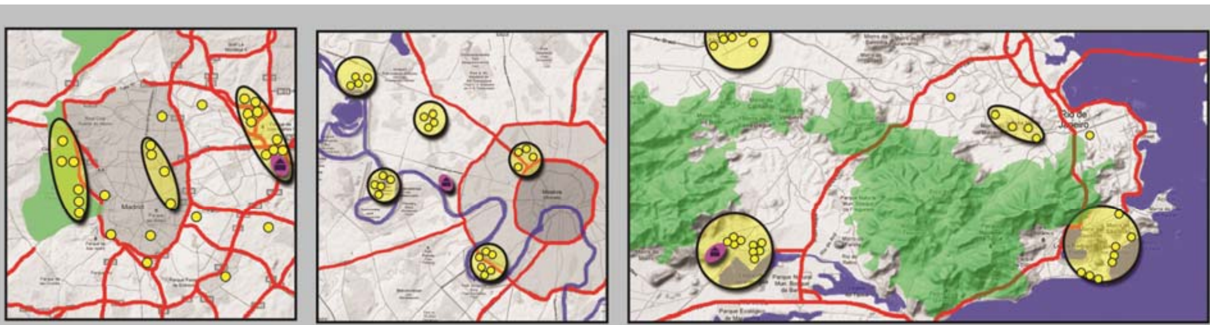


Figure 6.5: Scheme of distribution competition venues and the Olympic village for Madrid 2012, Moscow 2012 & Rio de Janeiro 2016.

Because of the scattered development strategy, this type could lead to the rehabilitation of multiple smaller areas through the upgrade of existing venues. The lacking transportation connections between the competition venues clusters mutually and connections between the clusters and the Olympic village could lead both to the stimulation of impulses for development of new transportation connections and the concentration of already existing infrastructure.

6.4 Examples

For each Olympic development strategy (ODS) an example has been elaborated in this paragraph. First, the most important Olympic spatial objective of that specific Olympic candidate city has been outlined; subsequently that spatial objective will be amplified. The Olympic candidates that will be discussed in this paragraph are:

ODS 1: Olympic Redevelopment (London 2012);
ODS 2: Olympic Urban Expansion (Osaka, 2008);
ODS 3: Strategic Olympic Clusters (New York 2012), and
ODS 4: Olympic Venue Scattering (Rio de Janeiro 2016).

6.4.1 Olympic Redevelopment

Most important Olympic spatial objective of London 2012: The regeneration of the Lower Lea Valley.

According to the IOC evaluation commission (IOC, 2005-B), the Olympic Games of London 2012 would be a catalyst for the re-development of the Lower Lea Valley, a 200-hectare rehabilitation and regeneration project in East London. With the development of the Olympic Park, which would be the centerpiece of London's proposal, along with major new public infrastructure (upgrading and extension of London's underground, light rail and regional rail networks) and the integration of varieties of (Olympic) functions such as the Olympic village multiple competition venues, this re-development would provide long-term benefits for the residents of London, including housing, educational and recreational opportunities and the development of sport. Therefore also the surrounding areas would benefit and revitalize from the large scale and thorough redevelopment.

Figure 6.6: Integrated redevelopment of the Olympic park in Lower Lea Valley (Source: LOGOC , 2010-A).
Figure 6.7: Collection of man-made waterfront islands in Osaka Bay (Source: OOGOC , 2010).

6.4.2 Olympic Urban Expansion

Most important Olympic spatial objective of Osaka 2008: The expansion of the city with the development of a new urban center on reclaimed land (new islands).

According to the IOC evaluation commission (IOC, 2001), the Osaka sports concept offers a spread of venues in and around the city and the surrounding area. The major development of three man-made islands in Osaka Bay, which would lead to the expansion of the city with a new urban center, will contain venues for 13 sports. Also the development of the Olympic Stadium and the Olympic Village are integrated on the development of these three islands. The Olympic village area proposed for the Osaka Games is a 100-hectare site on Yumeshima Island, the middle of the three Olympic Islands, and therefore has been included in the development of the Olympic Park. For the connection of the group of islands, the organization of the Olympic Games would lead to new impulses for transportation developments. Therefore, could be concluded that for Osaka, the Olympic Games would have been a driving force behind the very large planned infrastructure developments, with e.g. the construction of a subway and underwater tunnel, and a new road and railway tunnel.

6.4.3 Strategic Olympic Clusters

Most important Olympic spatial objective of New York 2012: The concentration of existing infrastructure and the rehabilitation of multiple promising areas.

The New York 2012 bid, which has been described in the 'Report of the IOC Evaluation Commission for the Games of the XXX Olympiad in 2012' (IOC, 2005-B), proposes an inner-city concept of three main competition clusters with most venues situated on two intersecting transport routes forming the 'Olympic-X' with the strategic positioning of the Olympic Village at its center. With the development of three clusters, with a more or less equal dissemination of competition venues over these clusters, the Olympic Games would accelerate the redevelopment and environmental rehabilitation of multiple promising and high-potential river front areas. The Olympic Village would be a compact waterfront (high-rise) settlement in the centre of the city with tall apartment buildings. Through the major transport construction and renovation investments that have been made during the last two decades (since 1980-1985), to modernize and expand rail and road systems, the city developed a comprehensive metropolitan transport network, which form the already strong foundations for the infrastructural connection between these Olympic clusters of competition venues.

Figure 6.8: Transformation of the riverfront area Long Island City (Source: NYOGOC, 2010).
Figure 6.9: High performance transport ring constructed for the Rio 2016 Games (Source: ROGOC, 2010).

6.4.4 Olympic Venue Scattering

Most important Olympic spatial objective of Rio de Janeiro 2016: Sport as a catalyst for social integration, through the dissemination of competition venues over (partial) existing sports clusters.

The IOC Evaluation Commission (IOC, 2009-A) described that the Games concept of Rio de Janeiro 2016 is based on the use of the 2007 Pan- American Games venues, which enables maximum use of already existing sports venues in Rio de Janeiro and therefore results in relative low investments for the permanent construction of new venues. Their concept for sports & venues include the dissemination of venues in four clusters, of which the cluster 'Barra' is the most important one during the Games, since that is the proposed Olympic Park. That cluster is an expanding area of the city which requires a considerable infrastructure and accommodation development. The Olympic village is located near the Olympic park, which after the Games will be converted into a residential community, offering accommodations in a rapidly growing part of the city. The Rio de Janeiro 2016 bid is centered on the vision of using sport as a catalyst for social integration. The Games would act as a catalyst for the development of new facilities, transport and other infrastructure and the physical regeneration, particularly of the city's waterways, the key development zones of the city. Therefore the Rio de Janeiro Olympic Games will lead to the rehabilitation of the four clusters. The Rio de Janeiro 2016 Olympic transport (infrastructure) concept is based on the construction of a new transportation connection, which would be a project designed to create a full 'High Performance Transport Ring', which connects the four clusters of competition venues on each side of the central positioned Tijuca National Park.

6.5 Conclusion

Should the overall concept of the Olympic Games in the Netherlands focus on the spatial objectives urban scale? And if so, should the development of Olympic Park in that case function more as a catalyst for the large scale redevelopment of obsolete/disused areas, which could initiate adequate possibilities for the rehabilitation of a whole area? Or should it more function as a strategic move for the expansion of the city through the development of a new urban center, where probably large investments in new infrastructures would be required? These kinds of strategic considerations will be, among other considerations, the subject of content for the SDR that has been designed for this study.

However, in order to make these considerations, the decision makers in the SDR wil have to make the translation of spatial policy to their spatial objectives, and from their spatial objectives to Olympic strategic characteristics. In other words, in the SDR the decision makers will have to overcome the difference between their individual policy objectives and strategic spatial characteristics. Based on the analysis of Olympic development strategies, it will be easier for the decision makers to comprehend the strategic considerations of other Olympic candidate cities, and to understand the possible Olympic spatial objectives that underlie to strategies of these Olympic candidate cities. These typologies have been established through the determination of differences between Olympic candidate cities in the following variables: (1) distribution of their competition venues (sports and venues), (2) the development of their Olympic village (Olympic village) and (3) their infrastructural adjustments (transport). Based on these variables, subsequently, the possible strategic approaches for the spatial organization of the Olympic Games have been distinguished in four different types:

ODS 1: Olympic Redevelopment;
ODS 2: Olympic Urban Expansion;
ODS 3: Strategic Olympic Clusters, and
ODS 4: Olympic Venue Scattering.

For each typology the spatial characteristics have been elaborated in this chapter.

Chapter 7: Olympic spatial content

7.1 Introduction

The aim of the analysis discussed in this chapter was to comprehend the spatial features and requirements for the allocation of the Olympic spatial content, specific for the case Rotterdam 2028. How many hectares will be needed for the development of each specific Olympic function? What are the spatial requirements concerning the allocation of these specific functions? And which functions should be developed in the Olympic park in the case Rotterdam 2028? The information that has been assembled in this analysis formed the basis for the input for the allocation model (chapter 11).

The Olympic spatial content of the host cities of 2008, 2012 and 2016 has been analyzed on the basis of four different Olympic functions, which are sports and venues, the IBC/MPC, the Olympic village and media accommodations. Subsequently, the translation of the Olympic spatial content to the case Rotterdam 2028 has been established. In this analysis, only the Olympic spatial content that is allocated in or around the Olympic park will be discussed, which is an area on approximately 6 km x 6 km. The Olympic park is the centre stage for the Olympic Games, and usually this park e.g. contains the Olympic stadium and a nucleus of the competition venues (VROM et. al, 2008).

7.2 Sports and venues

As already mentioned in paragraph 5.2.1, there can be distinguished four different kinds of competition venues, the specific stadiums, the sports complexes, the indoor halls and the landscapes (Huijsmans, 2005). According to VROM et. al (2008), the investments which are related to the competition venues that require landscapes (e.g. equestrian, rowing, marathon, sailing, etc.), are limited to the construction of temporary stadiums, grandstands and facilities which often, for practical reasons, are not developed in the Olympic Park. Therefore, the competition venues that require landscapes won't be mentioned further in this analysis.

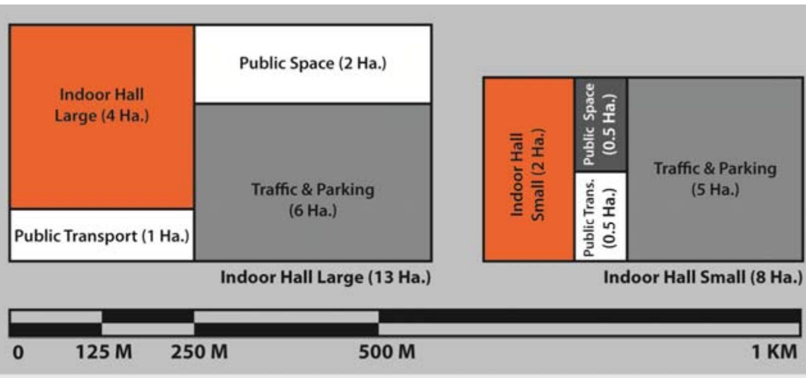


Figure 7.1: Graphical reproduction of gross surface areas Olympic spatial content (Source: VROM, et. al 2008, adapted).

In the 'Schetsboek - Ruimte voor Olympische Plannen', which is a publication about the first spatial explorations for the possible organisation of Dutch Olympic Games, an indication of the minimum requirement of sports facilities in the Olympic Park has been outlined (VROM et. al, 2008). VROM et. al (2008) indicated that at least the Olympic Stadium, the Olympic Indoor Hall, training facilities, the Olympic square, and transportation facilities (infrastructure) should be allocated in the Olympic park. The spatial features of competition venues (functional units), concern the gross surface area (GSA) required for the development of a these functions. In the GSA of a specific competition venue, the required surface area for the footprint of the concerning building (specific stadium, sports complex or indoor hall), public transport, traffic & parking and public space has been incorporated. In figure 7.7, a complete overview of the GSA for Olympic functions has been illustrated.

7.3 IBC/MPC

The International Broadcast Centre/Main Press Centre (IBC/MPC) will be a 24-hour media hub for around the 20.000 broadcasters, written press, photographers and journalists, covering a floor space area of 110.000 (London 2012) to 140.000 (Rio de Janeiro 2016) square meters. According to the ROCOG candidature file (2009) the IBC/MPC is defined as a accommodation that should offer efficient, modern and reliable facilities and services for the media covering the Games, where adequate work environment has been created, concentrating on the key elements required for the delivery of efficient media operations, accommodations, transport and technology. In their Technical Manual on Accommodations, the IOC (2005-C) described that the close proximity of media accommodation facilities to the IBC/MPC is important in ensuring short transfer times, such transfer times to the IBC/MPC should not exceed 30 minutes. Based on the Olympic host cities of 2008, 2012 and 2016 can be concluded that it therefore would be required allocating the IBC/MPC in or around the Olympic park.

In order to establish the required gross surface area (GSA) for the IBC/MPC, there are two features that will have to be determined. The first feature is required gross floor area, in this research there is assumed a GFA of 130.000 square meters (average of London 2012 and Rio de Janeiro 2016). The second feature is the building height: based on the IBC/MPC's London 2012 (4 floors) and Rio de Janeiro 2016 (8 floors) there is assumed an average building height of 4 floors (buildings height London 2012 is leading), the building footprint for the IBC/MPC would be: 130.000 m2 / 4 floors = 32.500 (3.3 Ha). Including space for public transport (1), traffic & parking (5) and public space (2), the IBC/MPC will require a total GSA of 11.3 Ha.

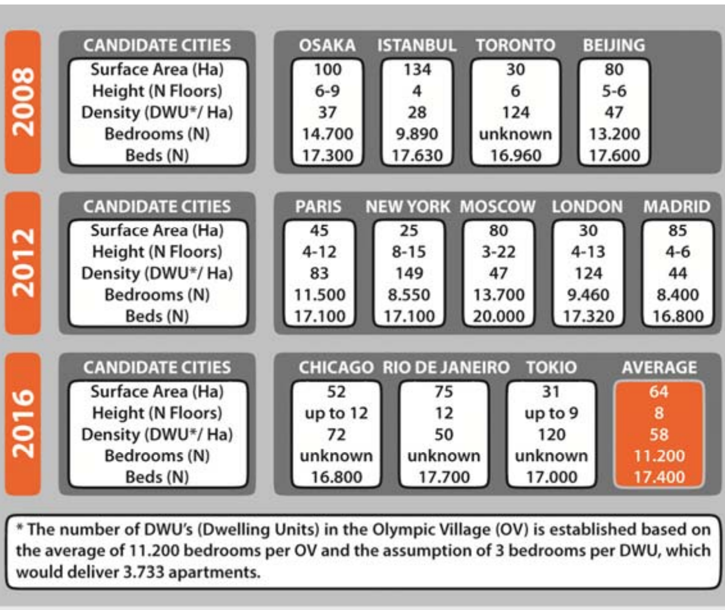
7.4 Olympic Village

During the Games the Olympic village will comprise apartments for at least 16.000 athletes and officials, along with shops, restaurants, medical, and media/ leisure facilities. In their Olympic village Manual, the IOC (2007-A) defined the village as a single, large accommodation facility or a collection of smaller accommodation facilities in a single location that is dedicated to a single constituent group, and which offers customized services to that group. In order to keep the athletes' travelling time to the minimum, the IOC (2007-A) requires that the Olympic village, is centralized in or around that Olympic Park, so that it would be developed in close proximity to the most important competition venues. For that matter, where Olympic venues are more than 50 km or one hour drive (under normal road and traffic conditions) from the Olympic Village, the IOC (2007-A) would require the development of an additional Olympic village.

Figure 7.2: Schematic floor plan and render Olympic village Rio de Janeiro 2016 (Source: ROCOG, 2009).

The Olympic village can be divided into three components: the residential zone (RZ), the Olympic village plaza (OVP), which would be the former International Zone) and the operational zone (OP). The IOC (2007-A) described that the RZ is the area in the Olympic Village where the accommodations for athletes and team officials is located. The RZ is the 'private' area of the Olympic Village and is the resident's home containing accommodation, dining and certain recreational activities and other services and operations. The OZ includes the back of house operations that ensure the Olympic Village functions efficiently, where e.g. the reception, accreditation and parking facilities for the whole village is organized. The OVP is the area in the Olympic village which facilitates the gathering of residents, guests and media.
In the analysis of Olympic villages of the candidate cities of 2008, 2012 and 2016, the total surface area of the residential zone (Ha), the average building height (number of floors), the density Dwelling Units/ Ha), the number of bedrooms (depending on the total

number of single and double bedrooms) and the number of beds have been studied. The average number of beds an Olympic village would be approximately 17.400, which are dispersed over 11.200 rooms. These averages are based on the mean of the aggregate. Assuming that an average apartment would accommodate 3 bedrooms, the required number of apartments in the Olympic village would be 3.733. The building density of Olympic villages can be established by dividing these 3.733 over the total surface area of the residential zone of that particular village.



2008 CANDIDATE CITIES	OSAKA	ISTANBUL	TORONTO	BEIJING
Surface Area (Ha)	100	134	30	80
Height (N Floors)	6-9	4	6	5-6
Density (DWU*/ Ha)	37	28	124	47
Bedrooms (N)	14.700	9.890	unknown	13.200
Beds (N)	17.300	17.630	16.960	17.600

2012 CANDIDATE CITIES	PARIS	NEW YORK	MOSCOW	LONDON	MADRID
Surface Area (Ha)	45	25	80	30	85
Height (N Floors)	4-12	8-15	3-22	4-13	4-6
Density (DWU*/ Ha)	83	149	47	124	44
Bedrooms (N)	11.500	8.550	13.700	9.460	8.400
Beds (N)	17.100	17.100	20.000	17.320	16.800

2016 CANDIDATE CITIES	CHICAGO	RIO DE JANEIRO	TOKIO	AVERAGE
Surface Area (Ha)	52	75	31	64
Height (N Floors)	up to 12	12	up to 9	8
Density (DWU*/ Ha)	72	50	120	58
Bedrooms (N)	unknown	unknown	unknown	11.200
Beds (N)	16.800	17.700	17.000	17.400

* The number of DWU's (Dwelling Units) in the Olympic Village (OV) is established based on the average of 11.200 bedrooms per OV and the assumption of 3 bedrooms per DWU, which would deliver 3.733 apartments.

Figure 7.3: Features of the Residential Zone for Olympic Villages (Sources: IOC 2001, 2005-B & 2009-A).

The differences in sizes of Olympic villages originate in dissimilar Ground Space Indexes (GSI), which is a variable that expresses the compactness of an area (Permeta, 2010). The smallest Olympic Village of the candidate cities in figure 7.4 was New York 2012, where the residential zone covered a surface area of 25 Ha, and the largest was Istanbul 2008 with 134 Ha, which is a difference of almost 110 Ha. Because of these large differences in village sizes, the compactness features of the residential zone of the village should also be incorporated in the decision support instrument for the UDR.

7.5 Media accommodations

The IOC (2009-A) requires 40.000 rooms within the 50 km radius from the Games center, in order to accommodate the Olympic family and media, which include accredited journalists, broadcasters and officials as well as members of the IOC. By way of illustration, on top of the already required 11.500 rooms (16.000 beds) for the Olympic village, which is discussed in the previous paragraph, the IOC requires an additional 40.000 rooms for media accommodation. The IOC also requires, where feasible, at least 10% (4.000 rooms) of media accommodation facilities within walking distance of the MPC/IBC, i.e. within 1 kilometer. In their Technical Manual on Accommodations, the IOC (2005-C) defined various types of accommodation facilities that a candidate city may offer to satisfy its accommodation obligations:

(1) Traditional hotel accommodations;
(2) Media village(s), and
(3) Alternative accommodations.

A traditional hotel is the type of accommodation facility that should make up the majority of a candidate city's accommodation inventory. According to the IOC (2005-C), in cases where the hotel infrastructure of the host city does not have sufficient and adequate capacity for all accredited media, the OCOG must provide a media village (or more than one, depending on the configuration of the Olympic venues). The use of alternative accommodations refers to various types of accommodations that are not traditional hotels, but which take on many of the characteristics of traditional hotels during the period of high accommodation demand around the Games, which e.g. are mobile/temporary accommodations, school and university dormitories and cruise ships.

The geographical location in relation to the oceans and the characteristics of the port structures determine the suitability for berthing cruise ships in a potential host city.

In the case of the Rotterdam, the berthing of cruise ships during the Olympics is likely since only 3.300 hotel rooms are provided in this port city (CBS, 2010). The large cities within the 50 km radius from Rotterdam are The Hague and Utrecht. But the Dutch research institution 'Statistics Netherlands' (CBS, 2010) calculated that these three cities nowadays would only deliver the collective amount of 8.200 rooms. Therefore, in the case Rotterdam 2028, the role of cruise ships will be essential. For port cities, the possibility of supplementing their available media accommodations by using cruise ships is attractive because of the low exploitation risks afterwards.

Based on the accommodation plans for Beijing 2008, London 2012 and Rio de Janeiro 2016, initially an accommodation plan for Rotterdam 2028 has been established. Because of the current relative low supply of hotels rooms in the city (3.200 rooms) and the required accommodation characteristics of the IOC (total of 40.000 rooms media accommodation), for the case Rotterdam 2028 the development of a new hotel cluster 1.000 rooms has been established. Therefore, the accommodation plan for Rotterdam 2028 consists of the existing 8.200 hotel rooms, the development of at least 3.000 rooms (1.000 apartments) in the media village(s), 27.800 rooms in alternative accommodations (e.g. cruise ships).

Figure 7.4: Accommodation plans Olympic host cities (Sources: IOC 2001, 2005-B & 2009-A).

In order to establish the required gross surface area (GSA) for the development of hotels, there are three features that will have to be determined. The first feature is total number of rooms: in the accommodation plan for Rotterdam 2028 there has been established a cluster of hotels with 1.000 rooms. The second feature is the gross floor area (GFA) for a hotel room: in 'Hotels, planning & Design' De Jong et. al (1996) established 56 m2 for a 4 stars hotel (including lodging, service and public spaces). The third feature is the building height: assuming an average building height of ten floors, the building footprint for the hotel development would be: 1.000 rooms x 56 m2 per room / 10 floors = 5.600 m2 (0.6 Ha). Including space for public transport (0.5), traffic & parking (4) and public space (1), the hotel cluster will require a total gross surface area of 6.1 Ha.

7.6 Post-Olympic use

Previous host cities showed that competition venues (specific stadiums, sport complexes and indoor halls), residential areas (Olympic village and media village[s]), and commercial accommodations (hotels and the IBC/MPC) are common developments in and around the Olympic Park of the host city. VROM et. al (2008) also emphasized that the development of high quality sports facilities more often is integrated with the development of dwellings, offices, hotels congress accommodations and retail, in order to attract private investments, which would increase the exploitation possibilities. An important issue related to the development of Olympic functions, is the determination of the future exploitation possibilities. An indication of possible post-Olympic use of Olympic facilities, therefore, has been summarized in figure 7.5.

The development of these large sports accommodations could only be economical viable if the exploitation would last longer than only the Olympic Games period. Other Olympic host cities showed creative solutions in order to decrease the large exploitation costs after the Games period. An example of this is London 2012, where the Olympic Stadium would be scaled back to 25.000 seats, so that it could host smaller sporting, cultural and community events. In general could be concluded that for the post-

Olympic use of large stadiums with a specific purpose, downscaling those large stadiums into smaller (local) accommodations would increase the exploitation possibilities.

	OLYMPIC USE	POST-OLYMPIC USE
LEISURE	Specific stadiums (Olympic Stadium, Football Stadiums, Velodrome, etc.)	After the Olympics the large (global) stadiums with a specific purpose can be scaled back into smaller (local) stadiums.
	Indoor halls (Gymnastics, Basketball, Volleyball, Handball, Judo, etc.)	The indoor halls can be adapted to become a multi-use sports centre for community use, so that a wide range of indoor sports can be offered. Also, it could be a facility for other sporting, cultural and community events.
	Complexes (Hockey complex, Tennis complex, Aquatics complex, etc.)	Sports complexes can be partial transformed into facilities for the local community, clubs and schools, so that the accommodation is attractive for both recreational sports as elite sports.
RESIDENTIAL	Olympic Village (area where the accommodations for athletes and team officials are located).	The residential zone of the Olympic village would be transformed into a residential community. After the Games, that community will be provided in a new constructed residenial area, including new parks, high quality open spaces, sufficient transport links, and a lots of possibilities for community facilities.
	Media Village(s) (area where the accommodations for media are located).	The residential zone of the media village(s) would be transformed into a residential community.
COMMERCIAL	IBC/MPC (24-hour media hub for around 20.000 broadcasters, photographers and journalists, including office and work spaces.	Various possibilities after the Games. Olympic host cities showed transformations into e.g. business space (London 2012), a convention center (Beijing 2008) or into shopping mall, combined with an office destination (Athens 2004).
	Hotels, lodges en hostels.	After the Games, the function of hotels, lodges and hostels will remain unchanged.

Figure 7.5: Indication of possible post-Olympic use of the Olympic spatial content.

VROM et. al (2008) also described similar exploitation difficulties for the indoor halls. In the Netherlands there are no indoor sports that popular, that they would attract 15.000-20.000 spectators. The multifunctional use of such large indoor halls, for that reason, would be an important precondition for the exploitation of these accommodations. The indoor halls could be adapted to become a multi-use sports centre for community use, so that a wide range of indoor sports can be offered. It could also be used for other sporting, cultural and community events. According to the panel of experts that were involved in the publication of the 'Schetsboek', the maximum number of large multifunctional indoor halls in the Netherlands would only be three or four (VROM et. al, 2008). The last category of competition venues, which are the sports complexes, could also be partial transformed into facilities for the local community, clubs and schools, so that the complexes in the post-Olympic period are accommodating both recreational sports as elite sports.

Because of the realization of about the 5.000 apartments (Olympic village and Media village[s]) at the same time, after the Games there could arise some difficulties in the exploitation of these dwellings. VROM et. al (2008) indicated that the quality of the areas in the city and the positioning of the Olympic and media villages in areas with a concentrated urbanization are crucial. According to VROM et. al (2008) the investment in extra media accommodations, such as e.g. hotels, would only be economic viable for areas where these media accommodations, also without the organization of the Games, would obtain sufficient commercial perspective. The same precondition could also be applied for the IBC/MPC, but for the IBC/MPC the possibilities for the post-Olympic use are more varied. Under the condition of a flexible design, the IBC/MPC would be able to accommodate a wide range of potential tenants and uses after the Games. Olympic host cities showed that the IBC/PPC could be transformed into e.g. business space (London 2012), a convention center (Beijing 2008) or into shopping mall, combined with an office destination (Athens 2004).

7.7 The case Rotterdam 2028

The development of sports venues, residential areas and commercial accommodations in and around the Olympic park, could be realized on in multifarious ways, as illustrated in figure 7.6, which reflects in the spatial feasibility as well as the economical feasibility. On the basis of the numerical features of the complete Olympic spatial content (summarized in figure 7.7), the required surface area for Olympic venues in the host cities of 2008, 2012 and 2016 has been established. Based on that, subsequently, the program for the Olympic park for the case Rotterdam 2028 is determined.

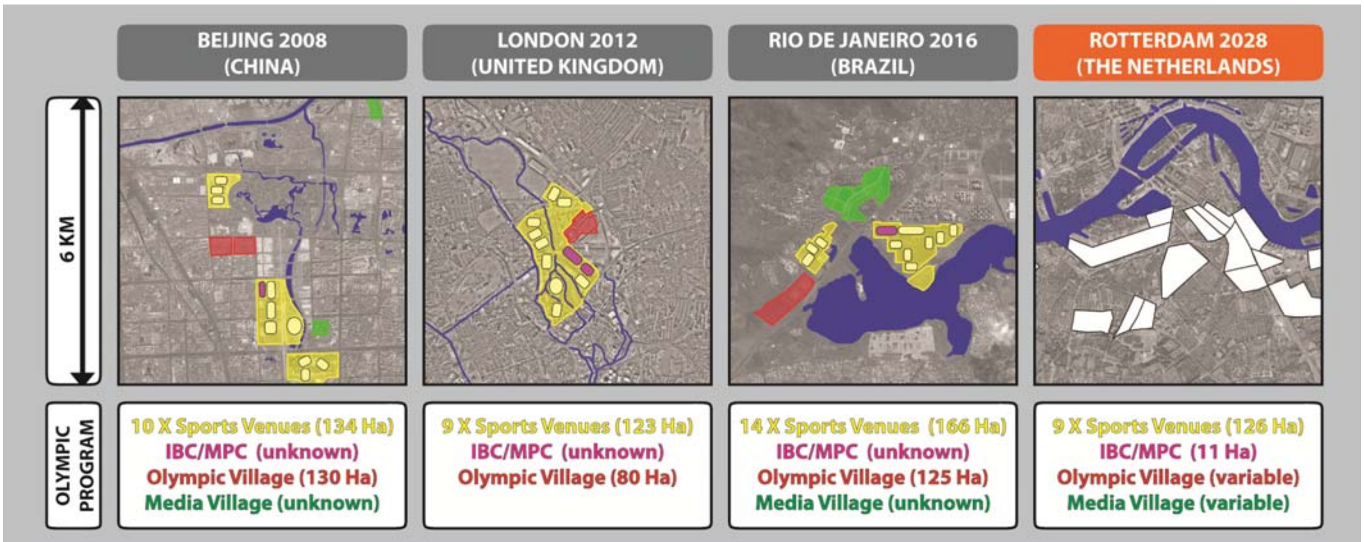


Figure 7.6: Venues that are allocated in and around the Olympic Park of host cities.

The level in which the sports venues in and around the Olympic park have been constructed for temporary use differ per host city, Beijing constructed 3 temporary venues (total of 10 venues), London (total of 9 venues) & Rio de Janeiro (total of 14 venues) only 2. For the exploration of the spatial feasibility, which is about the required units (Ha) per function, the ratio between the temporary and permanent construction of venues wouldn't influence the gross surface areas, since both the temporary as permanent competition venues would require approximately the same surface area. The program for the case Rotterdam 2028, which alongside the Olympic village (variable size), het IBC/MPC (11 Ha, see paragraph 7.3) and the media village(s) (variable size), would also concern the development of the following functions (figure 7.7):

[A] Olympic Stadium;
[B] Olympic Indoor Hall;
[L] Aquatics complex;
[K] Small Stadium (2x);
[H] Multipurpose Hall;
[J] Indoor Hall Small (2x), and
[N] Tennis complex.

London 2012 showed that the center of Olympic activities should provide at least 9 competition venues, which therefore would also be the starting point in the UDR. For the exploration of the financial feasibility, which is about the post-Olympic exploitation possibilities, the ratio between the temporary and permanent construction of venues is significant. If the decision makers in the UDR would indicate the possible permanent construction of 9 competition venues in the city of Rotterdam isn't economical viable, for the output of the UDR this would signify that ratio between temporary and permanent venues is shifted.

7.8 Conclusion

As mentioned in the introduction of this analysis, comprehending the Olympic spatial content has two components of which the first is about the functional units (in Ha) of the Olympic spatial content. The second one is about the requirements concerning the allocation of these specific functions. Based on these requirements, the technical features for the allocation model (chapter 11) have been determined. The information that has been assembled in this analysis, therefore, formed the basis for the input (exogenous variables and special constraints) of the allocation model. An extended version of the spatial features and requirements of the Olympic spatial content has been elaborated in appendix 2.

The functional units of the Olympic functions, which are exogenous variables in the allocation model, concern the gross surface area (GSA) required for the development of a these functions. In the GSA of a specific Olympic function, the required surface area for the footprint of the concerning building, public transport, traffic & parking and public space has been incorporated. In figure 7.7 a summary of numerical features for the complete Olympic program is illustrated. Since these functional units are exogenous variables in the allocation model, the decision makers ultimately have the possibility for adjusting the value of these variables, if that would be needed.

		Primary function (Ha)	Public Transport (Ha)	Traffic & Parking (Ha)	Public Space (Ha)	Gross Surface Area (Ha)		Number of units (N)	BEIJING 2008 (Ha)	Number of units (N)	LONDON 2012 (Ha)	Number of units (N)	RIO DE JANEIRO 2016 (Ha)		Number of units (N)	ROTTERDAM 2028 (Ha)
SUBTOT	**Program Olympic Park in Olympic host city**						SUBTOT	6	46.0	6	46.0	5	38.0	SUBTOT	6	57.3
[A]	Olympic Stadium	8.0	-	-	-	**8.0**	[A]	1	8.0	1	8.0	0	0.0	[A]	1	8.0
[B]	Olympic Indoor Hall	6.0	-	-	-	**6.0**	[B]	1	6.0	1	6.0	1	6.0	[B]	1	6.0
[C]	Training facilities	2.0	-	-	-	**2.0**	[C]	1	2.0	1	2.0	1	2.0	[C]	1	2.0
[D]	Olympic Square	-	-	-	10.0	**10.0**	[D]	1	10.0	1	10.0	1	10.0	[D]	1	10.0
[E]	Infrastructure	-	5.0	15.0	-	**20.0**	[E]	1	20.0	1	20.0	1	20.0	[E]	1	20.0
[F]	IBC/MPC	3.3	1.0	5.0	2.0	**11.3**	[F]	1	Unknown	1	Unknown	1	Unknown	[F]	1	11.3
SUBTOT	**Additional sports & venues program in Olympic host city**						SUBTOT	9	87.5	8	76.5	13	128.0	SUBTOT	7	71.5
[G]	Multipurpose Hall	4.0	1.0	6.0	2.0	**13.0**	[G]	0	0.0	0	0.0	1	13.0	[G]	1	13.0
[H]	Indoor Hall Large	4.0	1.0	5.0	1.0	**11.0**	[H]	0	0.0	0	0.0	3	33.0	[H]	0	0.0
[I]	Indoor Hall Small	2.0	0.5	5.0	0.5	**8.0**	[I]	3	24.0	3	24.0	5	40.0	[I]	2	16.0
[J]	Stadium Small	4.0	0.5	4.0	2.0	**10.5**	[J]	4	42.0	2	21.0	1	10.5	[J]	2	21.0
[K]	Aquatic Complex	4.0	1.0	5.0	2.0	**12.0**	[K]	1	12.0	1	12.0	1	12.0	[K]	1	12.0
[L]	Velodrome	4.0	0.5	3.5	2.0	**10.0**	[L]	0	0.0	1	10.0	1	10.0	[L]	0	0.0
[M]	Tennis Complex	5.0	0.5	3.0	1.0	**9.5**	[M]	1	9.5	1	9.5	1	9.5	[M]	1	9.5
SUBTOT	**Program Olympic village**						SUBTOT		130.0		80.0		125.0	SUBTOT		Variable*
[N]	Residential Zone	Variable*	-	-	-	**Variable***	[N]	-	80.0	-	30.0	-	75.0	[N]	-	Variable*
[O]	Operational Zone	25.0	-	-	-	**25.0**	[O]	-	25.0	-	25.0	-	25.0	[O]	-	25.0
[P]	Olympic Village Plaza	15.0	-	-	-	**15.0**	[P]	-	15.0	-	15.0	-	15.0	[P]	-	15.0
[Q]	Infrastructure	-	2.5	7.5	-	**10.0**	[Q]	-	10.0	-	10.0	-	10.0	[Q]	-	10.0
SUBTOT	**Program Media accommodations**						SUBTOT							SUBTOT		
[R]	Hotel accommodations	Variable**	0.5	4.0	1.0	**Variable****	[R]	-	Unknown	-	None	-	Unknown	[R]	-	6.1
[S]	Media village(s)	Variable**	2.5	7.5	-	**Variable****	[S]	2	Unknown	-	None	4	Unknown	[S]	-	Variable*
SUBTOT	**Surface Area Olympic program, excluding OV & MV (Ha)**						TOTAL		133.5		122.5		166.0			128.8
TOTAL	**Number of Olympic functions Olympic park (N)**						TOTAL	15		14		18		TOTAL	13	
TOTAL	**Surface Area Olympic program Olympic park (Ha)**						TOTAL		263.5		202.5		291.0	TOTAL		Variable*

* Depends on the GSI (compactness).

** Depends on the number of rooms and the GSI (compactness).

Figure 7.7: Complete overview of the numerical features of the Olympic spatial content (Sources: VROM et. al 2008, adapted & IOC, 2001, 2005-B & 2009-A).

Initially, the program for the Olympic park for the case Rotterdam 2028 has been established on the basis of the programs of the Olympic host cities of 2008, 2012 and 2016. The Olympic program is also exogenous, which enables the decision makers in the UDR to assess the market quality of the complete program for the Olympic park for the city of Rotterdam, based on future exploitation possibilities (post-Olympic use). The complete program encompasses competition venues (specific stadiums, indoor halls and sports complexes), the Olympic village, the IBC/MPC and the media accommodations (hotels, media village[s]).

Chapter 8: Olympic case Rotterdam 2028

8.1 Introduction

The aim of the analysis described in this chapter was the determination of zones [Z1-Z20] and functions [F1-F21] for the case Rotterdam 2028. The analysis of possible development zones is about establishing which UAD projects will obtain higher priority above others. The analysis of functions is about the determination of the Olympic status quo (current situation) of Rotterdam, so that the starting point for the possible organization of the Olympic Games can be established.

With the choice for Rotterdam there is certainly not suggested that Rotterdam would be most suitable as Dutch Olympic host city. Also other cities in the Netherlands dispose adequate spatial preconditions which will be needed for the organization of the Olympic Games. Compared with the city of Rotterdam, for example Amsterdam would provide a larger supply of media accommodations and a better connection to (inter)national transportation networks, and therefore could also have been analyzed for this study. Moreover, one of the recommendations of this research would be the design of a UDR for Amsterdam. Nevertheless, with the ambitious vision of the city of Rotterdam and the development of a major ‘Sports campus’ in the ‘Stadionpark’, including a new multifunctional stadium (with at capacity of approximately 80.000 seats), an educational program (25.000-50.000 m2), offices (50.000-100.000 m2) a residential program (1.000-2.000 dwellings), and the possible construction of a public transport hub, there could already be recognized some of the features of the Olympic spatial content (Municipality Rotterdam, 2009). Based this ambition, ultimately the choice for the elaboration of the case Rotterdam 2028 has been made.

8.2 Rotterdam urban development strategy

The Rotterdam urban development strategy, which is called the ‘Stadsvisie Rotterdam’, describes the urban vision of the municipality for the city of Rotterdam until 2030 (Municipality Rotterdam, 2007). It contains a survey of concrete plans the local authorities intend to carry out. On the basis of an effectiveness assessment, which was needed to establish which UAD projects would contribute most to the achievement of their urban objectives, thirteen VIP-areas have been designated that are crucial to achieving those urban objectives. These urban objectives are translated in two strategies, which are the development of a ‘strong economy’ and the creation of an ‘attractive residential city’. For each of the UAD projects the measure of the contribution of those projects to possible effects, the expenditures, employment, added value and the effectiveness of the financial investments have been quantified. In practice, this would signify that these thirteen VIP-areas will obtain higher priority than other UAD projects.

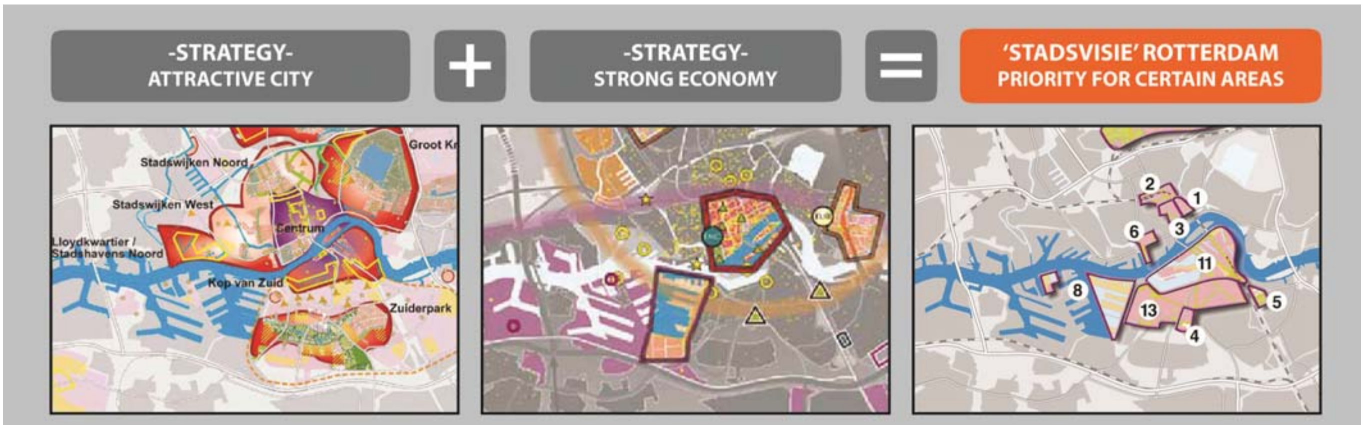


Figure 8.1: Development zones for the case Rotterdam 2028 (Source: Municipality Rotterdam, 2007).

Accrding to the municipality Rotterdam (2007), both strategies (‘strong economy’ and ‘attractive city’) are inextricably linked; to be able to live in the city there must be good housing and suitable employment. Good housing alone is not enough for an attractive residential city. Therefore, Rotterdam strives for quality residential environments by devoting a great deal of attention to public space and the indispensable facilities (education, child care, medical/social, sports and games, et cetera). In order to attract more high and medium income groups, also the residential environments of strong districts will be extended; top priorities in weaker districts are the restructuring of the existing housing stock. Employment, in turn, thrives only when the city can offer favorable conditions for business development, quality housing including the accompanying facilities and public space: in other words, complete residential environments that meet the demands of housing consumers. According to the municipality Rotterdam (2007), creating a strong economy concentrates on the transition from an industrial economy to knowledge and services economy, based on the further development of the medical and creative sectors.

8.3 VIP-areas

As described in the previous paragraph, in the Rotterdam urban development strategy there have been assigned thirteen VIP-areas, which would obtain higher priority than other UAD projects. In the allocation model, these VIP-areas will be assessed on their possibilities to develop (parts of) the Olympic spatial content. However, not all thirteen VIP-areas are considered as 'suitable' for the development of Olympic functions. Therefore in this analysis, a pre-selection of VIP-areas has been established. It must be mentioned that the determination of 'suitable' VIP-areas, is the interpretation of the USE (author JZ). The accuracy of these interpretations could be increased by the involvement of the municipality Rotterdam in this analysis, which hasn't been the case. Ultimately there have been established five VIP-areas, where possible Olympic activities could be centralized, which are described in figure 8.2.

	ZUIDPLEIN	STADIONPARK	WAALHAVEN OOST	KOP VAN ZUID	OUD ZUID
VISION FOR VIP-AREAS: ROTTERDAM DEVELOPMENT STRATEGY	The most important elements for the development of 'Zuidplein' are possible public transport improvements, the expansion of the retail center, and the development of a high quality leisure center with the expansion of top class multi-purpose accomodation 'Ahoy'.	The city of Rotterdam could strengthen their sports image through the development of 'Stadionpark', which includes a new Sports Campus, accommodating a new soccer Stadium (capacity of approximately 80.000 seats), and a new ice skating rink. The realization of a public transport hub also generates opportunities for the surrounding areas. Besides the main activities Sports & Leisure also retail, housing, education and offices are integrated in the urban vision for this area.	Because of the displacement of the dock industry to the 'Maasvlakte II', there are opportunities for the development of other businesses, offices, residents and leisure on a unique location in Rotterdam. The area 'Waalhaven Oost' is unique because of its central positioning in the city, the large available area sizes and the opportunities to combine various functions, such as working, living and recreating.	The Wilhelminapier and the Eramsus bridge make the 'Kop van Zuid' a district with international character: a location with a large history, a own skyline, an attractive mixture of living, working, culture and other facilities, an pleasant public space and a excellent accessibility. The north of the 'Kop van Zuid' will become a part of the city center, with high-rise and urban facilities, the south of the 'Kop van Zuid' will be redeveloped into a more quiet urban residential environment.	The revitalisation of obsolete residential urban neighbourhoods is the biggest assignment for 'Oud-Zuid'. Through the redevelopment of dwellings, additional facilities, investments in the public space and the improvement of the public safety, the spatial planners aim for an renewed identity for this city district.
OLYMPIC OPPORTUNITIES	The possible improvement of public transport (INFR), the possible further development of retail (COM) and the redevelopment of a high quality leisure accommodation (LEI), makes 'Zuidplein' possibly suitable as a Olympic area.	The possible development of a new 'Sports Campus', including various functions (COM, RES and LEI) and the improvement of the public transport (INFR), makes 'Stadionpark' possibly suitable as a Olympic area.	The various area destinations (COM + RES + LEI), combined with the large available areas, make this waterfront area possibly suitable for the development of Olympic functions.	The Olympic Games could possibly fit within the ambitious transformation of this district, with the high building density combined with a high functional diversity (RES+COM).	The development of the Olympic village in 'Oud-Zuid' could possibly contribute to the revitalisation of this residential district (RES).

Figure 8.2: Possibilities for the development of the Olympic spatial content in VIP-areas.

The Olympic spatial content has been subdivided in the development of a commercial program (COM), the residential development (RES), the development of competition venues (LEI) and the possibilities for the improvement of infrastructure (INFR). The visions for the development of these VIP-areas have been cross-referenced with the required development of

Olympic functions. If these two components (vision and required functions) proved to be similar, in functional terms (COM, RES, LEI and INFR) or/and in spatial terms (opportunity of these areas to accommodate the functional units), that particular VIP-area has not been assessed as possible 'suitable' for the development of Olympic functions.

8.4 Development zones

For a goal-orientated use of the decision support instrument on the UDR, which is the allocation model, the aggregation level of the functions (Olympic spatial content, F1-F21) and the zones (urban areas, Z-1-Z20) should more or less correspond. If the aggregation level of the areas is too high, there will be too less details in the output of the allocation model in order to facilitate the decision-making. If the aggregation level is too low, then more technical input will be required, such as the clustering of zones. The VIP-areas itself are significant larger than the specific Olympic functions, therefore the VIP-areas have been subdivided in zones. It must be mentioned that the determination of these zones, are also the interpretation of the USE (author JZ). Therefore the determination of zones partial occurred arbitrary, since municipality Rotterdam hasn't been involved in the process of determining the zones.

In the allocation model, only the zones in VIP-areas that have obtained a 'special status' in the Rotterdam urban strategies of developing a 'strong economy' and creating a 'attractive residential city', have been incorporated. The criteria for obtaining that 'special status' in Rotterdam urban development strategy are summarized below, the zones in VIP-areas have been demarcated by morphological characteristics, such as main road-, railway and water structures (Municipality Rotterdam, 2007):

(1) Areas which contribute to increase the level facilities in the city center (education, child care, medical/social, sports and games, etc.);
(2) Dock areas which dispose significant potential for the transformation into excellent locations for innovative businesses and knowledge institutes, along with exceptional residential, cultural or educational developments;
(3) Areas where large integrated UAD projects are planned;
(4) Waterfront areas where large scale water-related residential developments are planned, and
(5) Areas where a demand steered redevelopment of the obsolete building stock is the main priority.

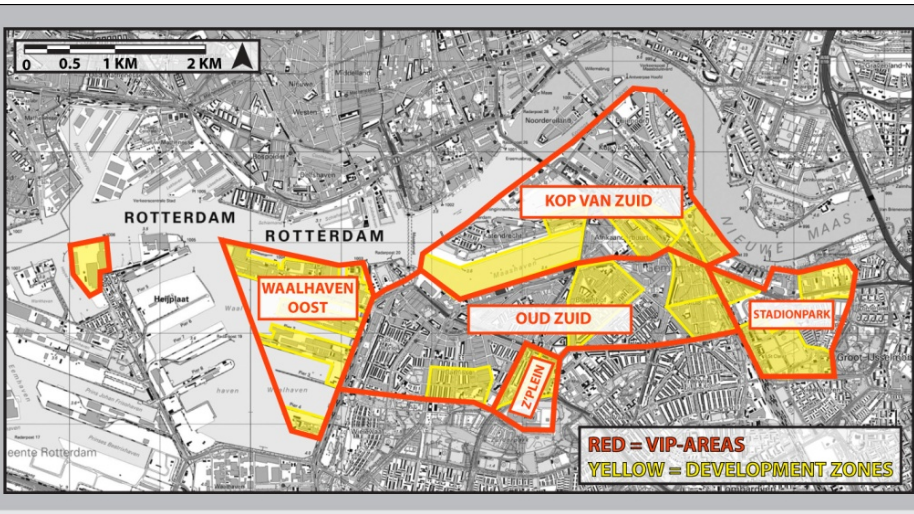


Figure 8.3: VIP-areas and development zones for the case Rotterdam 2028.

Based on the numerical features of Olympic functions (figure 7.7), the competition venues proved to be the smallest functions. For that reason, the size of the competition venues is decisive in the determination of the aggregation level of the zones. The largest competition venue that will be allocated in the UDR is the Aquatics complex [K], with a GSA of 12 Ha; therefore the majority of zones that have been established are larger than 12 Ha. If the size of functions that have to be allocated is larger than the size of zones, then multiple (relative smaller) zones will have to be combined in order to accommodate the (relative larger) functions, this is called the clustering of zones. In the allocation model the clustering of zones has been done for the Olympic village, of which the size of the residential zone varies from 25 Ha (New York 2012) too 134 Ha (Istanbul 2008), and for the larger competition venues. The clustering of zones will be discussed further in the technical elaboration of the allocation model, which is discussed in paragraph 11.4.

8.5 Olympic status quo Rotterdam 2028

As indicated in figure 7.7, the development of the Olympic park could be considered as a significant building assignment for the city of Rotterdam. The Olympic status quo (current status) of Rotterdam, will eventually determine the size of the building assignment. In this context, also the preconditions concerning the mobility of potential Olympic areas must be mentioned. Therefore, before the start of an UDR, the decision makers will have to consider the following questions:

(1) Which adjustments for (public) transportation infrastructures will be essential, to set up adequate spatial preconditions considering the mobility requirements for the organization of the Olympic Games?
(2) Which existing or already planned specific stadiums, indoor halls and complexes might be used as possible competition venues for the Rotterdam 2028 Olympic Games?

For the case Rotterdam 2028, the USE (author JZ) determined that the development of the major 'Sports campus' in the VIP-area 'Stadionpark', including a new multifunctional stadium, and the possible construction of a public transport hub (including intercity railway and subway connections) are essential components for the possible organization of the Olympic Games in Rotterdam. As part of the 'Stadionpark' project, a new subway section between the already existing subway stations 'Kralingse Zoom' and 'Marconiplein' is planned (Municipality Rotterdam, 2009). That new subway section would also intersect the VIP-areas Stadionpark, Zuidplein and Waalhaven Oost and therefore could significantly improve the mobility preconditions considering of these areas, which will influence the decision maker's preferences for zones.

The development of that new subway line, therefore, has been assumed as the starting point for the UDR. The development of a new multifunctional stadium has also been assessed as 'essential' in the context of the case of Rotterdam 2028. Recent study showed that, due financial reasons, the new multifunctional stadium will be accommodated with a capacity of 68.000 (Van Merwijk, 2010). Since the IOC 'only' requires a capacity of 60.000 for the Olympic stadium (IOC, 2004), that new soccer-stadium might also be used for Olympic purposes. However, this would only be possible with flexible designs, so that the multifunctional stadium could be temporary transformed into a facility for athletics, the opening and closing ceremony and the soccer finals. Besides the Olympic stadium, there is also assumed that the already planned ice-skating rink, which is also one of the elements of the 'Sports Campus', could function as a small indoor hall (I), and that the former Feyenoord stadium will be redeveloped to a small stadium (J). Also, the multifunctional indoor arena Ahoy, which after the renovation will dispose a capacity of 13.500 visitors, will be used as the Multipurpose Hall (G). Below the assumptions are summarized that have been made for establishing the starting point for the UDR, these are also illustrated in figure 8.4:

[A] Olympic Stadium (new Feyenoord stadium at Stadionpark);
[E] Infrastructure (new public transport hub at Stadionpark);
[G] Multipurpose Indoor Hall (currently renovated multifunctional indoor arena 'Ahoy', at Zuidplein);
[I] Indoor Hall Small (New ice-skating rink at Stadionpark), and
[J] Small Stadium (renovation of the former Feyenoord stadium 'The Kuip' at Stadionpark).

This would mean that the total number of competition venues, which are allocated in the allocation model, is lowered from 9 to 5 venues. But these assumptions would also mean that certain functions are affixed to certain zones. In one of the requirements (requirement_general_2) mentioned in appendix 2, is outlined that the minimum of sports facilities allocated in the Olympic park are the Olympic stadium, the Olympic Indoor Hall, training facilities, the Olympic square, and public transport facilities (infrastructure) and the IBC/MPC. If the developments of the Olympic stadium and the public transport facilities have been affixed to the Stadionpark, this would also mean that the Olympic Indoor Hall, training facilities, the Olympic square and the IBC/MPC will have to be allocated to zones in or around the Stadionpark.

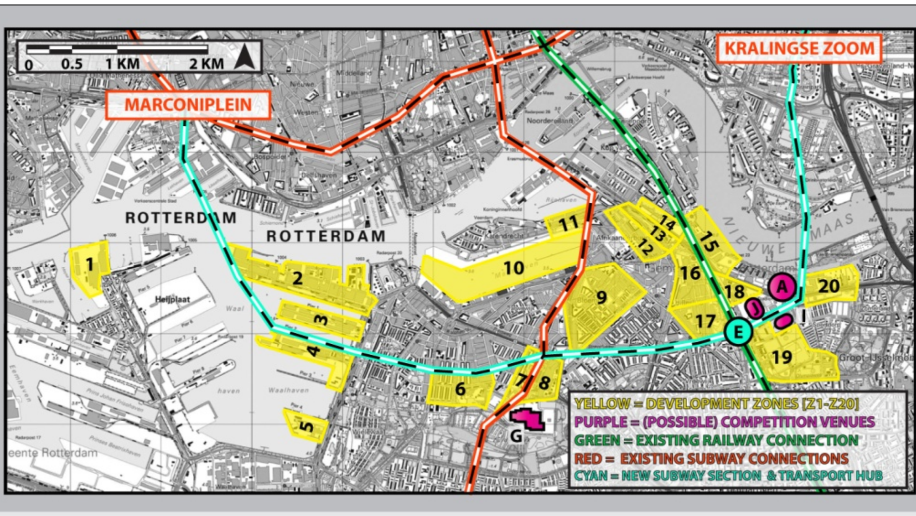


Figure 8.4: Starting point for the UDR, including already existing and already planned (public) transportation infrastructures and possible Olympic competition venues.

8.6 Conclusion

The aim of the analysis described in this chapter was the determination of zones [Z1-Z20] and functions [F1-F21] for the case Rotterdam 2028. In the Rotterdam urban development strategy there has been assigned thirteen VIP-areas, which would obtain higher priority than other UAD projects. Based on these VIP-areas, the possible development zones [Z1-Z20] have been determined, which are graphically reproduced in figure 8.4. It must be mentioned that the determination of these zones, is the interpretation of the USE (author JZ). The accuracy of these interpretations could be increased by the involvement of the municipality Rotterdam in the determination of zones, which hasn't been the case.

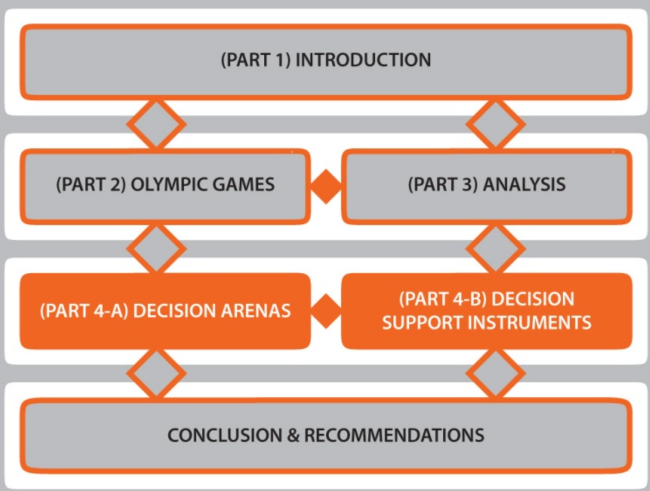
Based on the Olympic status quo, the remaining Olympic program [F1-F21] to be developed for the case Rotterdam 2028 could be determined. In chapter 7, the complete Olympic spatial content has been discussed, of which the complete program is summarized in figure 7.7. Based on the assumptions of the USE, which have been described in this chapter, the starting point for the UDR is established, and the functions [F1-F21] for the allocation model have been determined. These functions are summarized below:

[B] Olympic Indoor Hall (allocation model F1);
[C] Training Facilities (allocation model F3);
[D] Olympic Square (allocation model F7);
[F] IBC/MPC (allocation model F8);
[I] Indoor Hall Small (allocation model F2);
[J] Stadium Small (allocation model F4);
[K] Aquatic complex (allocation model F6);
[M] Tennis complex (allocation model F5);
[N] Olympic Village: Residential Zone (allocation model F10-F15);
[Q] Olympic Village: Infrastructure (allocation model F10-F15);
[R] Hotel Accommodations (allocation model F9), and
[S] Media Village(s): Residential Zone (allocation model F16-F21).

As described in the theoretical framework, the planning and decision-making process of urban planning questions should be an open-end process (Van Loon et. al, 2008). Through the assumptions of the USE, the open-end of this decision-making process is not guaranteed, since the influence of the decision makers was excluded in the establishment of assumptions. But it is essential that first the decision makers approve the assumptions of the USE, in order to guarantee that the final outcome of the allocation model actually has been the result of an open-end decision-making process. If they won't approve these assumptions, new assumptions will have to be established by the decision makers themselves.

PART 4

DECISION SUPPORT INSTRUMENTS



Chapter 9: The Olympic decision arenas

In this chapter, the positioning of the Olympic decision rooms (SDR and UDR) in the context of the Dutch UAD process, and the positioning of the decision support instruments (preference measurement model and the allocation model) in those Olympic decision arenas, will be discussed.

9.1 CU/CS-configuration for the Olympic decision rooms

In paragraph 2.1, Teisman (2001) mentioned that in order to manage decision-making processes concerning spatial planning, a distinction between (1) the interaction between governments, (2) the interaction between citizens, directors and professionals, and (3) the partnerships between public and private parties, has to be made. In the SDR, the decision-making between governments that are involved in the spatial planning will be facilitated. According to De Leeuw (2002), the determination of the aggregation level, defines whether individuals, groups, departments or a whole organization is represented in a decision arena. In the case of the SDR, the decision makers are delegates from four different departments, which collectively constitute the government (organization). In the UDR, the decision-making between the public (municipality) and private parties (commercial developers and housing corporations) that are involved in spatial planning, will be facilitated, In the UDR, these organizations are all represented by one decision maker.

The decision arenas will be illustrated on the basis of the system approach of De Leeuw (2002), where a controlling unit (CU) controls the controlled system (CS). De Leeuw (2002) defined the characteristics of a model (in this case a decision arena) based on the system approach. Models are systems that are used as medium to control other systems. It is important to realize the universality of De Leeuw his definition: with a model not only mathematical models are meant, rather they can be schedules, words, computer language, and mathematical symbols. As mentioned in paragraph 2.3, in order to achieve a conducted (goal-oriented) steering intervention, first the decision problem needs to be defined, which requires the specification of three necessary elements:

(1) The specification of the goal (output);
(2) The specification of the system that has to be controlled (CS), and
(3) The specification of the environmental characteristics (contextual influences).

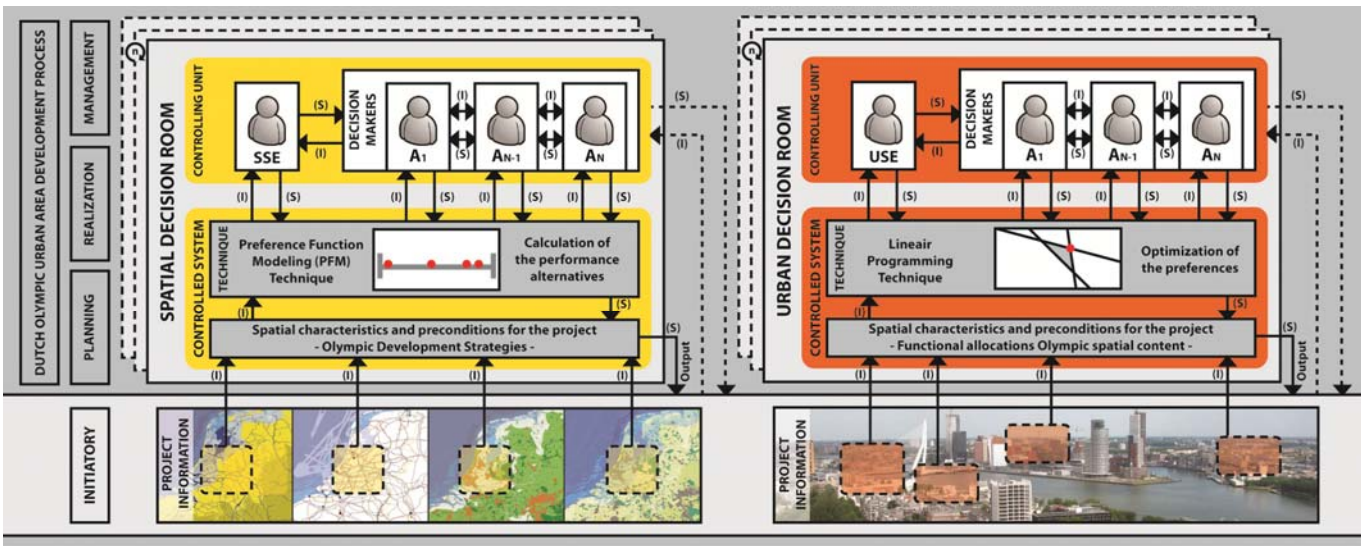


Figure 9.1: The CU/CS-configuration for both Olympic decision rooms (Source: Helmerhorst, 2007, adapted).

9.1.1 The output

The output of both decision arenas would be project information for the Dutch Olympic UAD process, in the configuration of preferences (support) for possible alternatives and the accompanying spatial preconditions for alternatives, both from decision makers that operate on a national as well as an urban scale level. In the SDR the emphasis of the content of decision-making would be the Olympic development strategies and their spatial preconditions. In the UDR the emphasis of the content of decision-making would be the possible functional allocations of the Olympic functions and the accompanying spatial preconditions for these allocations, in this UDR specific for the case Rotterdam 2028.

9.1.2 The controlled system

The system that needs to be controlled is the project information for the Dutch Olympic UAD process, which in the SDR is related to Olympic development strategies, and in the UDR to functional allocations of the Olympic program. In the initiatory phase, where complexity is most substantial (Bruil et. al, 2004), it will be difficult to establish spatial preconditions for strategies and functional allocations (controlled system), since it is complicated to determine possible alternatives. In order to generate alternatives, the decision support instruments have been designed, so that the decision-making process concerning spatial preconditions can be facilitated.

Since the decision makers steer on the variables in the decision support instruments, these models are also positioned in the controlled system. The most important feature, of the five basic features of an UDR that have been described in paragraph 2.5, for the decision support instruments in the SDR and in the UDR would be the end-means system feature for the representation of the relations in an interactive decision-making multi-actor network. Because of this, a direct link is made in between the visions (possible, various, conflicting, etc.) and goals of the decision makers involved in relation to the substantial urban planning variables and the associated decision-making process. The variables which can be steered in the SDR are the weights for criteria and ratings of alternatives, which will be amplified further in chapter 10. The variables which can be steered in the UDR are adjustments in the value of input-variables and adjustments in weights for zone/ function-combinations, which will all be amplified further in chapter 11.

De Leeuw (2002) defined the manipulation with the steering variables of decision support instruments, as ‘internal routine management’. Additionally, since the allocation model that will be developed for the UDR has been designed on the basis of the Linear Programming Technique, also the second system feature, about the group optimization for modeling the common dynamic solution space, will become of a significant importance. The modeling of the common solution space is intended to give the decision makers insight into the feasibility of their own plans, given the boundaries of this space, which in the allocation model will be possible through the determination of additional content-related requirements by the decision makers. De Leeuw (2002) defined the incorporation of additional requirements in the model, where the steering goals will be modified, as ‘Internal strategic (goal) management’.

9.1.3 The environment

The SDR and the UDR both operate in the same environment, which is the initiatory phase of the Olympic UAD process. In this context it is essential to emphasize that the initiatory phase has not been finished after the completion of the SDR and the UDR. The SDR and the UDR, which have been illustrated in figure 9.1, are only two sub-phases of the initiatory phase.

According to De Leeuw (2002), controlling could also occur indirectly: if the steering intervention of the CU is not aimed to the CS itself, but to the environment of the CS, so that the CS is influenced along an alternative way. This is e.g. the case when policy documents, which have been the basis for the content of both decision arenas, are expended with additional information. This would be very unlikely to occur. De Leeuw (2002) defined this way of manipulating of the steering variables, where the environment is considered as the CU, as ‘external routine management’. Since both decision arenas are positioned in the same environment, the output of both decision arenas can be used as project information for another, which might result in the determination of (possible) additional alternatives.

Both decision arenas can function independent from each other, since the content of both arenas is dissimilar. The content of the SDR is about the spatial strategic characteristics of the organization of Olympic Games, the content of the UDR is about putting these spatial strategic characteristics into operation. However, since the decision support instrument of the UDR is capable of incorporating these strategic spatial characteristics in the alternatives, it would be recommendable to complete the SDR before the start of the UDR.

9.2 The role of the systems engineer

Binnekamp et. al (2006) mentioned that the process leading to an 'Open Design', i.e. a design in which interests of all stakeholders are reflected in an optimal manner, is complex. The management of the entire Open Design process (communicate outcomes, to gain acceptance for these outcomes, to avoid stalemate situations, to maintain momentum, etc.) is in practice even more crucial to success than the mathematical methods and computer tools involved. Therefore, the role of the systems engineer is vital. After experimenting with their UDR (for the case Heijsehaven), Van Loon et. al (2008) concluded that the urban planning expertise of the systems engineer is essential in supporting decisions regarding urban development processes which, therefore, requires competences of the systems engineer in terms of technology, content and social interaction. Van Loon et. al (2008) introduced the role of 'Urban Systems Engineer' (USE), which encompasses performing the following design and modeling activities:

(1) Substantial-technological development of the model in relation to the design issues, so that the model could function in terms of substance as a decision support instrument in an interactive arena;
(2) Development and design of new (including content, communicative and process-related) management measures for the functioning of a UDR, aimed at improving the planning and decision-making process, and
(3) Managing and taking charge of UDR sessions aimed at group combinations, making progress, and preventing and removing any deadlocks.

If we translate these activities to the activities that the SSE has performed for the Olympic SDR, with the first activity is meant the design of the preference measurement model. With the second activity is meant the improvement of the functioning (both the content and the process) of the SDR, with the organization of a workshop (paragraph 10.5). With the first activity that the USE has performed for the Olympic UDR, is meant the design of the allocation model. With the second is meant the improvement of the functioning (primarily the content) of the UDR by performing technical tests with the allocation model (paragraph 11.5). The third activity would be performed if the models will actually be used in the practice of the Dutch Olympic UAD process, where the SSE/USE would manage and take charge of SDR/UDR sessions.

9.3 Measurement scales

In both Olympic decision arenas, the measurement of preferences is (one of the) basic elements for the input of the decision support instruments. The two measurements occur on different measurement scales, which is the result of the number of criteria (in the SDR multiple criteria, in the UDR one criterion), which requires different techniques for processing the data (in the SDR the PFM-technique, in the UDR the Linear Optimization-technique). The definite difference between these two measurements would be that on the basis of the PFM-technique, the performance of each of the alternatives can be measured, while the Linear Programming-technique would only deliver the 'best' alternative of an optimization.

The decision support instrument in the SDR will be able to perform a multiple criteria decision analysis, where the decision makers will have to establish weigths (preferences) for criteria and the performance of alternatives (on the basis of those criteria), which will be further amplified in chapter 10. For these kinds of measurements, the distinction, ranking, the equal differences and in this case also the equal ratio's (lowest ranked alternative is actually zero) of data are relevant. Therefore the ratio scale will be used for the preference measurement in the SDR. A ratio scale is a measurement scale in which a certain distance along the scale means the same thing no matter where on the scale you are, and where '0' on the scale represents the absence of the thing being measured. Thus a '4' on such a scale implies twice as much of the thing being measured as a '2' (Bruce et. al, 2010). The proportions on the ratio scale, therefore, are relevant.

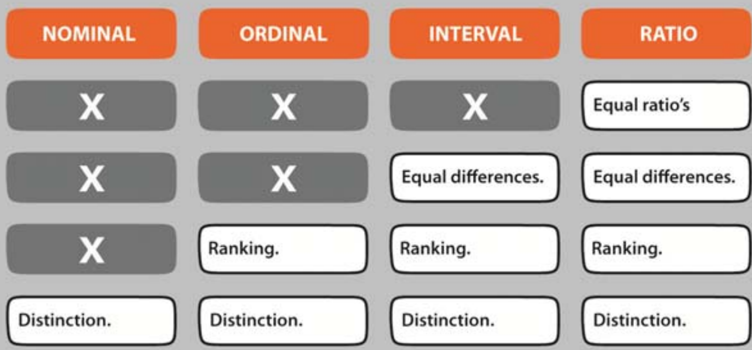


Figure 9.2: Characteristics of scale of measurement (Source: Van Oel, 2007)

In the UDR, the decision makers will have to establish the preference (or suitability) for zone/ function-combinations, which will be further amplified in chapter 11. According to Binnekamp (2010), ordinal scales arise from rank in ordering of data (distinction and ranking). These kinds of measurements are ordered in the sense that higher numbers represent higher values: it assigns values to objects based on their ranking with respect to one another (Bruce et. al, 2010). However, the intervals between the numbers are not necessarily equal. Therefore, while decision makers know that the value 2 is better than the value 1, there is no implication that a 2 is actually two times as good as a 1.

9.4 Conclusion

In the Olympic context, there could be distinguished multiple decision arenas, on various scale levels. In this thesis, therefore, two decision arenas will be discussed: one on the national scale and one on the urban scale. In the SDR (Spatial Decision Arena), the decision-making between governments (departments from the central government) that are involved in the spatial planning processes, will be facilitated. In the case of the SDR, the decision makers are delegates from four different departments. In the UDR (Urban Decision Arena), the decision-making between the public (municipality) and private parties (commercial developers and housing corporations) that are involved in the spatial planning processes, will be facilitated. This way of approaching the Olympic assignment, where in multiple decision arenas the assignment will be discussed, results in a spatial planning process where the assignment will be managed not only top-down (from the perspective of the national government), but also bottom-up (from the perspective of the 'local' stakeholders that will be involved in the development of the urban areas).

In the initiatory phase, where complexity is most substantial (Bruil et. al, 2004), it will be difficult to establish spatial preconditions for strategies and functional allocations, since it is complicated to determine possible alternatives. In order to generate alternatives, the decision support instruments have been designed, so that the decision-making process concerning spatial preconditions can be facilitated. In chapter 10, the design of a preference measurement for the Olympic SDR will be discussed, which would facilitate the decision-making concerning the Olympic development strategies and their spatial preconditions. In chapter 11, the design of a allocation model for the Olympic UDR will be discussed, which would facilitate the decision-making concerning the possible functional allocations of the Olympic program and the accompanying spatial preconditions for these allocations. In both Olympic decision arenas the measurement of preferences is (one of the) basic elements for the input of the decision support instruments. The two measurements occur on different measurement scales (in the SDR the ratio scale, in the UDR the ordinal scale), which is the result of the number of criteria (in the SDR multiple criteria, in the UDR one criterion), which requires different techniques for processing the data (in the SDR the PFM-technique, in the UDR Linear Optimization-technique).

Chapter 10: Preference measurement model

10.1 Introduction

According to Binnekamp (2010) in 'Preference-Based Design in Architecture', a Multiple Criteria Decision Analysis (MCDA) is composed of five ingredients, which are alternatives, criteria, stakeholders, weights and an algorithm. These ingredients will outlined by the translation of those terms into the content that will be discussed in the SDR. In the preference measurement model that has been developed for the SDR, the alternatives to choose from are Olympic development strategies (paragraph 6.3). In order to select the most preferred alternative, we need to find out which alternative is preferred over the others by stakeholders; Binnekamp (2010) described that process as the rating of an alternative's performance. The stakeholders in the SDR are four departments from the central government of the Netherlands. As these decision makers have difficulties judging the performance of an alternative as a whole, different attributes of alternatives are taken into account, termed criteria. For this model, the criteria are the national spatial policy objectives, which have been derived from the National Spatial Strategy. The relative importance of criteria and decision makers are incorporated using weights. The overall preference rating (performance) of an alternative is then determined by an algorithm that takes into account each alternative's performance on each criterion and its weight.

Figure 10.1: Preference measurement matrix.

10.2 Tetra

Binnekamp (2010) stated that a new theory of (preference) measurement has been developed by Barzilai. Barzilai established that the operations of addition and multiplication are not applicable to measurement scales (paragraph 9.3), that are based on common operations research methodologies. Binnekamp outlined that the main results of Barzilai his new theory are the construction of measurement scales to which linear algebra and calculus are applicable. Based on Barzilai his theory, a practical methodology for constructing proper preference scales, Preference Function Modeling (PFM), and a software tool that implements it, Tetra, have been developed. The Tetra online reference can be found online (Barzilai, 2010), the preference measurement model for the SDR has also been designed on the foundations of Tetra. The utilization of PFM has been summarized on the following generic formal procedure (Binnekamp, 2010):

(1) Specify the alternatives;
(2) Specify the decision maker's criteria tree;
(3) Rate the decision maker's preferences for each alternative against each leaf criterion as follows:
    (A) For each criterion establish reference alternatives: a 'bottom' reference alternative which is rated at 0, and a 'top' reference alternative which is rated at 100;
    (B) Rate the preference for the other alternatives relative to these reference alternatives on the scale established;
(4) To each leaf criterion assign decision maker's weight, and
(5) Use an algorithm (in this case the PFM-algorithm) to yield an overall preference scale.

The procedure for a group of decision makers is identical to the procedure for a single decision maker, with the exception that each decision maker has to rate his preference for the alternatives on each criterion (3B) and the weights to each leaf criterion (4).

10.3 Input model

For collecting and processing the data of decision makers, Tetra will be used, which therefore will function as a multi-criteria decision and evaluation tool. Based on the input, which are weights (for criteria) and ratings (of alternatives) of the decision makers, Tetra is able to establish the performance of Olympic development strategies.

10.3.1 Weights for criteria

The weights for valuing criteria (C1-C9) are about the decision maker's priority for these criteria, which is reflected in the extend to which that criteria might contribute to achieving their individual objectives. The weights for the criteria are relative; they represent the importance of a criterion in relation to the others. Since the decision makers have to rate the performance of the alternatives on the basis of these criteria, in the weigths for the criteria also the relation between the possibilities to achieve that policy objective by means of the organisation of the Olympic Games, should be reflected. Therefore, in the weigths for valuing criteria, there are two relations have to be considered by the decision makers:

(1) The relation between national policy objectives and the outcomes of the implementation of a policy, so that can be established which policy objectives are 'important', and
(2) The relation between the individual objectives of departments and the possibilities to achieve those 'important' policy objectives by means of the organisation of the Olympic Games.

The decision maker's weigth (preference) for a criterion, therefore, reflects the level of importance of a national spatial policy objective for achieving their individual objectives, and furthermore the extend to which it is possible that the Olympic Games contribute to the achievement of these individual objectives, which has been illustrated in figure 10.2.

Figure 10.2: Schematic reproduction of considerations required for the weighting of criteria.

10.3.2 Rating of alternatives

Rating of alternatives is about the opportunity to contribute achieving the national spatial policy objectives (C1-C9) by means of the spatial characteristics of the Olympic development strategies (A1-A4). The rating spectrum has been established with two reference alternatives, where a 'bottom' reference alternative is rated at Z/0, and a 'top' reference alternative is rated at H/100. As mentioned in procedure of a preference measurement (paragraph 10.2), at least two reference alternatives must be defined for each criterion on which the alternatives are rated, in order to establish a scale (rating ruler). For the determination of Z/0, a hypothetical alternative (A5) is added. The hypothetical 'Z'-object for each criterion would be that the Netherlands would not organize the Olympic Games, which means that the Games don't contribute to the achievement spatial policy objectives. As mentioned in the analysis of chapter six, there have been distinguished four Olympic development strategies. If the decision makers are able to determine the specifications of another Olympic development strategy, an additional alternative could be incorporated.

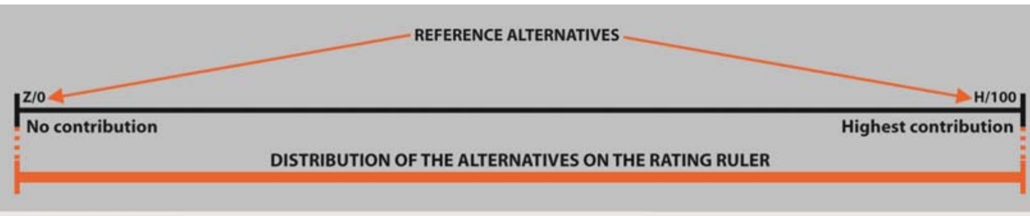


Figure 10.3: Input sheet performance alternatives.

In order to value the rating for the alternatives, there are two relations have to be considered by the decision makers:

(1) The relation between Olympic development strategies and their spatial characteristics, and
(2) The relation between spatial characteristics and the extent to which these characteristics contribute to achieve spatial policy objectives.

The rating of alternatives on the basis of a criterion is about the opportunity to achieve that national policy objective by means of the spatial characteristics of the Olympic development strategies, which has been illustrated in figure 10.4.

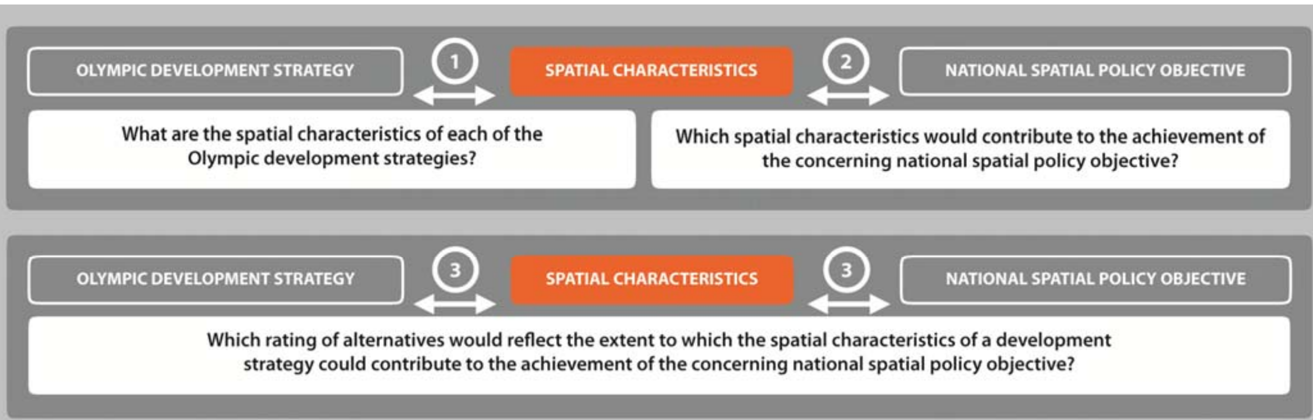


Figure 10.4 Schematic reproduction of considerations required for the weighting of alternatives.

10.4 Content model

In paragraph 10.1, the five 'ingredients' for an MCDA already have been introduced. In this paragraph, the content for three of these ingredients will be discussed in the context of the SDR, which are the decision makers (paragraph 10.4.1), the alternatives (10.4.2) and the criteria (paragraph 10.4.3).

10.4.1 Dutch departments

In the national decision arena there are four decision makers involved in the decision-making concerning the possible organisation of the Olympic Games of 2028. These are three ministeries that are direcly involved with the content of the policy document is the National Spatial Strategy (VROM, 2006); this document has been the basis for the determination of the criteria. The department of Health, Welfare & Sports has been added to the list of decision makers in the SDR, because of the sports-related decision subject. All decision makers in this decision arena, of which their roles are described in appendix 3, will have the same decision weight, the decision makers in the SDR are:

Decision maker 1: Department of Housing, Spatial Planning & the Environment;
Decision maker 2: Department of Transport, Public Works & Water Management;
Decision maker 3: Department of Economic Affairs, and
Decision maker 4: Department of Health, Welfare & Sports.

Figure 10.5: Departments that are represented in the SDR.

In order to evaluate the technical utilization and the possibilities to facilitate the content of the preference measurement model, the workshop SDR has been organized: the roles of the decision makers have been played by students from the faculty of Architecture of the University of Technology Delft. Their 'role prescriptions' have been determined based on the overall objectives of the departments. Also their possible individual objectives, which they might purpose to achieve through the organization of the Olympic Games, have been established. On the basis of possible trends and (inter)national issues that the departments might encounter in the next two decades, the spatial (DM1 & DM2), economical (DM3) and sportive (DM4) objectives concerning the organization of the Olympic Games, have been established. These trends and (inter)national issues have been derived from 'Olympic Plan 2028' (Program Office OP 2028, 2009), which is a document about the purposed Dutch Olympic ambitions, and from the publication 'Dutch Delta Games' (Van Hoorn et al., 2006), which is study of the Dutch Environmental Assessment Agency about the opportunities for the organization of the Olympic Games in the Netherlands. The possible individual objectives of the departments concerning the organization of the Olympic Games are elaborated in the role descriptions of appendix 3.

10.4.2 Olympic development strategies

On the basis of current attainability features and future exploitation possibilities, as a starting point for the SDR is assumed that the majority of Olympic activities will take place in the Randstad agglomeration. The alternatives to choose from are the Olympic development strategies established in paragraph 6.3, which are:

Alternative 1: Olympic Redevelopment;
Alternative 2: Olympic Urban Expansion;
Alternative 3: Strategic Olympic Clusters, and
Alternative 4: Olympic Venue Scattering.

These strategies describe the strategic differences in approaches for (1) The distribution of competition venues, (2) The purpose for the development of a new residential quarter and (3) The purpose of the construction of new infrastructure.

10.4.3 National spatial policy objectives

The performance of alternatives will be established on the basis of criteria. In the Olympic SDR these criteria are national spatial policy objectives, derived from the 'Nota Ruimte' (VROM, 2006). The National Spatial Strategy is an integrated document produced by four different departments, wherein the planning horizon is would be 2020 (Vink et. al, 2006). According to VROM, the main goal of the national spatial policy is to create space for the different functions that demand it (and to do so in a sustainable and efficient manner), to safeguard and increase the livability of the Netherlands, and to improve the spatial quality of urban and rural areas, paying particular attention to creating the right conditions for the application of development planning. More specifically, with the implementation of the National Spatial Strategy, the government focuses on four general objectives (VROM, 2006):

(1) Strengthening the international competitive position of the Netherlands;
(2) Strong cities and a vibrant, dynamic countryside;

(3) Preserving and developing important national and international spatial values, and
(4) Ensuring public safety.

The objectives that have been derived from the National Spatial Strategy are the objectives with a strategic character, which are related to the spatial content of the Olympic Games. In appendix 3, a short description of each of the following criteria has been attached:

Criterion 1: Concentration of urbanization in urban centers;
Criterion 2: Development of national urban networks;
Criterion 3: Improvement of accessibility in urban centers;
Criterion 4: Improvement of accessibility in national urban networks;
Criterion 5: Improvement of the livability of the urban environment;
Criterion 6: Improvement of the social-economic climate in cities;
Criterion 7: Integrating urbanization and water management;
Criterion 8: Strengthen the international position of the Randstad, and
Criterion 9: Strengthen the economical, ecological and social-cultural values.

10.5 Workshop

In order to assess the functionality of the preference measurement model, a workshop has been organized. During that workshop, the weighting of criteria and rating of alternatives proved to be complicated. This is caused by the large difference in scale between national spatial policy objectives and urban strategic spatial characteristics. Furthermore, the multitudes of factors which converge in the weight for criteria (figure 10.2) and in the rating for alternatives (figure 10.4) also complicate the process of delivering input. However, in practice the decision makers would be delegates from the departments, with a maximum knowledge of the national spatial policy objectives, their departments' individual objectives and the spatial characteristics of the Olympic development strategies. For these decision makers, therefore, the determination of their departments' position concerning the criteria and the alternatives would be more common.

In order to stimulate the decision-making concerning strategic characteristics of the organization of the Olympic Games, based on the workshop, the following structure for the decision-making process in the SDR has been established:

(1) Individual input round I;
(2) Collective evaluation of the individual input decision makers;
(3) Collective establishment of the reference alternatives (Z/0 & H/100);
(4) Individual input round II, and
(5) Establishment of the performance of the alternatives and the determination of preconditions.

Figure 10.6: Individual input round Workshop SDR.

After the first individual input round the decision makers will be faced with each other's input and the individual input of decision makers will be evaluated collectively: the decision makers will have to justify their weights for criteria and their ratings of alternatives. This is where the decision-making begins, the purpose of that process would be that the decision makers will comprehend each other's individual objectives and furthermore establish possible collective interests. Preliminary to the second input round, the decision makers will have to agree unanimous the 'H'-object for each criterion in order to obtain a valid measurement. As mentioned in paragraph 10.3.2, the hypothetical 'Z'-object for each criterion would be that the Netherlands would not organize the Olympic Games. After the second input round, the performance of the alternatives can be established. Moreover, the contradictions in the output will be discussed, so that also the spatial preconditions can be determined. An example of a contradiction in the output would be the situation where an alternative with, according to the decision makers, the highest overall performance, would perform weak on a particular criterion that obtained a significant priority of one of the decision makers.

The sensitivity of the variables (weights of criteria and ratings of alternatives) on the output (performance of alternatives) is significant. For the decision makers it therefore would be easy to 'manipulate' the outcome of a measurement. Nevertheless, the 'manipulability' of the model will be countered by the open way of decision-making (paragraph 1.5), since the decision makers collectively evaluate the individual input of decision makers.

10.6 Conclusion

Based on a Multiple Criteria Decision Analysis (MCDA), the overall preference rating (performance) of an alternative could established by an algorithm that takes into account the alternative's performance on each criterion and its weight, which have been established by the stakeholders. In the preference measurement model that has been developed for the SDR, the alternatives to choose from are Olympic development strategies, the criteria are the national spatial policy objectives, which have been derived from the National Spatial Strategy, and the stakeholders are four departments from the central government of the Netherlands.

The preference measurement model forces the decision makers to attach weights to the criteria and to attach a rating to the alternatives and, therefore, forces the decision makers to consider strategic spatial characteristics of the possible organization of the Olympic Games. The weighting of criteria and rating of alternatives proved to be complicated. This is caused by the large difference in scale between national spatial policy objectives and urban strategic spatial characteristics. Furthermore, the multitudes of factors which converge in the weight for criteria (figure 10.2) and in the rating for alternatives (figure 10.4) also complicate the process of delivering input.

The sensitivity of the variables (weights of criteria and ratings of alternatives) on the output (performance of alternatives) is significant. For the decision makers it therefore would be easy to 'manipulate' the outcome of a measurement. However, the 'manipulability' of the model will be countered by the open way of decision-making (paragraph 1.5). The decision makers collectively evaluate each other's the individual input; they will have to justify their weights for criteria and their ratings of alternatives. The purpose of that process would be that the decision makers comprehend each other's individual objectives concerning the possible organization of the Games and furthermore to establish possible collective interests.

10.7 Reflection

On the basis of Olympic explorations in part 2, the relevant content of the decision-making for the national spatial scale level (SDR) has been determined (paragraph 5.6). Furthermore, in part 4 the initiative for the design of a preference measurement model for the SDR was established. Nevertheless, the question about the application of the preference measurement model in the contemporary practice still remains unanswered. With this research, the foundations for a decision support instrument that is capable of steering on the content of decision-making in the SDR might have been developed. However, for the implementation of the model in the Dutch Olympic UAD process, the following preconditions should be taken into account:

(1) The involvement of decision makers in the process of the determination of relevant issues to be discussed in the SDR. Eventually the decision maker's support for the approach of translating the national policy into spatial preconditions, on the basis of the 'National Spatial Strategy' and Olympic development strategies, is essential.

(2) The involvement of decision makers in the process of the determination of the content for the preference measurement model. Since the decision makers will steer on the content of the model, it is essential that the decision makers agree which steering variables are being used for the model of the SDR, which are alternatives (Olympic development strategies) and the criteria (National spatial policy objectives). As mentioned earlier, on the basis of the workshop was concluded that the weighting of criteria and rating of alternatives proved to be complicated. Therefore, with the involvement not only the determination of steering variables is meant, but also the determination of the extent to which decision makers are able to steer on these variables. Furthermore, the 'sensitivity' of the steering variables proved to be significant. In this context it, therefore, is important mentioning that the preference measurement model should only be used to 'feed' the SDR with subjects for decision-making. In other words, the considerations and the spatial preconditions of decision makers should obtain the primary focus, instead of the calculated performance of alternatives.

(3) When the decision makers have been involved both in the determination of relevant issues to be discussed in the SDR and in the determination of the content for the preference measurement model, the following precondition would consider providing accurate technical circumstances for the organization of the SDR. This would primarily signify the improvement of the 'user-friendliness' of the preference measurement model, the connection of a number of computers to a network, and the possibilities for the projection of the output of the model.

(4) The precondition of adequate management of the SSE in the SDR. As mentioned in paragraph 9.2, the management of the entire Open Design process is in practice even more crucial to success than the mathematical methods and computer tools involved (Binnekamp et. al, 2006). In this context, therefore, must be emphasized that the role of the SSE, as a technological content-based model builder as well as a mediator who's managing the decision-making between the parties in the SDR, is vital.

Chapter 11: Allocation model

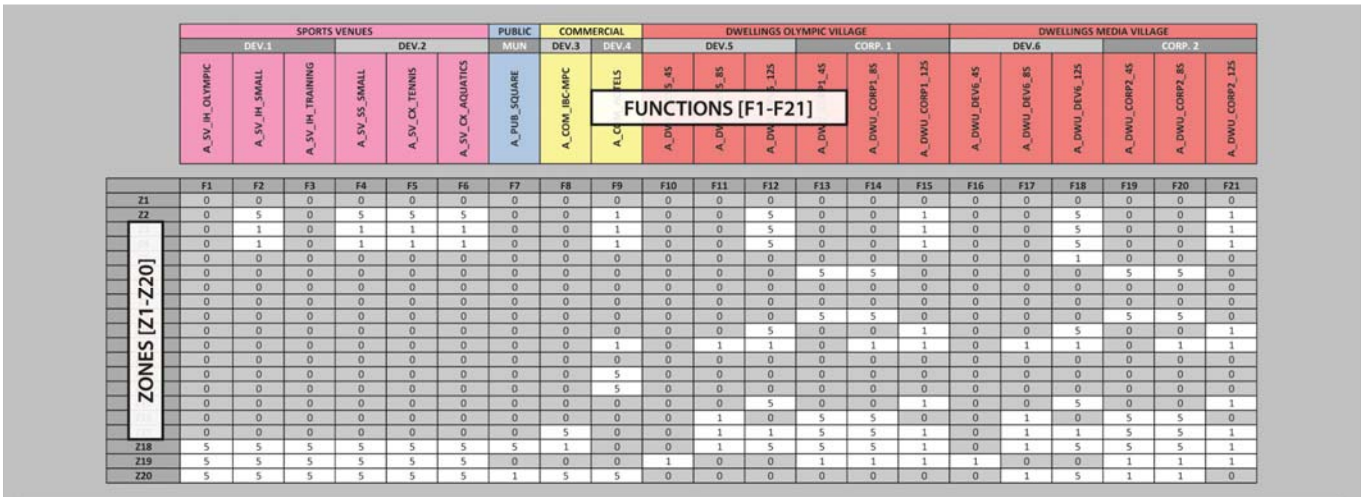
11.1 Introduction

An allocation model is a digital system which is capable of performing an optimization of a functional allocation, on the basis of the specification of a solution space and preferences of decision makers. Such a decision support instrument can be used for UAD related 'problems', of which the complexity is primarily caused by various possible objectives/interests of the multiplicity of decision makers (paragraph 2.2), because of the dynamic character of the model, which enables to produce alternative solutions for each of these various objectives of decision makers that are relating to the particular UAD.

The allocation model has been designed on the basis of the information derived from the analysis of chapter 7, about the functional units (in Ha) of the Olympic spatial content and the requirements concerning the allocation of these specific functions. In addition, the analysis of chapter 8, about the specification of possible development zones [Z1-Z20] and the determination of the required program [F1-F21] for the case Rotterdam 2028, also is consulted for the design of the allocation model.

11.2 What'sBest!

The allocation model is designed with the spreadsheet program Microsoft Excel in combination with the add-in of a program that is called 'What'sBest!'. According to users guide of 'What'sBest!, that add-in is a digital 'solver': it is an system which is capable of performing linear, integer, and nonlinear optimization on the most difficult of problems (Lindo Systems, 2007). In that users guide there is also mentioned that are three steps to setting up a model to be solved by 'What'sBest!', which are the determination of 'adjustable' cells, the definition of a 'best' cell, and the specification of 'constraint' cells. The adjustable cells are the cells in the worksheet that 'What'sBest!' can adjust in its quest for a solution. In mathematical programming terms, these are called variables. Specifically, these 'decision' variables are used to identify the cells that may be adjusted by the solver in its search for a solution that optimizes the objective cell while satisfying all constraints. The constraint cells identify any limitations in a model. The 'best' cell, which also could be referred to as the objective of optimization, is the cell whose value is to be minimized or maximized during optimization. The best cell must be an adjustable cell or a formula depending upon an adjustable cell defining exactly what there has to be optimized.



	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20	F21
Z1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z2	0	5	0	5	5	5	0	0	1	0	0	5	0	0	1	0	0	5	0	0	1
	0	1	0	1	1	1	0	0	1	0	0	5	0	0	1	0	0	5	0	0	1
	0	1	0	1	1	1	0	0	1	0	0	5	0	0	1	0	0	5	0	0	1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	5	5	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	5	5	0
	0	0	0	0	0	0	0	0	0	0	0	5	0	0	1	0	0	5	0	0	1
	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	0	1	1	0	1	1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	5	0	0	1	0	0	5	0	0	1
	0	0	0	0	0	0	0	0	0	0	1	0	5	5	0	0	1	0	5	5	0
	0	0	0	0	0	0	0	5	0	0	1	1	5	5	1	0	1	1	5	5	1
Z18	5	5	5	5	5	5	5	1	0	0	1	5	5	5	1	0	1	5	5	5	1
Z19	5	5	5	5	5	5	0	0	0	1	0	0	1	1	1	1	0	0	1	1	1
Z20	5	5	5	5	5	5	1	5	5	0	0	0	0	0	0	0	1	5	1	1	0

Figure 11.1: Preference-matrix allocation model.

For the allocation model that has been designed for the case Rotterdam 2028, an optimization takes place based on the decision maker's preferences for the development of certain functions on certain development zones (preferences for zone / function-combinations) and the degree in which the allocation of these functions to certain zones is possible (specification of constraints concerning these zones and functions), which in the allocation model has been translated into the following objective of optimization:

SUMPRODUCT {(preference-matrix): (constraint-matrix)}

Through the definition of that formula, the model will generate the solution within the identified solution space (specified by the constraint-matrix), wherein the zone/function-combinations that have obtained a higher preference will be allocated rather than zone/function-combinations with a lower preference. A particular situation occurs when the preferences are undifferentiated, which would mean that the allocation of a specific function is the same for various zones, so that there are multiple alternatives with an equal preference. Based on the solution-algorithm of 'What'sBest!' the allocation model would still be able to generate a single alternative. Therefore, it is essential to accurately examine the output of the model after an allocation round. If the input for certain zone/function-combinations is neutral, and the decision makers declare that this specific output of the allocation model won't reflect their preferred alternative, these decision makers should also be able to translate that deviating 'preference' into other input variables. In that situation, the input won't be 'neutral' anymore, and therefore won't lead to the same optimum for the multiple alternatives.

In order to facilitate the decision-making process, it is essential that the allocation model generates multiple possible alternatives, based on e.g. the adaption of input variables, the fixation of specific zone / function-combinations, or the specification of additional constraints. During that cyclic process where the decision makers deliver input variables for the allocation model, where the model delivers an alternative and where subsequently the decision makers discuss the features of that alternative, sometimes the allocation model isn't able to deliver output through 'infeasible' solutions. Since the objective for the allocation model is the optimization of the sum product of the preference-matrix and the constraint-matrix, these infeasible solutions are caused due insolvabilities in one of these matrixes. For the preference matrix these infeasibilities are the result of too little positive zone/function-combinations, which would mean that the decision makers indicate that there are too less 'suitable' zones for the development that particular program. In order to prevent that the allocation model will deliver infeasible solutions through the insolvability of the preference-matrix, there have been incorporated 'dummy' zones. A dummy zone in the model would only be used for the allocation of functions if there are no other zones left for the allocation of these/that function(s), since it is connected to a relative low preference (zero) for the allocation of each function. If the infeasibility in the model is caused by insolvabilities in the constraint matrix, this would mean that (some of) the constraint(s) have been specified so tight that there couldn't be defined a solution space, or that there have been incorporated multiple contradictory constraints. In that case, the particular constraints that have caused the insolvability would have to be identified by the USE. Subsequently, the USE should establish in accordance with the decision makers, which of these constraints could be adapted.

11.3 Input model

As indicated in the previous paragraph, the objective of optimization for the allocation model would be sum product of the preference-matrix and the constraint-matrix. The values of the input variables and the constraints that are incorporated in both matrixes are determined by the decision makers through exogenous variables (paragraph 11.3.1), constraints (paragraph 11.3.2), and weights for zone / function-combinations (11.3.3) and boundary conditions (11.3.4).

11.3.1 Exogenous variables

The exogenous variables are variables of which the value exogenous is determined, for example by the decision makers in the UDR. Initially these values have been established by the USE, on the basis of the analysis of chapter 6, 7 and 8. If the decision makers collectively agree on other values, these exogenous variables can be adapted. In this report, these exogenous variables have been described in small characters. Besides the exogenous variables there are also endogenous variables, which are the values of variables that will be determined through the optimization. In this report, the codes of these endogenous variables have been described in capitals.

The accuracy of the output of the allocation model is partly determined by the sensitivity of exogenous variables. The number of media villages (n_mv_tot) significantly influences the allocation the media village functions [F16-F21], since it determines the aggregation level of the media village(s). As mentioned in paragraph 7.6, the exploitation possibilities of the Olympic and media villages after the Games, which in the model will be steered by that variable (n_mv_tot), is strongly related to their (mutual) positioning in the city. Therefore, it will essential that all decision makers comprehend the consequences of the value that variable.

INPUT (Exogenous variables)					
DESCRIPTION			CODE	VALUE	UNIT
REQUIREMENTS	RESIDENTIAL DEVELOPMENT	Number of DWU in the Olympic Village	n_dwu_ov_tot	3733	DWU
		Number of apartments in the Media Village	n_dwu_mv_tot	1000	DWU
		Min. perc. Affordable Housing Olympic Village	pmin_dwu_aff_ov	50.0	%
		Max. perc. Affordable Housing Olympic Village	pmax_dwu_aff_ov	55.0	%
		Min. perc. Affordable Housing Media Village	pmin_dwu_aff_mv	50.0	%
		Max. perc. Affordable Housing Media Village	pmax_dwu_aff_mv	55.0	%
		Min. number of DWU developed by DEV5	nmin_dwu_dev5_tot	0	DWU
		Max. number of DWU developed by DEV5	nmax_dwu_dev5_tot	3733	DWU
		Min. number of DWU developed by DEV6	nmin_dwu_dev6_tot	0	DWU
		Max. number of DWU developed by DEV6	nmax_dwu_dev6_tot	1000	DWU
		Density 4 storey high residential buildings	dens_dwu_4s	29	DWU/Ha
		Density 8 storey high residential buildings	dens_dwu_8s	58	DWU/Ha
		Density 12 storey high residential buildings	dens_dwu_12s	87	DWU/Ha
		Max. surface area development of DWU Olympic Village total	amax_dwu_ov_tot	150	Ha
		Max. surface area development of DWU Media Village total	amax_dwu_mv_tot	50	Ha
		Max. surface area development of DWU total	amax_dwu_tot	200	Ha
		Number of Media villages	n_mv_tot	2	village(s)
DESCRIPTION			CODE	VALUE	UNIT
SPATIAL FEATURES	OLYMPIC VENUES	Required surface area for the Olympic Indoor Hal	a_sv_ih_olympic	6.0	Ha
		Required surface area for the Small Indoor Hall (1)	a_sv_ih_small_1	8.0	Ha
		Required surface area for the Small Indoor Hall (2)	a_sv_ih_small_2	8.0	Ha
		Required surface area for the training facilities	a_sv_ih_training	2.0	Ha
		Required surface area for the Small Stadium	a_sv_ss_small	10.5	Ha
		Required surface area for the Tennis complex	a_sv_cx_tennis	9.5	Ha
		Required surface area for the Aquatics complex	a_sv_cx_aquatics	12.0	Ha
		Required surface area for the Olympic Square	a_pub_square	10.0	Ha
		Required surface area for the IBC/MPC	a_com_ibc/mpc	11.3	Ha
		Required surface area for the cluster of Hotel Accommodations	a_com_hotels	6.1	Ha

Figure 11.2: Exogenous variables allocation model.

Adapting the GSA (in Ha) of the Olympic venues also would have a strong influence on the outcome of the allocation model. This is caused by the aggregation level of the zones in the allocation model, which have been attuned to the GSA of Olympic competition venues (paragraph 8.4). If the decision makers in the UDR collectively agree that the GSA of certain Olympic functions should be adapted, then also the aggregation level of zones should be modified (clustering).

11.3.2 Constraints

As mentioned earlier, the constraint cells identify any limitations in a model. In the allocation model there can be distinguished technical constraints and constraints that are about the content of the model. With the technical constraints is meant the equitation's that are essential for mathematical reasons. As an example, the incorporation of the definition of the total number of dwellings in the Olympic village that are developed in 4 storey high buildings (definition_equation_dwu_4s_ov_tot), has been illustrated in the following constraint:

(-1 * A_DWU_DEV5_4S) + (-1 * A_DWU_CORP1_4S) + (1 * A_DWU_4S_OV_TOT) = 0

The constraints about the content of the model concern the incorporation of Olympic spatial content-related requirements, which have extensive been discussed in the analysis of chapter 7, and concern the incorporation of the decision makers' spatial preconditions. The constraint cells enforce restrictions, as an example the incorporation of the precondition that the Olympic village would be developed with at particular minimum percentage affordable dwellings (pmin_dwu_aff_ov) has been illustrated in the following constraint:

dens_dwu_4s * A_DWU_CORP1_4S + dens_dwu_8s * A_DWU_CORP1_8S + dens_dwu_12s * A_DWU_CORP1_12S ≥ pmin_dwu_aff_ov * n_dwu_ov_tot

As mentioned in the previous paragraph, if (some of) the constraint(s) have been specified too tight, it is possible that these particular constraints cause an insolvability in the model, since there couldn't be defined a solution space. Therefore, it is essential for the USE to actually comprehend the essence of that specific requirement, before that specific requirement is translated into one or more constraint(s) for the allocation model. This will be illustrated on the basis of the incorporation of the requirement of clustering the Olympic village. In order to incorporate that requirement into the model, it is essential to understand that the clustering the Olympic village isn't the aimed goal, but it is a mean in order to achieve another objective, e.g. minimizing the traveling distances for the athletes or simplifying the security measures of that village. In that case, if the requirement concerning the clustering of the Olympic village during one of the allocation rounds would cause insolvability for the model, the USE would be able to specify other constraints for the specific requirement, in such a way that the translation of the requirement into constraints would still justify the objective that initially was purposed.

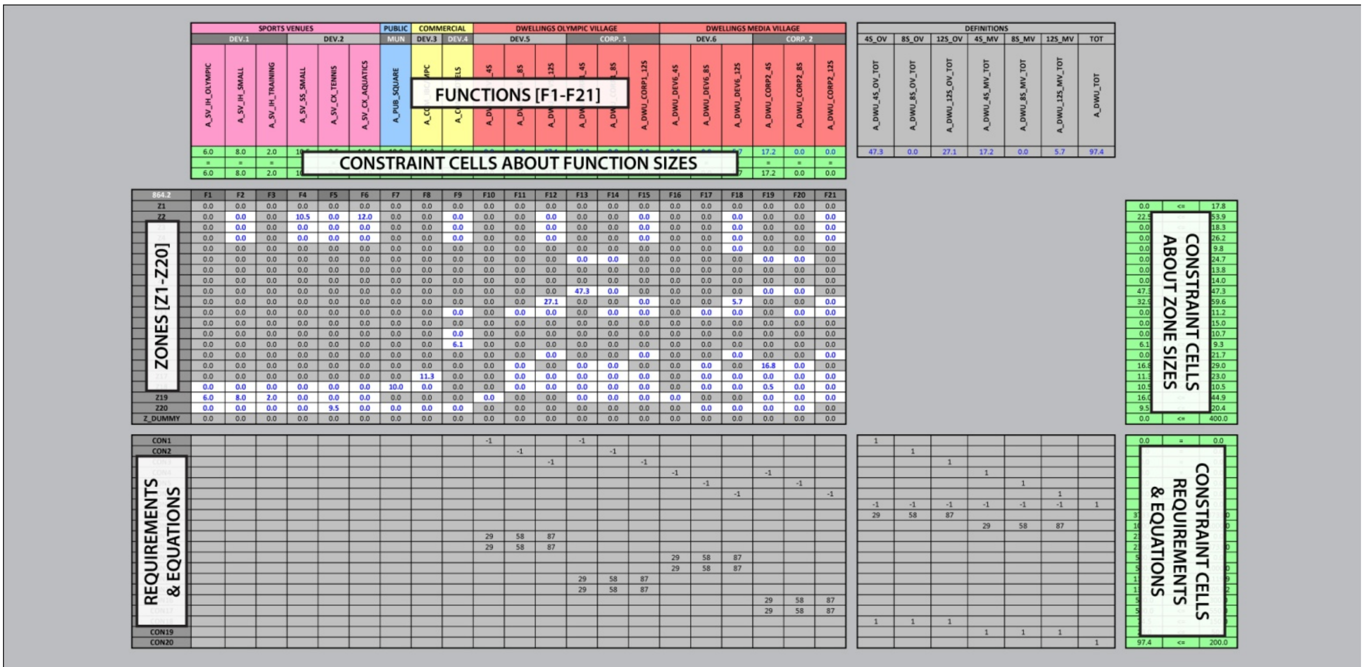


Figure 11.3: Constraint-matrix allocation model.

11.3.3 Weights for suitability zone/function-combinations

The decision maker weights for suitability of zone /function-combinations indicate the level in which they see opportunities for the development of their program in these particular zones. In the UDR there are various specialists represented, which each have obtained equal weights. These decision makers have specific specialism in the field of real estate development, and therefore will only assess weight to zone/function-combinations that concern their specialism. Therefore, the complete program [F1-F21] has been subdivided:

(1) Functions for developer 1 (DEV1), specific for the development of indoor halls [F1-F3];
(2) Functions for developer 2 (DEV2), specific for the development of stadiums and sports complexes [F4-F6];
(3) Function for the municipality (MUN), specific for the positioning of a public square [F7];
(4) Function for developer 3 (DEV3), specific for the development of commercial real estate [F8];
(5) Function for developer 4 (DEV4), specific for the development of hotels [F9];
(6) Functions for developer 5 (DEV5), specific for the development of commercial dwellings in the Olympic village [F10-F12];
(7) Functions for Housing Corporation 1 (CORP1), specific for the development of affordable dwellings in the Olympic village [F13-F15];
(8) Functions for developer 6 (DEV6), specific for the development of commercial dwellings in the media village(s) [F16-F18], and
(9) Functions for Housing Corporation 2 (CORP2), specific for the development of affordable dwellings in the media village(s) [F19-F21].

Initially the highest value that decision makers could asses to the suitability of a zone / function-combination was connected to the value of 2. In the first technical tests of the model, that value delivered an undesired side effect. That side effect was caused by the incorporation of three possible different densities for the allocation of the variable residential program, of which the highest density is three times as high as the lowest density. Since the allocation model optimizes the sum product of the preference-matrix and the constraint-matrix, it would allocate the less suitable (with value 1) residential program with a low density rather than higher densities that obtained a high suitability (with value 2), because in the allocation model 'high' densities are be three times as compact as 'low' densities. Since, the decision maker's weights for the suitability of a zone /function-combination will be measured on an ordinal scale (paragraph 9.5), it is allowed to replace the value 2 that initially was used for the decision makers to express their weights for the suitability of a particular zone/ function-combination with the value 5. For the decision makers the following input-values can be assigned to zone/ function-combinations:

Value 0: it is not allowed to allocate that specific zone/function-combination;
Value 1: it is allowed to allocate that specific zone/function-combination, and
Value 5: there is a preference for allocating that specific zone/function-combination.

With the value of 5, the preference of the decision makers will be decisive in the sum product of the preference-matrix and the constraint-matrix, so that the preference of decision makers has been processed accurately in the allocation model.

11.3.4 Boundary conditions decision makers

The decision makers that will set the boundaries for the allocation of the Olympic spatial content for the case Rotterdam 2028 are the NOC and the municipality Rotterdam. In the UDR, these decision makers have obtained the right to express a veto for the complete Olympic program (all zone/ function-combinations), which reflects in the following input-values for these decision makers;

Value 0: it is not allowed to allocate that specific zone/function-combination, and
Value 1: it is allowed to allocate that specific zone/function-combination.

The NOC (national Olympic committee) will be represented in the UDR as a specialist who is familiar with the requirements concerning the allocation of these specific functions. That specialist is able to ventilate the IOC-objectives concerning the allocation of the functions [F1-F21] into IOC-requirements and subsequently constraints for the allocation model. The municipality Rotterdam is represented by an urban planner with sufficient knowledge about the most important UAD projects of the city of Rotterdam, which has been expressed in the Stadsvisie Rotterdam. The urban planner is responsible for the adequate demarcation of development zones for the case Rotterdam 2028, the translation of the municipality's purpose for each of the zones (which Olympic functions would be allowed in that particular zone), and for determination of the building heights (for the residential program) that are allowed in the zones.

The overall suitability for a zone / function-combination that will be incorporated in the preference-matrix is the sum of input-values of the decision makers. The example of the overall suitability for the allocation of [F1] in [Z1] has been illustrated below:

DEV1 [Z1/F1] * MUN [Z1/F1] * NOC [Z1/F1] = 0, 1 or 5

If one of the input-values is zero, the overall suitability for the zone/ function-combination would result in suitability of zero. Through the addition of a Microsoft Visual Basic-script, the zone / function-combinations that have obtained an overall suitability of zero, will not become adjustable cells in the constraint-matrix, which would mean that those cells remain unused in the optimization process of the model. An exception has been made for the dummy zones: with a suitability of zero these zone/function-combinations would still remain usable.

11.4 Technical features model

Based on the requirements concerning the allocation of these specific functions, which have been elaborated in the analysis in chapter 7 (and appendix 2), the technical features for the allocation model are determined. In this paragraph, the translation of these specific requirements into constraints for the allocation model will be discussed; the technical translation is elaborated in appendix 4. The technical features of the allocation model are:

(1) Various building densities for the residential development;
(2) The Olympic village as an accommodation facility on a single location;
(3) The number of DWU for the media village accommodations, and
(4) The allocation of all units of a specific function to the same area.

11.4.1 Various building densities for the residential development

The large differences in urban characteristics of Olympic villages for the candidate cities of 2008, 2012 and 2016 (figure 7.3) significantly influences the spatial feasibility. The term 'urban density' is often used to indicate the relation between the surface area (Ha) and the developed program (number of DWU) within that area (Meyer et. al, 2008). The diversity in urban characteristics has been translated in the model with the incorporation of three different types of urbanization, which are defined as low, medium and high density residential areas. Based on the analysis of chapter 7, an average building density for Olympic villages of 58 DWU/ Ha was established. Subsequently there is assumed that low density village would be three times as large as a high density village.

Since the building density itself doesn't reflect the compactness of an area, in the allocation model the ground space index (GSI) for is these three densities are affixed. The GSI of an area can be calculated by dividing the footprint of the building(s) through the total surface area (Meyer et. al, 2008). As reproduced in figure 11.4, there initially is assumed that for all densities the GSI will remain the same. Through the fixation of the GSI for each category, the proportions between the building footprints and the open spaces of an area will also be similar.

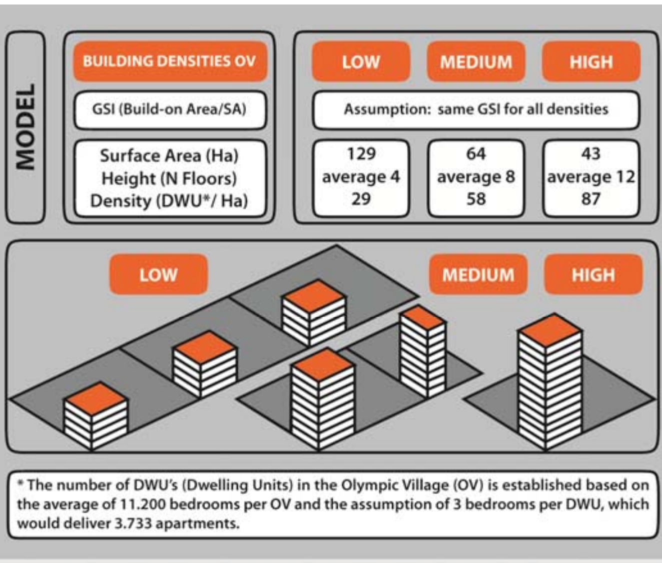


Figure 11.4: Summary of the urban characteristics that have been incorporated in the model.

The side effect that is accompanied with the incorporation of various building densities for the residential development would be that the allocation model maximizes the development of the residential program with a low density. Since the allocation model optimizes the sum product of the preference-matrix and the constraint-matrix, it will allocate the residential program with low densities rather than high densities. Therefore, it is essential that there will be added special constraints to the residential program.

11.4.2 The Olympic village as an accommodation facility on a single location

According to the IOC (2007-A), the Olympic village is a facility or a collection of facilities on a 'single location', which would signify that if one of six functions of the Olympic village [F10-F15] is allocated, also de rest of these functions should be allocated to the same 'single location'. Although there are six functions that collectively constitute the Olympic village, since both a developer [F10-F12] a housing corporation [F13-F15] are able to allocate the residential program with three different densities, it could be possible that the Olympic village is composed of only two functions, e.g. if only high density functions [F12 and F15] have been allocated. A high density (87 DWU/Ha) Olympic village would cover a surface area of 43 Ha, if the Olympic village is developed with solely a low density (29 DWU/Ha), it would cover a surface area of 129 Ha. Since the smallest zone is 9.3 Ha, and half of the zones are smaller than 20 Ha, it will be necessary to combine multiple zones, in order to accommodate the (relative large) Olympic village; this is called the clustering of zones.

The clusters for the development of the Olympic village have been established on the basis of possible urban strategic objectives, which Rotterdam purposes to achieve through the development of the Olympic village, based on their urban development strategy. It must be mentioned that the determination of these objectives and the subdivision of zones to clusters, are the interpretation of the USE (author JZ). The three possible urban strategic objectives are discussed below:

Urban strategic objective 1: The expansion of the urban center of Rotterdam, through the transformation of former port areas (RDC et. al, 2010), which could be achieved through the development of the Olympic village in the clusters 1 and 3 [C1 & C3];

Urban strategic objective 2: Tackling the existing housing stock, through the rehabilitation and regeneration of the obsolete residential district Rotterdam South (Municipality Rotterdam, 2007), which could be achieved through the development of the Olympic village in the clusters 2 and 4 [C2 & C4];

Urban strategic objective 3: The strengthening of the leisure zone Stadionpark, through the integration of leisure with a high quality residential area (Municipality Rotterdam 2009), which could be achieved through the development of the Olympic village in cluster 5 [C5].

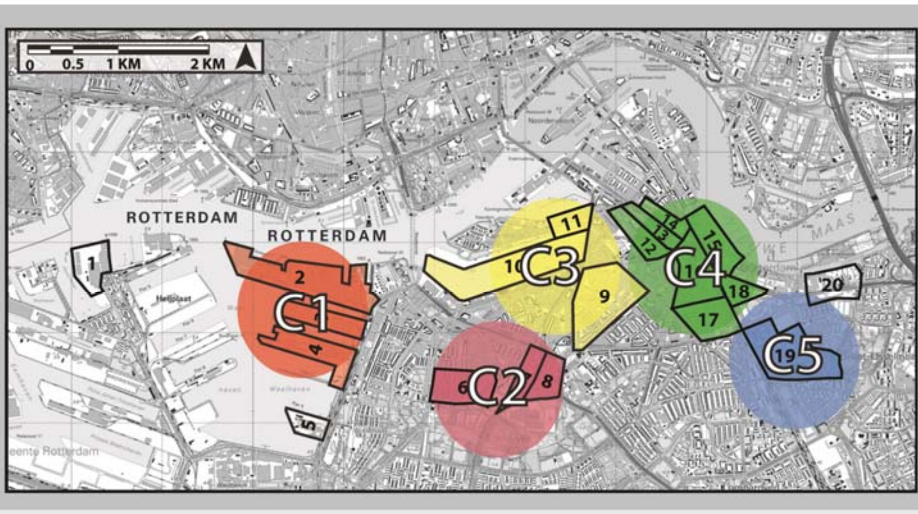


Figure 11.5: Subdivision of zones in clusters for the allocation of the Olympic village.

11.4.3 The number of DWU for the media village accommodation(s)

The media village is, as well as the Olympic village, a facility or a collection of facilities on a ‘single location’, which would signify that if one of six functions that are about the allocation of a media village [F16-F21] is allocated to a specific zone, also the rest of these functions for that specific media village should be allocated to the same ‘single location’. In the accommodation plan for the case Rotterdam 2028, which has been discussed in chapter 7, the number of DWU required in the media village is established at 1.000. A high density (87 DWU/Ha) media village would cover a surface area of 11.5 Ha, if the media village is developed with solely a low density (29 DWU/Ha), it would cover a surface area of 34.5 Ha. Because it could be possible that there are developed multiple media villages in the Olympic host city, the allocation of a media village [F16-F21] to a specific zone could occur more than one time.

As mentioned above, in the current model 1.000 DWU will be allocated. However, some of the zones [Z5, Z11, Z13, Z14 and Z18] are too small for accommodating a media village with 1.000 DWU, even if the media village would be developed with a density of 87 DWU/ Ha. One of the side effects accompanied with the incorporation of the number of DWU for media village accommodation(s) is that the model wouldn't be able to allocate a (relative large) media village of to (relative small) zones. Therefore, the aggregation level of the zones should be adapted; the relative small zones have been clustered. However, if the decision makers in the UDR establish that there could be allocated for example 2.000 DWU in the media village accommodations, the aggregation level of the zones should also be adapted.

A side effect of clustering zones would be that if the relative small zone of a cluster has been assessed as 'preferred' (value 5) for the development of a specific function, and the relative large zone of that specific cluster has been assessed as 'unsuitable' (value 0), the media village wouldn't be allocated to that cluster. A side effect of clustering of zones, where possible multiple media villages could be allocated, would be the possibility of allocating the media villages to adjacent zones. In that case, the model achieves the allocation of multiple (smaller) media villages in multiple zones, while in practice the model has allocated one large media village.

11.4.4 The allocation of all units of a specific function to the same area

As mentioned in chapter 7, the GSA of specific Olympic functions concern the total of units (Ha) that are required for that specific function, which includes the necessary surface area for footprint, public transport, traffic & parking and public space. The requirement concerning the allocation of Olympic functions would be that if the functions are allocated, all required units for that function will have to be allocated in the same zone. Without that requirement, the allocation model would be allowed to disseminate the GSA over multiple zones: in practice, this would signify that e.g. a part of the aquatics complex would be allocated to the 'Waalhaven-Oost'-area, while another part of the aquatics complex would be allocated to the 'Stadionpark'-area.

In paragraph 8.4 the aggregation level of zones has been discussed. If the aggregation level of the zones is too high, the allocation of functions would deliver only little information. If the aggregation level is too low, certain (large) functions couldn't be allocated to the relative smaller zones. In the case of a low aggregation level of zones, multiple adjacent zones need to be connected in order to accommodate a specific function, which is called the clustering of zones. The side effect of clustering zones has also been mentioned in the previous subparagraph; it is related to contradictory preferences for zone/ function-combinations ('preferred' and 'unsuitable') that are assigned to the same cluster, which could influence the allocations.

11.5 Technical test

In order to evaluate the (possible) usability of the allocation model in the practice of the Olympic UAD process, several alternatives there have been elaborated. The aim was to analyze in what way the model would respond to the incorporation of different objectives. Therefore three alternatives have been established, which are the 'Social', the 'Compact' and the 'Waterfront' Games, of which the details are discussed on appendix 5, 6 and 7. In order to comprehend the optimization process of the model, first the input and the constraints that have been applied in the model will be outlined. Subsequently, the alternatives will be discussed. The input and the constraints that have been applied for optimization of the alternatives are:

(1) In the hypothetical input round there is assumed that the housing corporations prioritize the (re)development of zones that currently accommodate an obsolete existing housing stock, they also prefer the development of their residential program with 'regular' densities, which according to Meyer (2008) for Dutch urban areas would be 46 dwellings per Ha;
(2) In the hypothetical input round there is assumed that the commercial developers are only interested in the transformation of former port areas if they can develop their residential program with high densities, because of the exploitation difficulties for the redevelopment of these former industrial areas (e.g. polluted soil), these commercial developers also prioritize zones that are situated directly along river the Maas, because of their architectural potential;
(3) The objective of optimization for the allocation model is the sum product of the preference-matrix and the constraint-matrix, therefore the model will allocate zone/ function-combinations with a high priority rather than zone/ function-combinations with a low priority;
(4) On the basis of the preference-matrix and the constraint-matrix the residential program will be established, since these functions [F10-F21] are adjustable in the allocation model. Because lower densities generate a larger result for the models' objective of optimization, the model will allocate low density functions rather than high density functions;

(5) Because of the IOC-requirement concerning the 'compact' development of the Olympic park combined with the assumption that the Olympic stadium and the public transport hub are developed in the Stadionpark (paragraph 8.3), the starting point for UDR would be that the Olympic indoor hall, the Olympic square and the IBC/MPC can only be allocated in or around the Stadionpark-area [Z18, Z19 & Z20], and
(6) The allocation of the functions [F1-F21] occurs on the basis of the IOC-requirements concerning the allocation of Olympic functions, which in the allocation model have been translated into constraints (paragraph 11.4).

A possible objective for the housing corporations could be that especially the less advantaged residents of Rotterdam benefit from the organization of the Games. In that case, the Games should operate as a mean for the advanced implementation of the rehabilitation and regeneration of the obsolete residential areas. In the alternative 'Social' Games, at least 50 percent of the residential development (both the Olympic and media villages) will be completed with social housing. Based on the output of alternative 'Social' Games, which is illustrated in figure 11.5, a possible subject of decision-making in the UDR could be the issue of tunneling the railway on the location of the Olympic village.

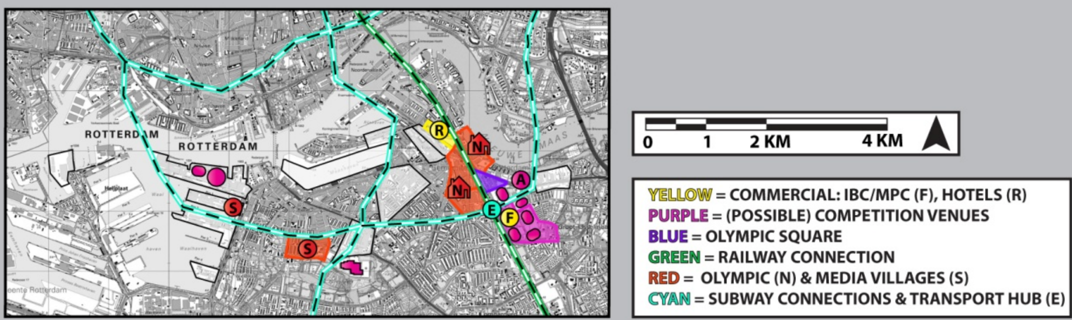
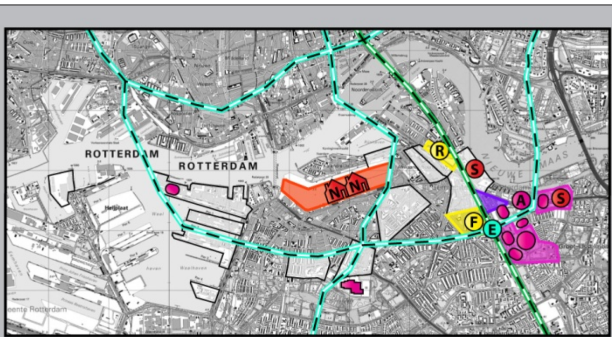


Figure 11.5: Alternative 'Social' Games.

Another possible objective of the decision makers could be that the residential program will be developed with a minimal surface area, so that only the minimum of land will have to be acquired. In the alternative 'Compact' Games, the maximum size of the Olympic village (3.733 DWU) would be 43 Ha and the maximum size for the two media villages (1.000 DWU) would be 11.5 Ha. Based on the output of alternative 'Compact' Games, which is illustrated in figure 11.6, a possible subject of decision-making in the UDR could be the development of the large number of Olympic venues in and around the Stadionpark.



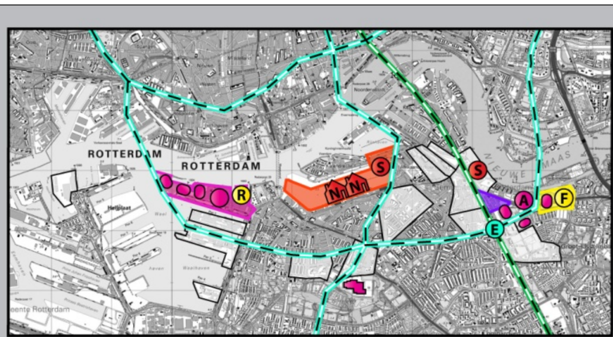


Figure 11.6: Alternative 'Compact' Games.
Figure 11.7: Alternative 'Waterfront' Games.

The possible objective for the municipality Rotterdam could be that the organization of the Olympic Games activates the advanced transformation of former port areas and other waterfront locations. In the alternative 'Waterfront' Games, only the zones that are directly in connection with water have been used for the allocation of the functions. Based on the output of alternative 'Waterfront'

Games, a possible subject of decision-making in the UDR could be the mobility issue of a additional cluster of the competition venues in the Waalhaven.

For each alternative the decision maker(s) have to evaluate if the translation of the stated objective into constraint(s) in the allocation model actually is the correct interpretation wherein their intended purpose is expressed. Furthermore, as described in chapter 7, the possibility/desirability of the development of the operational zone (25 Ha) and the Olympic village plaza (15 Ha) in one of the adjacent areas of the residential zone of the Olympic village should also be discussed.

11.6 Conclusion

An allocation model is a digital system which is capable of performing an optimization of a functional allocation, on the basis of the specification of a solution space and preferences of decision makers. The model that has been developed for the UDR primarily expresses the spatial feasibility: for each function [F1-F21] that has to be allocated, the required GSA has been connected, for all possible zones [Z1-Z20] where these functions might be allocated, the size has been specified. Furthermore, the requirements for allocating the Olympic functions have been established, which have been established on the basis of the analysis described in chapter 7, have been translated into constraints for the allocation model, so that a solution space is demarcated.

The economical feasibility is expressed in the model by the input variables, of which the value ultimately is determined by the decision makers. They will have to establish an economic viable program (e.g. number of DWU, the number of competition venues, etc.), before the start of the allocation round(s). If these decision makers determine that development of nine competition venues (paragraph 7.7) proves to be less viable, these venues will have to be constructed only for temporary use. Furthermore, before the start of an allocation round(s) they have to determine the possible strategic urban objectives that by means of the organization could be achieved (e.g. about the contribution of the development of the Olympic village to the achievement of a particular objective), therefore also the strategic purpose of the Games is expressed in the output of the model.

The decision makers steer on the output of the model (alternatives) through the implementation of adjustments in the value of input-variables, through adjustments in their weights for zone/ function-combinations, or through the determination of additional content-related requirements. Because of the dynamic character of the digital system, it will be possible to restart the cycle of an input round, the optimization of the allocation model, and the decision-making concerning that specific alternative, over and over again. Since there will be established several possible alternatives, which deliver definite information about functions which have been allocated to zones, the model would be able to contribute to the decision-making process. Subsequently, for each alternative the support from the decision makers and their spatial preconditions (e.g. concerning the mobility-requirements that are accompanied with the organization of the Games) can be established.

11.7 Reflection

The relevant content of decision-making for the urban spatial scale level (UDR), as well as the content for the SDR, has been determined on the basis of the explorations in part 2. Furthermore, in part 4 the initiative for the design of an allocation model for the UDR was established. This paragraph discusses the application of the allocation model in the contemporary practice of the Dutch Olympic UAD process. In order to do that, the following preconditions should be taken into account:

(1) The involvement of decision makers in the process of the determination of relevant issues to be discussed in the UDR. The issues described in paragraph 5.6 concern the spatial features and mobility features of potential urban areas, the integration Olympic program into the urban development strategy of a potential city, and economic feasibility for the development of the Olympic program. Since the decision makers haven't been involved in the determination of these issues, it is unclear whether or not they would also assess these three issues as 'relevant'.

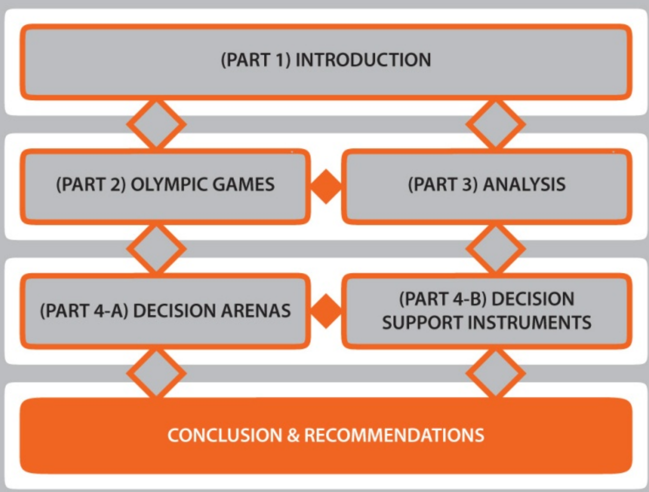
(2) The involvement of decision makers in the process of the determination of the content for the allocation model. Since the decision makers will steer on the content of the model, it is essential that the decision makers agree which steering variables are being used for the model of the UDR. In the current model these steering variables are the value of input-variables, weights for zone/ function-combinations and content-related requirements. According to Binnekamp (2010), the technique of LP is poorly

equipped; it can only produce single-criterion design solutions, which satisfy only one criterion of only one decision maker. Based on the technical tests (paragraph 11.5) can be concluded that on the basis of the current content of the allocation model, it is possible to produce design solutions. However, if decision makers indicate that the level of detail for steering variables of the model is too limited, the input possibilities for the model should be increased. Furthermore, the municipality Rotterdam should be involved in the determination of VIP-areas (paragraph 8.3) and development zones (paragraph 8.4).

(3) The following precondition would consider providing accurate technical circumstances, in this case for the organization of the UDR. The preconditions concerning the 'user-friendliness', the connection to a network, and the projection of the output of the model, which are described in the reflection of the preference measurement model (paragraph 10.7), also hold for the allocation model. Processing the input and output of the decision support instrument for the UDR is more complex as the instrument for the SDR. For that reason especially the 'user-friendliness' of the allocation model deserves major attention, which in the case of the input would consider the ease of operating steering variables, for the output it would consider accelerating the translation of data into figures and tables.

(4) The precondition of adequate management of the USE in the UDR; even if there has been complied with all preconditions described above, the opportunity of steering on the content of decision-making in the UDR, still couldn't be guaranteed. The first reason for that is the feature of unpredictability of the end product of the UDR (Binnekamp et. al. 2006). Therefore, the outcome of the decision-making process in the UDR remains open-ended. Second because, just as in the SDR, in the UDR also the role of the systems engineer could be considered as vital for the success of the UDR. As discussed in paragraph 9.4, that role requires competences of the systems engineer in terms of technology, content and social interaction (Van Loon et. al, 2008).

CONCLUSION & RECOMMENDATIONS



Conclusion 1/4

The research question that on the basis of this master thesis is purposed to answer, originated from the need to realize the Olympic Plan 2028 in such a way that both national interests as urban interests are reflected in that plan. This approach would require multiple Olympic decision arenas. Decision-making concerning the spatial content of the Olympic Plan 2028, where both national interests (top-down) and urban interests (bottom-up) are taken into consideration, is a time-consuming process. Therefore, the following research question has been formulated:

Are there possibilities to manage the complex decision-making process in the initiatory phase, for the sustainable realization of the Olympic Games of 2028 in the Netherlands whereby both national and urban long-term spatial objectives will be achieved, so that the decision-making process can be accelerated?

The management approach of De Leeuw (2002) has been the basis for structuring the complex decision-making process concerning the realization of the Olympic Plan 2028. De Leeuw outlined that the basis of steering is a 'controlling unit' (decision makers) that controls the 'controlled system' (spatial features Olympic Plan 2028). This configuration can be expanded by the introduction of the environment (initiative phase of the Dutch Olympic UAD process), wherein multiple arenas (both on a national as urban scale) can be distinguished. In 2016, when the Olympic alliance will assess the (spatial) possibilities for a Dutch Olympic candidature, the output of various decision arenas should be the basis for the determination of the collective support for the realization of the Olympic Plan 2028.

In order to facilitate steering on the spatial content of the Olympic Plan 2028, there have been designed decision support instruments. Decision support instruments offer interactive support to planning and decision-making issues relating to future urban developments. The main principle of the use of these instruments would be that, on the basis of the input of decision makers, possible alternatives are delivered, so that the decision makers are able to attach spatial preconditions to the alternatives.

The content of decision-making for the decision arenas (SDR & UDR) that have been elaborated in this research, is explored (part 2) on the basis of Olympic developments and trends concerning the spatial content, both in an international, national and an urban context. Relevant issues in the SDR consider the mutual attuning between multiple departments of the central government, wherein spatial preconditions are attached to possible Olympic development strategies. Relevant issues to be discussed in the UDR would consider assessing the possibilities for the development of the Olympic functions in a potential host city, wherein spatial preconditions are attached to possible functional allocations. The possibilities for the development of Olympic functions is determined by the spatial preconditions that potential urban areas would offer (spatial features and mobility features), the objectives that decision makers purpose to achieve through the realization of the Olympic Plan 2028 (integration Olympic spatial content into the urban development strategy), and the willingness of the market parties to develop the spatial content of the Olympic Plan 2028 (financial-economic feasibility).

In order to establish adequate content and to determine the technical requirements for the decision support instruments, three analyzes have been executed. The first analysis was about the distinction of possible Olympic development strategies and moreover about the determination of their strategic characteristics. The aim for the second analysis was to comprehend the spatial features and requirements of the Olympic spatial content, which delivered functional units (in Ha) and the requirements for the allocation of the Olympic functions. The purpose for the third analysis was the determination of zones [Z1-Z20] and functions [F1-F21] for the allocation of the Olympic spatial content for the case Rotterdam 2028.

Since the research content of this master thesis can be considered as a part of a larger system, subsequently, the functionality of the models will be assessed on the basis of the primary research objective as well as the additional objectives (figure 1.2), which are established on the basis of the systems approach of De Leeuw (2002).

Conclusion 2/4

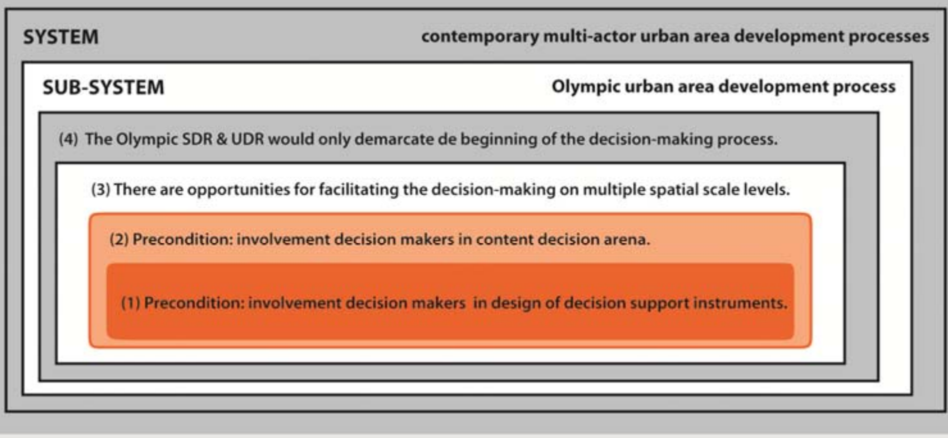


Figure C.1: Evaluating the functionality of the designed decision support instruments on the basis of the system approach.

(1) Primary objective: Design of multiple decision support instruments, which facilitate the decision-making of the Dutch Olympic UAD process.

In the preference measurement model that has been developed for the SDR, the overall preference rating (performance) of an alternative (Olympic development strategy), is established by an algorithm that takes into account the alternative's performance on each criterion, and its weight. The criteria are national spatial policy objectives, which have been derived from the National Spatial Strategy, the decision makers are delegates from four departments of the central government of the Netherlands.

An allocation model, which has been developed as a decision support instrument for the UDR, is a digital system which is capable of performing an optimization of a functional allocation, on the basis of the specification of a solution space and preferences of decision makers. The model primarily expresses the spatial feasibility: for each function [F1-F21] that has to be allocated, the required GSA has been connected, for all possible zones [Z1-Z20] where these functions might be allocated, the sizes have been specified. The financial-economical feasibility is expressed in the model by the input variables, of which the value ultimately is determined by the decision makers. They will have to establish an economic viable program (e.g. number of DWU, number of competition venues), before the start of the allocation round(s). Furthermore, before the start of an allocation round(s) they have to determine the possible strategic urban objectives that by means of the organization of the Games could be achieved, therefore also the strategic purpose of the Games is expressed in the model.

(2) Additional objective: Steer on the content of decision-making in the concerning decision arenas by means of the decision support instruments.

The preference measurement model in the SDR forces the decision makers to attach weights to the criteria and to attach a rating to the alternatives. Because of that, the decision makers will have to consider the strategic spatial characteristics for the realization of the Olympic Plan 2028. However, during a workshop where the functionality of the model was tested, the weighting of criteria and rating of alternatives proved to be complicated for the decision makers. This is caused by the large difference in scale between national spatial policy objectives and urban strategic spatial characteristics, and the multitudes of factors which converge in the weight for criteria (figure 10.2) and in the rating for alternatives (figure 10.4). The decision makers collectively evaluate the individual input of decision makers: the decision makers will have to justify their weights for criteria and their ratings of alternatives.

Conclusion 3/4

The purpose of that process would be that the decision makers will comprehend each other's individual objectives concerning the possible organization of the Games and furthermore to establish possible collective interests. Subsequently, the decision makers are able to establish spatial preconditions for the particular alternatives.

In the UDR, the decision makers steer on the output of the model (alternatives) through the implementation of adjustments in the value of input-variables, through adjustments in their preference for zone/ function-combinations, or through the determination of additional content-related requirements. Because of the dynamic character of the digital system, it will be possible to restart the cycle of an input round, the optimization of the allocation model, and the decision-making concerning that specific alternative, over and over again. Since there will be developed several possible alternatives, which deliver definite information about functions which have been allocated to zones, the model would be able to contribute to the decision-making process. Subsequently, for each alternative the support from the decision makers and their spatial preconditions (spatial features and mobility features) can be established.

With this research, the foundations for decision support instruments which facilitate steering on the content of decision-making in the SDR as well as the UDR might have been developed. However, for the implementation of the model in the Dutch Olympic UAD process, the following preconditions should be taken into account (figure C.1):

(1) The involvement of decision makers in the determination of relevant issues to be discussed in the decision arena;
(2) The involvement of decision makers in the design of the decision support instrument;
(3) Providing accurate technical circumstances for operating an decision arena (SDR/ UDR), which concerns the improvement of the 'user-friendliness' of the decision support instruments, the connection of computers to a network, and the projection of the output of the model on screens, and
(4) Adequate management of the systems engineer (SSE/USE) in the decision arena (SDR/ UDR), which is complex since the role of the systems engineer requires competences in terms of technology, content and social interaction (Van Loon et. al, 2008).

(3) Additional objective: Improve and accelerate the decision-making process in the initiative phase of the Dutch Olympic UAD process.

The SDR and the UDR both operate in the initiatory phase of the Olympic UAD process, which is the phase in the UAD process where complexity is most substantial (Bruil et. al, 2004). Especially in the start-up of this phase, where there are many uncertainties as to the surroundings (context), where realization plans still haven't been determined (content), where a multiplicity of actors attempt to influence the process (actors), and where the relations between these actors are explored (means), the management of the decision-making is complex.

As mentioned earlier in this conclusion, in the Olympic approach illustrated in this research, the (spatial) possibilities for a Dutch Olympic candidature will be established on the basis of the output of various decision arenas. In this context it is essential to emphasize that the initiatory phase has not been finished after the completion of the SDR and the UDR. After the UDR Rotterdam, therefore, also e.g. the UDR Amsterdam should be developed. The decision arenas developed in this research, which are the SDR and the UDR, can function independent from each other, since the content of both arenas is dissimilar. The content of the SDR is about the spatial strategic characteristics of the organization of Olympic Games, the content of the UDR is about putting these spatial strategic characteristics into operation. However, since the decision support instrument of the UDR is capable of incorporating these strategic spatial characteristics in the alternatives, it would be recommendable to complete the SDR before the start of the UDR.

Conclusion 4/4

With the design of multiple decision support instruments it should be possible to steer on the content of decision-making, so that spatial preconditions can be established. Nevertheless, when designing these instruments it is essential that the preconditions mentioned for additional objective 2, about the involvement of the decision makers, the accurate technical circumstances, and the management of the systems engineer should be taken into account. In both arenas (top-down and bottom-up) the strategic aspect of the realization of the Olympic Plan 2028 will be discussed, so that the output of both decision arenas on that aspect can be compared. That enables the opportunity of establishing the collective support, from both the national as the urban spatial scale level, which ultimately could lead to an improved and accelerated decision-making process. However, the definite criteria that will be used for comparing the output of multiple decision arenas can only be established after the completion of the decision arenas. This is the result of the unpredictability of the end product, since the outcome of the decision-making process in the Olympic decision arenas remains open-ended.

(4) Additional objective: The ‘in time’ completion of the initiatory phase of the Dutch Olympic UAD process and, if the output of the decision arenas reflect sufficient support for the organization of the Olympic Games in the Netherlands, then also the ‘optimal’ realization of the Dutch Olympic UAD process.

As mentioned in the introduction of this thesis, the ‘optimal’ realization of the Olympic Plan 2028 would be the realization in which interests of all decision makers are reflected in an optimal manner. On the basis of decision support instruments designed in this research it will be possible to ventilate the decision maker’s interests. In the decision support instrument for the SDR, the decision maker’s interests are reflected in weights for valuing the importance of criteria and the ratings for valuing the performance of alternatives. In the decision support instrument for the UDR, the decision maker’s interests are reflected in erogenous input-variables, preferences for zone/function-combinations and the specification of content-related requirements. In the SDR as well as the UDR, furthermore, spatial preconditions will be attached to each of the alternatives delivered by the decision support instrument, which also could be considered as the ventilation of decision maker’s interests. Nevertheless, the decision makers eventually determine if the extent to which their interests are reflected in the alternatives delivered by the decision support instruments, is sufficient.

On the basis of a structured approach of the complex decision-making process concerning the realization of the Olympic Plan 2028, under the preconditions mentioned for additional objective 2, it will be possible to steer on goal-orientated decision making in the initiatory phase of the process, which could improve and accelerate the decision-making in these decision arenas. However, the SDR and UDR which have been discussed in this research would only demarcate de beginning of the decision-making process concerning Dutch Olympic UAD, towards the completion of the initiatory phase. In the initiatory phase also additional decision arenas would take place, wherein the remaining relevant aspects for the realization of the Olympic Plan 2028 would be discussed. The multiple decision support instruments should be mutually related, which requires the management of the overall process. Based on the output of that overall process, eventually, the (spatial) possibilities for a Dutch Olympic candidature could be determined, wherein both national as urban interests have been taken into consideration.

Recommendations

(1) DECISION MAKERS ESTABLISHING CONTENT SDR AND UDR

In this research, the content of decision-making for the SDR and UDR has been established on the basis of international, national and an urban Olympic developments and trends concerning the spatial content. However, since the potential decision makers haven't been involved in the process of determining the relevant content for decision arenas, it is unclear whether or not the decision makers assess the content of the SDR and the UDR as 'relevant'. This has also been the main reason for the fictive character of this research, which possible influences the relevance of the Dutch Olympic approach illustrated in this research. Nevertheless, if the support from the potential decision makers to participate in the Olympic decision arenas is established, this research might deliver important points of departure for further researches wherein the acceleration and improvement of the Dutch Olympic UAD process also is purposed. For that reason, it is recommended that in the early stage of the process, potential decision makers are involved in the determination of the content of decision arenas.

(2) INVOLVEMENT DECISION MAKERS IN THE DESIGN OF DECISION SUPPORT INSTRUMENTS

The decision makers will steer on the content of the decision support instrument. Therefore, it is essential that they agree which steering variables are being used. Since the decision makers haven't been involved in the design process of the decision support instruments illustrated in this research, the functionality of these instruments in the contemporary practice of the Dutch UAD process couldn't be assessed. However, based on a workshop (paragraph 10.7) and technical tests (paragraph 11.7), the possible inadequacies of both decision support instruments have been indicated.

On the basis of the workshop was concluded that the weighting of criteria and rating of alternatives for the preference measurement model proved to be complicated. In addition, during the functional tests the level of detail for steering variables of the allocation model proved to be limited, which means that the input possibilities for the allocation model should be increased before the model would actually be used in the UDR. For that reason, it is recommended that potential decision makers are involved in the design of the decision support instruments. If that would have been the case, for both the SDR as well as the UDR, the systems engineer could have anticipated to the inadequacies of these instruments. Moreover, for both instruments the involvement of authorities in the design process is recommended, so that the policy documents ('Nota Ruimte' for the SDR, 'Stadsvisie' Rotterdam for the UDR) are adequately incorporated in the decision support instruments.

(3) THE FURTHER ELABORATION OF THE DUTCH OLYMPIC APPROACH

In the SDR and the UDR the strategic aspect of the realization of the Olympic Plan 2028 will be discussed, which enables the opportunity to compare the output of both decision arenas. As mentioned in the conclusion, in additional decision arenas the remaining relevant aspects for the realization of the Olympic Plan 2028 will be discussed. Therefore, in the process towards the completion of the initiatory phase of the Dutch Olympic UAD process, from the science field of Urban Area Development there will also be opportunities designing additional decision support instruments for these particular decision arenas.

Since the city of Amsterdam also disposes adequate spatial preconditions required for the organization of the Olympic Games, it would be recommendable also to design an UDR for Amsterdam, based on the same technical features as the allocation model designed for Rotterdam. Furthermore, in subsequent stages in the process, where there would be more clearness concerning the context, actors and content and means for realization, possible other decision support instruments that are offered by the Real Estate & Housing department of the Delft University of Technology could be brought into operation. An example is the program IGOMOD, which relates the design, financial land use planning and real estate development of urban development in a comprehensive way in one instrument. Since the Dutch Olympic approach, wherein both national interests (top-down) and urban interests (bottom-up) are taken into consideration, might deliver important points of departure for further researches, the final recommendation would be to further elaborate the Dutch Olympic approach with additional decision arenas.

Reflection

(1) WHY

In this report the traditional top-down approach for spatial planning in the Netherlands has been brought up for discussion. On the basis of the decision-making process concerning the organization of the Dutch Olympic Games of 2028, the foundations for a new way of spatial planning is elaborated. That new way of spatial planning is termed the Dutch Olympic approach, wherein both national (top-down) as urban interests (bottom-up) are considered simultaneously. With the elaboration of the Dutch Olympic approach, the improvement and acceleration of the decision-making process in the initiative phase of the Dutch Olympic UAD process has been purposed, which should be facilitated through the design of decision support instruments for multiple Olympic urban decision arenas. In this context its important mentioning that when designing decision support instruments for these Olympic decision arenas, the preconditions discussed in paragraph 10.7 and 11.7, should be taken into account. The improvement and acceleration of the decision-making process eventually will be essential for the successful completion of the Olympic Plan 2028, whereby eventually both national and urban long-term spatial objectives will have to be achieved.

(2) HOW

Initially the hierarchical structure of the top-down process also was applied to the decision-making process discussed in this report, where the spatial preconditions of the content were demarcated first by the national spatial planning layer and subsequently by the urban spatial planning layer. However, the main concern against this traditional approach was the possible elimination of alternatives on a national scale level, where that specific alternative on an urban scale might have gained large support. Furthermore, that traditional approach wouldn't have lead to an acceleration of the process, since the decision-making on an urban scale could only take place after the completion of the national decision arena(s).

Eventually, there has been established an approach where the decision-making on the national and urban spatial planning layer function more or less simultaneously. In that approach two decision arenas are distinguished, the SDR and the UDR. The content of the SDR is about the spatial strategic characteristics of the organization of Olympic Games, the content of the UDR is about putting these spatial strategic characteristics into operation. This approach could only be realized if the various decision arenas in the Dutch Olympic UAD process are mutually related, which requires the management the overall process. However, the definite criteria that will be used for comparing the output of multiple decision arenas can only be established after the completion of the decision arenas, because of the open-ended character of the decision arenas.

Furthermore, it is essential that the detail level of the decision support instrument on the urban scale level is attuned to the detail level of the output of the national scale level. This will be illustrated on the basis of an example. If the decision makers on a national scale level prefer the development strategy of 'Olympic Redevelopment', the decision support instrument on an urban scale level should be able to perform an optimization in which the redevelopment of obsolete areas obtains the primary focus. This enables the opportunity to compare the differences between national and urban interests immediately, which ultimately could lead to an improved and accelerated decision-making process.

(3) WHAT

After 2008, when the Dutch new Spatial Planning Act came into force, the national provincial and municipal authorities are planning their spatial policy more collaborative. Nowadays, they steer through the publications of integrated Structural Visions, which are policy documents that are established through a joined contribution from national, provincial and municipal authorities. Although eventually that collaboration is essential in the Dutch Olympic approach, the interests for both spatial planning layers can only be considered, if initially these planning layers are subdivided in different decision arenas. Subsequently, after the completion of SDR and the UDR, when the intentions in relation with the Olympic Plan 2028 from both spatial planning layers are clear, there can be preceded with the collaboration between the various planning layers.

References 1/5

(1) BOOKS

BINNEKAMP, R., GUNSTEREN, L.A., LOON, P.P., VAN (2006), Open Design, a Stakeholder-oriented Approach in Architecture, Urban Planning, and Project Management, Amsterdam: IOS Press.

BINNEKAMP, R. (2010), Preference-Based Design in Architecture, Amsterdam: IOS Press.

BRUIL, I., HOBMA, F., PEEK, G.J. and WIGMANS, G. (2004), Integrale Gebiedsontwikkeling; het stationsgebied 's-Hertogenbosch, Nijmegen: Uitgeverij SUN.

CASTELLS, M. (1996), The Rise of the Network Society, Oxford: Blackwell Publishers.

JONG, T. DE, BRAAK, J.J. and MULKEN, H.M. VAN (1996), Hotels, Planning en Ontwerp, Delft: IOS Press BV.

LEEUW, A.C.J. DE (2002), Bedrijfskundig management: Primair process, strategie en organisatie, Assen: Koninklijke Van Gorcum BV.

MEYER, H., WESTRIK, J. and HOEKSTRA, M.J. (2008), Stedenbouwkundige regels voor het bouwen, Amsterdam: SUN.

LOON, P.P. VAN (1998), Interorganisational design: a new approach to team design in architecture and urban planning, Delft: Publicatiebureau Bouwkunde.

LOON, P.P. VAN, HEURKENS, E. and BRONKHORST, S. (2008), The Urban Decision Room: an urban management instrument, Delft: IOS Press BV.

PELLIKAAN, H. (1994), Anarchie, Staat en het Prisoner's Dilemma, Delft: Eburon.

PREUS, H. (2004), The Economics of Staging the Olympics, A Comparison of the Games 1972 – 2008. Cheltenham: Edward Elgar Publishing Limited.

ROBERT, P. and SYKES, H. (2000), Urban regeneration and renewal, in Gold, J.R. and Gold M.M. (ed), 'City Agendas, Planning and the World's Games, 1896 to the Present', London: Routledge.

TEISMAN, G.R. (1998), Complexe besluitvorming: een pluricentrisch perspectief op besluitvorming over ruimtelijke investeringen, 's Gravenhage: Elsevier.

TEISMAN, G.R. (2001), Besluitvorming en Ruimtelijk Procesmanagement, Delft: Eburon.

WALL, R. (2009), Netscape: Cities and Global Corporate Networks, Alblasserdam: Haveka BV.

WIGMANS, G. (1998), De facilitaire stad. Rotterdams grondbeleid en postmodernisering, Delft: DUP.

(2) ARTICLES

ESSEX, S. and CHALKLEY, B. (1999), Olympic Locations and Legacies: A Study in Geography and Tourism, in 'Pacific Tourism Review', Elmsford, Vol. 3.

References 2/5

FURRER, P. (2002), Sustainable Olympic Games: A dream or a reality?, Article in Bollettino della Società Geografica Italiana, Serie XII, Volume VII, 4.

VERLAAT, J. VAN 'T (2007), Outlines of Urban Area Development, Faculteit Bouwkunde, Delft.

VINK, B. and VAN DEN BURG, A. (2006), New Dutch spatial planning policy creates space for development, disP 164.

ZIMBALIST, A. (2010), Is It Worth It: Hosting the Olympic Games and other mega sporting events is an honor many countries aspire to, but why?, Finance and Development, March.

BOERSMA, J. H., (2009), De ontwikkeling van een mega-evenement, Special edition of Nova Terra, Juli.

(3) IOC-REPORTS

IOC (1999), The commitment of the various members of the Olympic movement to the application of agenda 21: Olympic movements, AGENDA 21, IOC Lausanne, Switzerland.

IOC (2001), Report of the IOC Evaluation Commission for the Games of the XXIX Olympiad in 2008, IOC Lausanne, Switzerland.

IOC (2003-A), The Legacy of the Olympic Games 1984-2000: Conclusions and Recommendations, IOC Lausanne, Switzerland.

IOC (2003-B), Olympic Games Study Commission: Report to the 115th IOC Session, IOC Lausanne, Switzerland.

IOC (2004), Report by the IOC Candidature Acceptance Working Group: Games of the XXX Olympiad in 2012, IOC Lausanne, Switzerland.

IOC (2005-A), Olympic review: legacies and costs of the Games, IOC Lausanne, Switzerland.

IOC (2005-B), Report of the IOC Evaluation Commission for the Games of the XXX Olympiad in 2012, IOC Lausanne, Switzerland.

IOC (2005-C), Technical Manual on Accommodation, IOC Lausanne, Switzerland.

IOC (2007-A), Technical Manual on Olympic Village, IOC Lausanne, Switzerland.

IOC (2007-B), Olympic Charter, IOC Lausanne, Switzerland.

IOC (2009-A), Report of the IOC Evaluation Commission for the Games of the XXXI Olympiad in 2016, IOC Lausanne, Switzerland.

IOC (2009-B), The environment and sustainable development: factsheet July 2009, IOC Lausanne, Switzerland.

(4) DOCUMENTS

HELMERHORST, G.J. (2007), Dynamic Actor Network Steering and Control, Master Thesis, Delft University of Technology.

References 3/5

HEURKENS, E. (2005), Multi-actoren beslissingsmodel voor ruimtelijke ontwikkelingsprojecten van de Olympische spelen van 2028 in Nederland, Master Thesis, Delft University of Technology.

HOORN, A. VAN, HORNIS. W. and WAGT, M. VAN DER (2006), Dutch Delta Games: Pleidooi voor de Olympische Spelen in de Randstad, Netherlands Environmental Assessment Agency, Bilthoven.

HUIJSMANS, M. (2005), De Olympische Spelen in de Deltametropool, Master Thesis, Delft University of Technology.

MUNICIPALITY ROTTERDAM (2009), Stadionpark: Ontwerp Structuurvisie, milieueffecten in kaart gebracht, Gemeente Rotterdam.

MUNICIPALITY ROTTERDAM (2007), Rotterdam Urban Vision, Gemeente Rotterdam.

OECD (2006) [Organization for Economic Co-operation and Development], Competitive Cities in the Global Economy, Paris.

PIESLA, J. (2006), Herstructurering Lijn 11-zone in Transvaal: een spel van multi-actoren, Master Thesis, Delft University of Technology.

PROGRAM OFFICE OP 2028 (2009) [Program Office Olympisch Plan 2028], Olympisch Plan 2028: heel Nederland naar Olympisch niveau, Drukkerij Em. De Jong, Baarle-Nassau.

RANDERAAT, G. (2008), Steering in the complexity of in-town urban area development, Master City Developer Thesis (MCD Thesis), Collaboration of Delft University of Technology, Erasmus University Rotterdam and Rotterdam Development Corporation, Rotterdam.

ROCOG (2009) [Rio de Janeiro Organizing Committee Olympic Games], Candidature file for Rio de Janeiro to host the 2016 Olympic and Paralympic Games.

VROM (2006), National Spatial Strategy: Creating space for development, A joint publication of the Ministry of Housing, Spatial Planning and the Environment, the Ministry of Agriculture, Nature and Food Quality, the Ministry of Transport, Public Works and Water Management and the Ministry of Economic Affairs, The Hague.

VROM, NOC*NSF, TWYSNTRA GUDDE and NIEUWE GRACHT (2008), Schetsboek: Ruimte voor Olympische Plannen, Utrecht.

VROM (2009), Reiswijzer Gebiedsontwikkeling 2009: een praktische routebeschrijving voor marktpartijen en overheden, A joint publication of the Ministry of Housing, Spatial Planning and the Environment, the association of Dutch Project Development Corporations, Ministry of the Interior and Kingdom Relations, and the Cross-provincial consultation group, The Hague.

(5) MISCELLANEOUS

ESSEX, S. and CHALKLEY, B. (2003), Urban transformation from hosting the Olympic Games- University lecture on the Olympics, International Chair in Olympism (IOC-UAB).

WIGMANS, G. (2008), Management of Urban Area Development 2: The Role of Plans, MSc Real Estate & Housing 2b, Presentation on April 22th.

LINDO SYSTEMS (2007), What'sBest! 9.0 Help: What'sBest! User's Guide, Chicago (USA).

References 4/5

OEL, C. VAN (2007), Presentation AR1R010: Methodological Program 1, Lecture 2, Delft University of Technology.

FIFA (2009) [Fédération Internationale de Football Association], Bidding process for the 2018 FIFA World Cup and the, 2018 FIFA World Cup, Zurich (Switzerland).

(6) WEBSITES

ANFQ [Ministry of Agriculture, Nature & Food Quality] (2010), About the ministry of Agriculture, Nature & Food Quality: Organisation.
[Date of consulted: 22/03/2010] http://www.minlnv.nl

ARCHITECTENWEB [Largest architecture related website of the Netherlands] (2010), Ground Space Index.
[Date of consulted: August 2010]] http://www.architectenweb.nl

BARZILAI, J. (2010), Scientific Metrics - Tetra quick start guide.
[Date of consulted: 23/03/2010] http://scientificmetrics.com

BRUCE, P., TROIANO, V. and DEOKAR, K. (2010), Glossary Statistics: ordinal and ratio scale
[Date of consulted: September 2010] http://www.statistics.com

EA [Ministry of Economical Affairs] (2010), About the ministry of Economical Affairs: Organisation, Tasks & aims.
[Date of consulted: 19/03/2010] http://www.ez.nl

ESSEX, S. and CHALKLEY B. (2003), Urban transformation from hosting the Olympic Games: university lecture on the Olympics, Barcelona: Centre d'Estudis Olímpics (UAB).
[Date of consulted: 01/03/2010] http://olympicstudies.uab.es

GUCP [Global Urban Competitiveness Project] (2010), Global Urban Competitiveness Project.
[Date of consulted: July 2010]] http://www.gucp.org

HSPE [Ministry of Housing, Spatial Planning & Environment] (2010), About the ministry of Housing, Spatial Planning & Environment: Organisation, Tasks & aims.
[Date of consulted: 22/03/2010] http://international.vrom.nl

HWS [Ministry of Health, Welfare & Sport] (2010), About the ministry of Health, Welfare & Sport: Organisation.
[Date of consulted: 22/03/2010] http://www.minvws.nl

KLINK, A (2010), Kabinet steunt organisatie WK Voetbal 2018,
[Date of consulted: September 2010] http://www.rijksoverheid.nl

LOGOC [London Olympic Games Organizing Committee] (2010-A), Aesthetics and Infrastructure at London 2012.
[Date of consulted: September 2010]] http://www.blueprintmagazine.co.uk

LOCOG [London Olympic Games Organizing Committee] (2010-B), The International Broadcast Centre/Main Press Centre (IBC/MPC).
[Date of consulted: May 2010]] http://www.london2012.com

References 5/5

MERWIJK, J. VAN (2010), Nieuwe Kuip moet het doen met 68.000 plaatsen,
[Date of consulted: September 2010] http://www.ad.nl

NYOGOC [New York Olympic Games Organizing Committee] (2010), From Olympic Village to Affordable City Housing.
[Date of consulted: September 2010]] http://www.gothamist.com

OOGOC [Osaka Olympic Games Organizing Committee] (2010), Osaka Bay Area.
[Date of consulted: September 2010] http://www.japan-guide.com

PERMETA (2010), Density, variables: Ground Space Index,
[Date of consulted: October 2010] http://www.permeta.nl

RDC [Rotterdam Development Corporation] and the Port of Rotterdam, Vision: Excellent location. [Date of consulted: August 2010]] http://www.stadshavensrotterdam.nl

ROGOC [Rio de Janeiro Olympic Games Organizing Committee] (2010), Learn all about Rio's application to host the 2016 Olympic Games and Paralympics.
[Date of consulted: August 2010]] http://www.rio2016.org

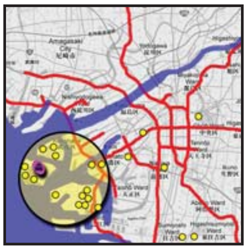
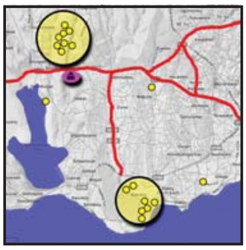
TPWWM [Ministry of Transport, Public Works & Water Management] (2010), About the ministry of Transport, Public Works & Water Management: Organisation, Motto & vision.
[Date of consulted: 22/03/2010] http://www.verkeerenwaterstaat.nl

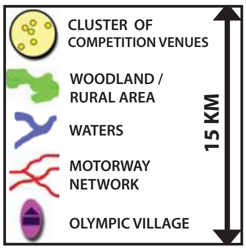
VROM [The Dutch Ministry of Housing, Spatial Planning and the Environment] (2010), New spatial planning act.
[Date of consulted: July 2010] http://www.vrom.nl

IUCN [World Conservation Union] (2010), Model of Sustainable Development,
[Date of consulted: September 2010] http://www.iucn.org

Appendix

Appendix 1.1: Candidate cities for the Games of the XXIX Olympiad in 2008 (IOC, 2001)

CANDIDATE CITIES FOR THE GAMES OF THE XXIX OLYMPIAD IN 2008	OSAKA (JAPAN)	TORONTO (CANADA)	BEIJING (CHINA)	ISTANBUL (TURKEY)
	OSAKA 2008	TORONTO 2008	BEIJING 2008	THE MEETING OF CONTINENTS İSTANBUL 2008
GENERAL CONCEPT	Shortage of land in Japan - the Olympic construction on three reclaimed Islands in Osaka Bay: the major development in Osaka Bay includes venues for 13 sports (Olympic Stadium) and the Olympic Village.	The Toronto sports concept is based on a compact sports venue plan which will contain 17 venues and the Olympic Village on the Toronto Waterfront. Long travel times for the other venues!!	The design of the bid is centred on the "Olympic Green" area to the north of the city centre. This site will contain the Olympic Village and venues for 15 sports, including the Olympic Stadium.	The overall concept is based on two main clusters of venues – the "Olympic Park" and the Southern Complex – situated outside the city centre and designed to provide a legacy.
LEGACY	(1) OG are a driving force behind the very large planned infrastructure developments. (2) The number of venues that will be upgraded or constructed is unknown: the quality of the existing competition venues is outstanding .	(1) The environmental rehabilitation, revitalisation and development plans for the Waterfront site will provide a significant legacy for the City. (2) Large sports legacy: Upgrade of 12 and the permanent construction of 9 venues.	(1) Enormous environmental legacy: the development of the "Olympic Green" project & the realization of the Beijing Sustainable Development plan including 20 key projects and a number of anti-pollution measures. (2) Large sports legacy: The permanent construction of 14 venues (upgrade of existing venues is unknown).	(1) The development of a sporting culture and the establishment of sports as a way of life: Upgrade of 8 and the permanent construction of 12 venues.
SPORTS & VENUES	The construction of at least 14 new venues (13 on the reclaimed Islands) and a spread of venues around the city and the surrounding area.	9 venues (26%) need to be built (it is unknown what the permanent/temporary ratio is).	22 venues (60%) need to be built (14 permanent & 8 temporary).	12 venues (39%) need to be built (it is unknown what the permanent/temporary ratio is).
OLYMPIC VILLAGE	30 apartments blocks (6-9 storeys high) on the reclaimed Yumeshima Island in Osaka Bay.	The Village will be constructed on a Waterfront site. After the Games the Village will become a residential suburb.	The Olympic Village will be constructed on the Olympic Green. The venue is regarded as being central to the competition venues, the airport, the city centre and historical sites.	The Olympic Village is to be constructed as part of Phase 5 of the Halkali public housing project.
TRANSPORT	(1) Connection Islands: a subway and underwater tunnel, and a new road and railway tunnel is being built. (2) Five new railway lines.	(1) Expansion of the railway network (also new Railway Station at the Waterfront area). (2) Road extensions as part of the Waterfront plan. (3) Expansion of Pearson Airport.	(1) A third runway and an additional terminal for Beijing Airport. (2) Roadway construction of up to 228 km of new roads, including the 5th ring road which will link many venues, is planned. (3) Five metro lines are planned (in addition to the 2 existing lines). (4) A metro extension to the 'Olympic Green' will be constructed.	Major infrastructure improvements are planned to: (1) The rail transit network (additional 150 km). (2) A new Bosphorus Tunnel. (3) Metro (up to 47 km) and light rail extensions (up to 78 km) linking the Airport to the City Centre.
SCHEME 15 KM X 15 KM (1:300.000)				

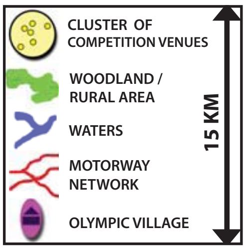


The basis for this analysis was the Report of the IOC Evaluation Commission
Source: IOC (2001), Report of the IOC Evaluation Commission for the Games of the XXIX Olympiad in 2008, International Olympic Committee Lausanne, Switzerland

Appendix 1.2: Candidate cities for the Games of the XXX Olympiad in 2012 (IOC, 2005-B)

CANDIDATE CITIES FOR THE GAMES OF THE XXX OLYMPIAD IN 2012	PARIS (FRANCE)	NEW YORK (USA)	MOSCOW (RUSSIA)	LONDON (UNITED KINGDOM)	MADRID (SPAIN)
GENERAL CONCEPT	Paris proposes a compact "one village, two cluster" concept, along the main ring road.	New York proposes an inner-city concept of three main competition clusters with most venues situated on two intersecting transport routes forming the "Olympic-X" with the Olympic Village at its centre.	Moscow proposes a "one-city" concept. The concept is based on the legacy of the 1980 Olympic Games, using existing wellmaintained venues in four of the five main competition clusters alongside or near the Moscow river.	The Olympic Games would be a catalyst for the re-development of the Lower Lea Valley), which would be the centrepiece of London's proposal is the Olympic Park, to be constructed in east London. London proposes two additional clusters (River and Central).	Madrid's sports plan is based on three main clusters (East, Central and West), with the well-located Olympic Village in the East cluster.
LEGACY	(1) Comprehensive environmental and accessibility actions are integrated into Games planning, construction and operations and would provide significant ecological and social legacies in Paris and across France. (2) The Olympic Villlage as a revitalised quarter of the city (the regeneration of a partly disused railyard) . (3) Upgrade of 4 and the permanent construction of 3 venues.	(1) The Olympic Games would accelerate the redevelopment and environmental rehabilitation of derelict river front areas and other sites for Olympic venues. (2) Upgrade of 5 and the permanent construction of 6 venues.	(1) The regeneration and environmental rehabilitation of riverfront areas, sites for the Olympic Village and media village and the IBC & MPC would be accelerated through the Olympic Games. (2) Upgrade of 23 and the permanent construction of 4 venues.	(1) The Olympic Games would be a catalyst for the re-development of the Lower Lea Valley, a 200-hectare rehabilitation and regeneration project in East London. Along with major new public infrastructure, this re-development would provide long-term benefits for the residents of London, including housing, educational and recreational opportunities and the development of sport. (2) Upgrade of 2 and the permanent construction of 3 venues.	(1) There would be significant environmental legacies with the rehabilitation of large areas into new parks and green zones. 2) Upgrade of 2 and the permanent construction of 6 venues.
SPORTS & VENUES	16 venues (50%) need to be built (3 permanent & 13 temporary).	11 venues (35%) need to be built (6 permanent & 5 temporary).	Moscow proposes major upgrading of 23 existing, well-maintained venues, 8 venues (21%) need to be built (4 permanent & 4 temporary).	12 venues (36%) need to be built (3 permanent & 9 temporary).	83% of competition venues already exists, 6 permanent venues (17%) are need to be built (and ZERO temporary venues).
OLYMPIC VILLAGE	The Olympic Village will become a revitalised quarter of Paris providing a new residential district, office, leisure, commercial, community and educational facilities.	The Olympic Village would be a compact waterfront (high-rise) settlement in the centre of the city with apartment buildings.	The Olympic Village would be built in the northwest of the city, on the banks of the Moscow River.	The Olympic Village would be situated in Olympic Park, apartment buildings would be clustered around landscaped squares.	The Olympic Village accommoda-tion and facilities would form part of a new residential neighbourhood after the Olympic Games, which the city has planned in order to face growing needs.
TRANSPORT	(1) Rail public transport, to further enhance transport services to areas of Paris with concentrations of Olympic venues: the construction of three new tram lines and the extension of a metroline.	(1) A 2 km subway extension from Time Square to Olympic Square. (2) A 4 km suburban rail link to Meadowlands (football and volleyball) in New Jersey. (3) New ferry landings.	(1) A 63 km ring road will be completed. (2) Among the numerous metro projects, the new Moscow city line will be extended along the Moscow River to serve the Olympic Village. (3) The three Moscow airports, will be expanded to double their capacity by 2012. (4) Connection Airport to the centre of Moscow by a new express rail link.	(1) A new rail connection between the 2 airports and the Olympic Park. (2) International access to central and east London trought the completion of Channel Tunnel Rail Link (CTRL). (3) A new station in the Olympic Park: Stratford International. (4) London's underground, light rail and regional rail networks will be substantially upgraded and extended, particularly in east London.	(1) The airport will be accessed by a new urban motorway and an express subway line. (2) The National railway company is adding four lines to its high-speed rail line, and all remote 2012 football cities will be connected by high-speed rail. (3) Madrid's subway network, will be extended by a further 90 km to approximately 320 km. Metro line extensions will serve, amongst other sites, the Madrid Airport extension, the Olympic Stadium and the Olympic Village.

SCHEME 15 KM X 15 KM (1:300.000)

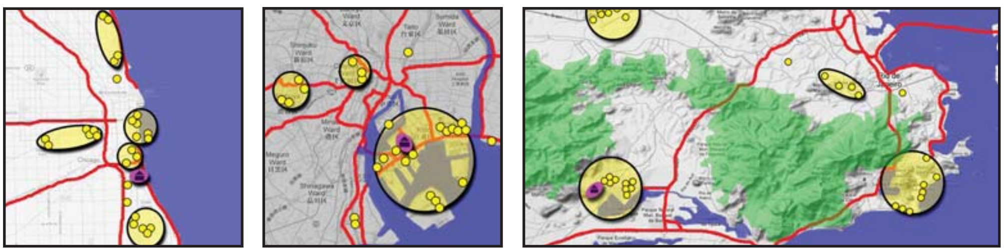


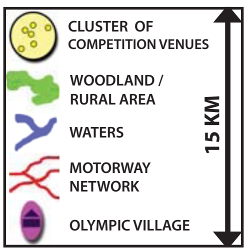
The basis for this analysis was the Report of the IOC Evaluation Commission
Source: IOC (2005), Report of the IOC Evaluation Commission for the Games of the XXX Olympiad in 2012, International Olympic Committee Lausanne, Switzerland

Appendix 1.3: Candidate cities for the Games of the XXXI Olympiad in 2016 (IOC, 2009-A)

CANDIDATE CITIES FOR THE GAMES OF THE XXXI OLYMPIAD IN 2016	CHICAGO (USA)	TOKYO (JAPAN)	RIO DE JANEIRO (BRAZIL)
GENERAL CONCEPT	The majority of the proposed 31 venues would be located along the lakefront, close to the city centre. The venues are grouped into five zones.	Tokyo proposes a highly compact Olympic Games concept with all venues within an 8 km radius of the Olympic Stadium. The venues are grouped into 2 overlapping zones; the Heritage Zone (containing venues from the 1964 Olympic Games) and the Tokyo Bay Zone (centre of Olympic activities).	The development of four key zones in the city on each side of the Tijuca National Park. The zones will be connected by the construction of the 'High Performance Transport Ring', with a metro, suburban rail, bus rapid transit system and an Olympic lane network.
LEGACY	(1) Chicago 2016's aim is to leave sustainable environmental, social and sports legacies for the community, particularly for youth, rather than to construct permanent major sports venues. (2) The permanent construction of six venues.	(1) Using former Olympic venues and building new facilities and infrastructure, Tokyo proposes creating a "100 year" Olympic legacy. There is an emphasis on sustainable development and urban regeneration, aligning Games plans with the city's long-term urban planning strategies (connection city & sea). (2) Upgrade of two and the permanent construction of ten venues.	(1) The Rio de Janeiro 2016 bid is centred on the vision of using sport as a catalyst for social integration. The Games would act as a vehicle for new facilities, transport and other infrastructure and physical regeneration, particularly of the city's waterways and key development zones of the city. (2) Upgrade of eight and the permanent construction of two venues.
SPORTS & VENUES	15 venues (48%) need to be built (6 permanent & 9 temporary). The six new additional permanent venues will be scaled down after the Games).	Half of all venues exist, 17 venues (50%) need to be built (10 permanent & 7 temporary).	8 venues (24%) need to be built (2 permanent & 6 temporary).
OLYMPIC VILLAGE	A compact Olympic Village located at the heart of the Games. The plan includes a lakefront park recreational zone and private beach for residents.	The Olympic Village would be constructed at a waterfront area. All Village buildings would incorporate environmentally friendly design elements such as green roofs and energy efficiency.	The Olympic Village would be converted into a residential community, offering medium to high quality accommodation in a rapidly growing part of the City.
TRANSPORT	(1) Upgrade of the transport infrastructure, particularly rail transport. (2) 90.000 temporary park-and-ride facilities within 100 km would be connected to the Chicago radial rail system.	(1) Tokyo Bay Zone is located on a group of islands of reclaimed land will be interconnected by tunnels, new bridges and new public transport links. (2) A new high speed rail line between Narita Airport and the centre of Tokyo.	(1) Extending and upgrading Rio International Airport. (2) Completing the Rio motorway bypass and other road projects in the Barra area. (3) Extension and capacity improvements of suburban rail and metro. (4) Development of three BRT lines totalling 70 km connecting the four Olympic zones to Barra Olympic Park. (5) New rolling stock for suburban rail (70%), metro and BRT buses.

SCHEME 15 KM X 15 KM (1:300.000)





The basis for this analysis was the Report of the IOC Evaluation Commission
Source: IOC (2009), Report of the IOC Evaluation Commission for the Games of the XXXI Olympiad in 2016, International Olympic Committee Lausanne, Switzerland

Appendix 2.1: Spatial features of the Olympic spatial content

The spatial features of the Olympic spatial content are specified in general features (feature_general_n), features about Sports & Venues (feature_s&v_n), features about the IBC/MPC (feature_IBC/MPC_n), features about the Olympic village (feature_ov_n) and features about the Media accommodations (feature_acc_mv_n and feature_acc_hotels_n).

feature_general_1: The minimum of sports facilities allocated in the Olympic Park are the Olympic Stadium, the Olympic Indoor Hall, training facilities, the Olympic square, the public transport facilities (infrastructure) and the IBC/MPC.

feature_IBC/MPC_1: The gross surface area (GSA) for the development of the IBC/MPC would be: 130.000 m2 / 4 floors = 32.500 (3.3 Ha), space for public transport (1), traffic & parking (5) and public space (2), which would result in a GSA for the hotel cluster of 11.3 Ha.

feature_ov_1: The Olympic village will comprise apartments for at least 16.000 athletes and officials. Based on the candidate cities of 2008, 2012 and 2016, an average of 11.200 bedrooms could be established. If there is assumed each apartment would provide the average 3 bedrooms rooms, the total number of DWU required in the Olympic village would be 3.733.

feature_ov_2: The average village, based on calculating the means of all villages, covers an area of 64 Ha, which would be developed with an average building height of 8 floors.

feature_ov_3: In the Olympic village cluster a Residential Zone (of which the size is variable), an Operational Zone (15 Ha) and an Olympic Village Plaza (25 Ha) are being developed.

feature_ov_4: The Olympic village would be developed in or around the Olympic Park.

feature_ov_5: The previous host cities showed that the post-Olympic use of the operational zone [O] and the Olympic village plaza [P] of the Olympic village is limited; therefore these functions couldn't be incorporated in the allocation model, since the allocation of functions is primarily based on their post-Olympic use. For the spatial feasibility, during the decision-making process the numerical features of 25 Ha (operational zone) and 15 Ha (Olympic village plaza) will be discussed after an input round. The main subject in that case would be to determine the possibilities to develop also the operational zone and the Olympic village plaza in the same cluster where the residential zone of the Olympic village is allocated.

feature_acc_mv_1: The required number of rooms within the 50 km radius from the Games center, for the media accommodation is 40.000. Since the IOC requires at least 10% (4.000 rooms) of media accommodation facilities (hotels, media village(s) and/or alternative media accommodations) within walking distance of the MPC/IBC, i.e. within 1 kilometer, the accommodation plan for the case Rotterdam 2028 would concern the use of already existing hotels (current supply is 8.200 rooms), the development of an extra cluster of hotels (1.000 rooms), alternative accommodations (variable) and the development of one or more media village(s) (variable, at least 3.000 rooms).

feature_acc_mv_2: The total number of DWU that, apart from the development of the Olympic village, also should be allocated in the city of Rotterdam is variable (see accommodation plan described in feature_acc_mv_1, this would be at least 3.000 rooms). If there is assumed each apartment would provide the average 3 bedrooms rooms, the minimum of number of DWU required in the media village(s) would be 1.000. In the UDR, the decision makers should collectively establish the market potential for the extra number of DWU that could be allocated in the city of Rotterdam for the development of the media village(s).

feature_acc_mv_3: Based on the Olympic villages of Beijing 2008 (2 media villages, 5.500 and 1.500 rooms) and Rio de Janeiro 2016 (4 media villages, 20.800, 1.800, 1.200 and 1.200 rooms), the minimum number of rooms for the development of a media village has been established at 1.200 rooms. If there is assumed each apartment would provide the average 3 bedrooms rooms, the minimum of number of DWU required in a Media village would be 400.

Appendix 2.1: Spatial features of the Olympic spatial content

feature_acc_hotels_1: The total number of rooms that, apart from the development of the media village(s) and alternative accommodations is required in order to bring the total number of rooms within the 50 km radius from the Games center up to 40.000, should be allocated in the city of Rotterdam is established at 1.000 rooms (see accommodation plan feature_acc_mv_1). In the UDR the decision makers should collectively determine the market potential for the development of a hotel cluster of 1.000 rooms in the city of Rotterdam.

feature_acc_hotels_2: The gross surface area (GSA) for the development of a hotel cluster accommodating 1.000 rooms would be: 1.000 rooms x GFA of 56 m2 per room / 10 floors = 5.600 m2 (0.6 Ha), space for public transport (0.5), traffic & parking (4) and public space (1), which would result in a GSA for the hotel cluster of 6.1 Ha. If the hotel cluster is allocated, all required units for that specific function will have to be allocated in the same zone.

Appendix 2.2: Requirements concerning the allocation of the Olympic spatial content

The requirements of the Olympic spatial content are specified in general requirements (requirement_general_n), requirements for the Olympic village (requirement_ov_n) and requirements for the Media accommodations (requirement_acc_mv_n).

requirement_general_1: The GSA of the specific Olympic functions, with exception of the residential development (Olympic & Media village[s]), which includes the necessary surface area for footprint, public transport, traffic & parking and public space, concern the total of units (Ha) that are required for that specific function. This would consider the allocation of Olympic functions such as the competition venues, the IBC/MPC and the hotel cluster. If these specific functions are allocated, all required units for that function will have to be allocated in the same zone.

requirement_ov_1: The Olympic village is defined as a single, large accommodation facility or a collection of smaller accommodation facilities in a single location.

requirement_ov_2: The gross surface area of the residential zone of Olympic villages in the analyzed Candidate cities vary from 25 Ha (New York 2012) too 134 Ha (Istanbul 2008). Therefore, for the development of the Olympic village, various building densities should be incorporated in the decision support instrument of the UDR.

requirement_acc_mv_1: The spatial characteristics of the residential development of the Olympic village of the media village(s) are practically similar. Therefore, also for the development of the media village(s), various building densities should be incorporated in the decision support instrument.

requirement_acc_mv_2: A media village is defined as a single, large accommodation facility or a collection of smaller accommodation facilities in a single or in multiple locations. Depending on the configuration of the Olympic venues, it could be possible that there might be developed more than one media village in the Olympic host city. The fragmented development of the media village accommodations therefore should be facilitated by the allocation in the model. Consequently, also the minimum requirement of the number of DWU for a media village will have to be established.

Appendix 3.1: Role prescriptions decision makers (DM1-DM4)

In order to evaluate the technical utilization and the possibilities to facilitate the content of the preference measurement model, the workshop SDR has been organized: the roles of the decision makers have been played by students from the faculty of Architecture of the University of Technology Delft. Their 'role prescriptions' have been determined based on the overall objectives of the departments. Also their possible individual objectives, which they might purpose to achieve through the organization of the Olympic Games, have been established. On the basis of possible trends and (inter)national issues that the departments might encounter in the next two decades, the spatial (DM1 & DM2), economical (DM3) and sportive (DM4) objectives concerning the organization of the Olympic Games, have been established. These trends and (inter)national issues have been derived from 'Olympic Plan 2028' (Program Office OP 2028, 2009), which is a document about the Dutch ambitions for the organization of the Olympic Games, and from the publication 'Dutch Delta Games' (Hoorn et al., 2006), which is study of the Dutch Environmental Assessment Agency about the possibilities and moreover the opportunities Olympic Games in the Netherlands.

DM1. Department of Housing, Spatial Planning & the Environment

Maintaining the welfare society needs respect for nature, space and raw materials. 'Working for a permanent quality of the living environment' is the overall objective of the Department of Housing, Spatial Planning & the Environment. The Department operates in three major areas, which are living space, housing and environment. The most important guidelines for the Department are (1) Sustainable development, (2) Quality (diversity) of the living environment and (3) Satisfying expectations and wishes of the general public (including the less privileged) in our society (Department of HSPE, 2010).

Possible individual objectives that could be achieved through the contribution of spatial characteristics of the Olympic development strategies to the achievement of 'important' national policy objectives are:

A. Improvement of the international business climate (economic competitiveness).
B. Improvement of the livability in urban areas.
C. The stimulation of the development of promising urban centers.

DM2. Department of Transport, Public Works & Water Management

The Department of Transport, Public Works & Water Management ensures that the physical basis (the foundations of the Netherlands) is solid and that we can move quickly and easily so that we can live and work in safety. The main goals of the department are to protect the Netherlands against water and to ensure secure connections of international quality. Accordingly, the department's mission statement is: reliable with water, progressive in connections (Department of TPWWM, 2010).

Possible individual objectives that could be achieved through the contribution of spatial characteristics of the Olympic development strategies to the achievement of 'important' national policy objectives are:

A. Counter the traffic congestion on Dutch roads.
B. Construction of more sustainable infrastructural connections.
C. Better integration of the water management in existing urban areas.

DM3. Department of Economic Affairs

The Department of Economic Affairs stated that their mission is to achieve a prosperous, sustainable and enterprising Netherlands as part of an open global economy. Therefore the department aims to make the Netherlands an attractive knowledge economy for innovative development. Successful companies are at the basis of a healthy economic growth and sufficient employment. That is why the department of Economic Affairs strives to make the Dutch business climate as attractive and encouraging as possible for domestic and foreign-owned companies (Department of EA, 2010).

Appendix 3.1: Role prescriptions decision makers (DM1-DM4)

Possible individual objectives that could be achieved through the contribution of spatial characteristics of the Olympic development strategies to the achievement of 'important' national policy objectives are:

A. Improvement of the international business climate (global competitiveness).
B. Counter the traffic congestion on Dutch roads.

DM4. Department of Health, Welfare & Sports

The Department of Health, Welfare & Sport's objective is to care for people (the old, the young and for people with physical or mental disabilities) in a healthy society. The Department ensures that enough health services are available and people have enough choice and encourages people to live healthily. To improve the position of the less privileged, the Department is working with the Departments of economics, education and housing to strengthen the social infrastructure. Important areas of the social policy are voluntary work, youth and child care. Sport is good for people's health, personal development and social life. The Department strives to enable everyone to engage in sport. It also finances top-level sport, enabling the Netherlands to compete at an international level (Department of HWS, 2010).

Possible individual objectives that could be achieved through the contribution of spatial characteristics of the Olympic development strategies to the achievement of 'important' national policy objectives are:

A. Improvement of the livability of urban areas.
B. Reducing the population's ratio of overweight people (especially the youth)
C. Improvement of the top-class sports climate.

3.2 National spatial policy objectives (C1-C9)

The objectives that have been derived from the National Spatial Strategy are the objectives with a strategic character, which are related to the spatial content of the Olympic Games. In this appendix, a short description of each criterion has been attached. Furthermore, the weighting and rating definitions for criteria one has been determined. The criteria for measuring the performance of alternatives in the SDR are:

Criterion 1: Concentration of urbanization in urban centers;
Criterion 2: Development of national urban networks;
Criterion 3: Improvement of accessibility in urban centers;
Criterion 4: Improvement of accessibility in national urban networks;
Criterion 5: Improvement of the livability of the urban environment;
Criterion 6: Improvement of the social-economic climate in cities;
Criterion 7: Integrating urbanization and water management;
Criterion 8: Strengthen the international position of the Randstad, and
Criterion 9: Strengthen the economical, ecological and social-cultural values.

Criterion 1: Concentration of urbanization in urban centers. The principle of urbanization in urban centers is about a more efficient use of the cultivated area through a higher building density. Urban centers could provide cities (besides the functions living and working) also sports and leisure. This objective not only stimulates the concentration of urbanization in the existing city centers, but it could also to stimulate the development of new high concentrated urban centers.

- Weight C1: The decision maker's weigth (preference) for criterion one reflects the level of importance of a concentration of urbanization in (existing or new) urban centers, for achieving their individual objectives, and furthermore the extend to which it is possible that the Olympic Games contribute to the achievement of these individual objectives.
- Rating A1-A4: The ratings of alternatives on the basis of criterion one is about the opportunity to achieve a concentration of urbanization in (existing or new) urban centers by means of the spatial characteristics of the Olympic development strategies.

Criterion 2: Development of national urban networks. An urban network is defined as an entity of larger and smaller cities, including the open spaces in between. Cooperation will reinforce the economical, social and cultural power for the cities within the urban network, so that the (international) economical competitiveness will be promoted and the development of a diversity of functions and public facilities will be stimulated. In this, the development of brain ports and other clusters, such as knowledge & innovation clusters or tourism, recreation & leisure clusters is crucial. The cities and centers that comprise these networks complement and reinforce each others' strengths, so that they have more to offer together than they do as individual cities.

Criterion 3: Improvement of accessibility in urban centers. The possibilities for the concentration of existing and new urban centers depends, besides the spatial and economical possibilities and the spatial context, mainly on the presence of (or the possibilities for the development of) transportation infrastructure. The policy of the local and regional governments involved in the improvement of accessibility in urban centers is aimed at a frequent utilization of the new and existing infrastructure (road and railway network). Therefore it is important to realize the improvement of capacity of infrastructure together with the concentration of urbanization.

Criterion 4: Improvement of accessibility in national urban networks. In order to improve the accessibility, the objective is to concentrate infrastructure in national urban networks, economic core areas and major transport axes as much as possible. In this context, the national government primarily focuses its efforts on the major transport axes between the two main ports (Amsterdam Airport Schiphol and the seaport of Rotterdam), their surrounding regions and the most important major urban areas in the Netherlands and abroad.

3.2 National spatial policy objectives (C1-C9)

Criterion 5: Improvement of the livability of the urban environment. Urban renewal and restructuring are urgently required to increase the livability of the cities. The presence of sufficient (green) recreational areas also is an important ingredient for the livability, welfare and the health of the residents. Housing and living environments in the cities will also be improved by providing a diversity of functions, such as sports, recreation and facilities.

Criterion 6: Improvement of the social-economic climate in cities. Because of the limited variation in residential areas with a low social-economic status and low-quality dwellings, the quality of the public space and the social coherence is under high pressure. To prevent an unbalanced population structure from developing, the national government is encouraging more variation in the types of housing. Redevelopment and transformation of existing urban areas provide an important contribution to the improvement of the diversity of the supply of residents.

Criterion 7: Integration urbanization and water management. Opportunities for combinations with nature development, recreation, housing near the water and water management should be exploited. Where possible, space for water will be found by combining water management with other functions: water offers good opportunities for strengthening the historical identity of cities and landscapes. Within the context of this criteria, not only the physical relation with water should be suggested, but also for example the sediment transportation improvements in urban areas.

Criterion 8: Strengthen the international position of the Randstad. The development perspective is aimed at preserving and strengthening the spatial, cultural and economic diversity of the Randstad urban agglomeration and responding to the Randstad's own need for space. Boosting the economy, increasing the strength and dynamics of the cities and developing the unusual qualities and the vitality of the Green Heart contribute to this goal.

Criterion 9: Strengthen the economical, ecological and social-cultural values. The government stimulates the organization of hallmark events, since these international occasions might contribute to the desired exposure and the possible acceleration of the larger UADs. The precondition would be that these UADs strengthen the social-cultural (people), economical (profit) and ecological (planet) values.

Appendix 4.1: The Olympic village as an accommodation facility on a single location

The development of the Olympic village as a facility or a collection of facilities on a 'single location' has been translated into the model through the subdivision of the total number of zones into clusters, which accommodate one or more than one zones. The requirement that ultimately will be connected to these clusters is that only one of the clusters could accommodate the Olympic village. Not only the model shows which cluster is the preferred location for the development of the village, but also the densities that decision makers prefer for the residential development in the specific zones of that cluster. For the technical translation of requirement_ov_1, five steps have been passed, which were:

(1) Defining the functions that collectively constitute the function Olympic village;
(2) Defining the clusters for the allocation of the Olympic village;
(3) Adding a 'binary integer' to each cluster/function-combination;
(4) Defining a solution space for each cluster/function-combination, and
(5) Incorporation of the requirement that the Olympic village is allocated to only one cluster.

(1) Define the functions that collectively constitute the Olympic village.

The Olympic Village is the aggregate of the functions [F10, F11, F12, F13, F14 and F15], which are:

[F10] = A_DWU_ DEV5_4S
[F11] = A_DWU_ DEV5_8S
[F12] = A_DWU_ DEV5_12S
[F13] = A_DWU_ CORP1_4S
[F14] = A_DWU_ CORP1_8S
[F15] = A_DWU_ CORP1_12S

(2) Defining the clusters for the allocation of the Olympic village.

The clusters [C1- C5] where the functions of the Olympic village [F10- F15] could be allocated have been defined on the basis of possible urban strategic objectives that the municipality wants to achieve through the development of the Olympic village in the city of Rotterdam. These possible urban strategic objectives have been described earlier in this paragraph, the clusters that have been established are:

Cluster 1 [C1], which is defined as the sum of [Z2], [Z3] and [Z4]
Cluster 2 [C2], which is defined as the sum of [Z6], [Z7] and [Z8]
Cluster 3 [C3], which is defined as the sum of [Z9], [Z10[en [Z11]
Cluster 4 [C4], which is defined as the sum of [Z12], [Z13], [Z14], [Z15], [Z16], [Z17] and [Z18]
Cluster 5 [C5], which is defined as [Z19]
Dummy cluster [C_dummy], which is defined as [Z_dummy]

Important to mention in this context is that the zones that are not part of a cluster, which are [Z1], [Z5] and [Z20], should obtain the status 'unsuitable' (input value of 0) for the allocation Olympic village functions [F10-F15]. Otherwise these three zones, beside the defined clusters, still might be used for the allocation of Olympic village functions, since these zones are not connected to the binary integer (WBBIN_Clusters_OV) of the cluster/function-combinations. For that specific reason the dummy zone has been defined, which subsequently also has been connected to the same binary integer.

Appendix 4.1: The Olympic village as an accommodation facility on a single location

(3) Adding a 'binary integer' to each cluster/function-combination.

With the term function in 'cluster/function-combination' is meant all functions that collectively constitute the Olympic village [F10-F15]. The 'Binary Integer'-command in the 'What's Best!'-program allows the USE to restrict adjustable cells to being binary integers, so that these specific cells will only return a zero or one. By doing this, it will be possible to define the number of clusters that will accommodate the Olympic villages (which should be equal to or less then 1). For the range of cells that are specified as binary (WBBIN_Clusters_OV), the program 'What'sBest!' will find the best solution, that returns a 0 or 1 in that cell. As already mentioned, the best solution is the optimum of the sum product of the preference-matrix and the constraint-matrix. The sum of the binary integers of all possible cluster/function-combinations for the Olympic village is defined as:

WBBIN_Clusters_OV = WBBIN ([C1]/ [F10-F15]) + WBBIN ([C2]/ [F10-F15]) + WBBIN ([C3]/ [F10-F15]) + WBBIN ([C4]/ [F10-F15]) + WBBIN ([C5]/ [F10-F15]) + WBBIN ([C_dummy]/ [F10-F15])

(4) Defining a solution space for each cluster/function-combination.

Each binary integer (WBBIN) of the cluster/function-combinations is connected to a 'large' number, so that if the binary integer would attain the value 1, sufficient solution space is defined to allocate the sum of the functions [F10-F15] in the cluster. Since the total number of DWU in the Olympic village has been established at 3.733 and the lowest Olympic village density would be 29 DWU/ Ha, the maximum coverage of the Olympic village would be 128.7 Ha. Therefore the value of 200, for the definition of the solution space would be sufficient, which delivered the following constraints for the allocation model:

[C1]/ [F10-F15] ≤ WBBIN ([C1]/ [F10-F15]) * 200
[C2]/ [F10-F15] ≤ WBBIN ([C2]/ [F10-F15]) * 200
[C3]/ [F10-F15] ≤ WBBIN ([C3]/ [F10-F15]) * 200
[C4]/ [F10-F15] ≤ WBBIN ([C4]/ [F10-F15]) * 200
[C5]/ [F10-F15] ≤ WBBIN ([C5]/ [F10-F15]) * 200

(5) Incorporation of the requirement that the Olympic village is allocated to only one cluster.

The sum of the binary integers of all possible cluster/function-combinations (WBBIN_Clusters_OV) for the development of the Olympic village is equal to or smaller than one, which is illustrated in of the following constraint:

WBBIN_Clusters_OV ≤ 1

Appendix 4.2: The number of DWU for the media village accommodation(s)

For the technical translation of the incorporation of the number of DWU for media village accommodation(s), six steps have been passed, which were:

(1) Defining the functions that collectively constitute a media village;
(2) Defining the number of DWU for each of the zones;
(3) Adding a 'binary integer' to each zone/ function-combination;
(4) Connecting each 'binary integer' to the specific zone/ function-combinations and define the minimum requirement of DWU per zone;
(5) Defining the number of media villages, and
(6) Incorporation of the possibility of clustering (relative small) zones.

(1) Defining the functions that collectively constitute a media village.

The media village is the aggregate of the functions [F16-F21], which are:

[F16] = A_DWU_ DEV6_4S
[F17] = A_DWU_ DEV6_8S
[F18] = A_DWU_ DEV6_12S
[F19] = A_DWU_ CORP2_4S
[F20] = A_DWU_ CORP2_8S
[F21] = A_DWU_ CORP2_12S

(2) Defining the number of DWU for each of the zones.

The total number of DWU in a zone is determined by the surface area(s) of the functions [F16-F21] and the density of these specific residential functions, which are allocated in that zone. The following example defines number of DWU for zone 1:

N_DWU_Z1 = ([Z1]/ [F16]) * dens_dwu_4s + ([Z1]/ [F17]) * dens_dwu_8s + ([Z1]/ [F18]) * dens_dwu_12s + ([Z1]/ [F19]) * dens_dwu_4s + ([Z1]/ [F20]) * dens_dwu_8s + ([Z1]/ [F21]) * dens_dwu_12s

(3) Adding a 'binary integer' to each zone/ function-combination.

With the term function in 'cluster/function-combination' is meant all functions that collectively constitute a media village [F16-F21]. As mentioned in the previous subparagraph, the 'Binary Integer'-command in the 'What's Best!'-program allows the USE to restrict adjustable cells to being binary integers, so that these specific cells will only return a zero or one. By doing this, it will be possible to define the number of zones that will accommodate a media village(s). The sum of the binary integers of all possible zone/function-combinations for the media village(s) is defined as:

WBBIN_MV_TOT = WBBIN ([Z1]/[F16-F21]) + WBBIN ([Z2]/ [F16-F21]) + WBBIN ([Z3]/ [F16-F21]) + WBBIN ([Z4]/ [F16-F21]) + WBBIN ([Z5]/ [F16-F21]) + WBBIN ([Z6]/ [F16-F21]) + WBBIN ([Z7]/ [F16-F21]) + WBBIN ([Z8]/ [F16-F21]) + WBBIN ([Z9]/ [F16-F21]) + WBBIN ([Z10]/ [F16-F21]) + WBBIN ([Z11]/ [F16-F21]) + WBBIN ([Z12]/ [F16-F21]) + WBBIN ([Z13]/ [F16-F21]) + WBBIN ([Z14]/ [F16-F21]) + WBBIN ([Z15]/ [F16-F21]) + WBBIN ([Z16]/ [F16-F21]) + WBBIN ([Z17]/ [F16-F21]) + WBBIN ([Z18]/ [F16-F21]) + WBBIN ([Z19]/ [F16-F21]) + WBBIN ([Z20]/ [F16-F21])

Appendix 4.2: The number of DWU for the media village accommodation(s)

(4) Connecting each binary integer to the specific zone/ function-combinations and define the minimum requirement of DWU per zone.

With the term function in 'cluster/function-combination' is meant all functions that collectively constitute a media village [F16-F21]. Each binary integer (WBBIN) of the zone/ function-combinations is connected to the minimum requirement of number of DWU per zone. For the allocation model this feature would signify that if the media village functions [F16-F21] are allocated to that specific zone, then with at least more than the minimum requirement of DWU that has been established. The minimum requirement of DWU per zone is exogenous established by the decision makers in the UDR. They determine the total number of DWU (n_dwu_mv_tot) that for the media village accommodations should be allocated and the total number of media villages (n_mv_tot) that would be needed. There has been assumed that if there should be allocated more than one media village, the number of DWU per media village will be equal. This is illustrated in the following example:

N_DWU_Z1 ≥ WBBIN ([Z1]/ [F16-F21]) * (n_dwu_mv_tot /n_mv_tot)

(5) Defining the number of media villages.

The sum of the binary integers of all possible zone/function-combinations (WBBIN_MV_TOT) for the development of the media village(s) is equal to the exogenous determined number of media village(s), which is illustrated in the following equitation:

WBBIN_MV_TOT = n_mv_tot

(6) Incorporation of the possibility of clustering (relative small) zones.

In the current model 1.000 DWU will be allocated. As mentioned above, a high density (87 DWU/Ha) media village (1.000 DWU) would cover a surface area of 11.5 Ha. Some of the zones [Z5, Z11, Z13, Z14 and Z18] are too small for accommodating a media village with 1.000 DWU. One of the additional hidden functions that are accompanied by the incorporation of the minimum number of DWU for the media village accommodation(s) is that the model wouldn't be able to allocate a (relative large) media village of that amount of DWU to these (relative small) zones. Therefore, the aggregation level of the zones should be adapted; the relative small zones have been clustered. Zone 5 [Z5] is isolated, which means that there are no possibilities for connecting that zone to others. Zone 11 is situated adjacent to zone 10, therefore these two zones have been connected: the value of the number of DWU for zone 10 (N_DWU_Z10) and for zone 11 (N_DWU_Z11) have been accumulated. For this aggregation level (1.000 DWU), also the zones 13 and 14 and 16 and 18 have been clustered. If the decision makers in the UDR establish that there could be allocated for example 2.000 DWU in the media village accommodations, the aggregation level of the zones should also be adapted: in that case zones that are smaller than 23.0 Ha will have to be connected to one or more surrounding zone(s). Below the principle of the clustering of zone 10 and 11 has been illustrated:

(N_DWU_Z10 + N_DWU_Z11) ≥ WBBIN ([Z10, Z11]/ [F16-F21]) * (n_dwu_mv_tot /n_mv_tot)

Another additional hidden function that is accompanied by the incorporation of this feature is that if the relative small zone of a cluster (in the example above [Z11]) has been assessed as 'preferred' (value), and the relative large zone of that specific cluster (in the example above [Z10]) has been assessed as 'unsuitable', the media village wouldn't be allocated to that cluster. The final additional hidden function that is accompanied by the incorporation of this feature is that it might be possible that there are allocated media villages to adjacent zones. In that case, the model achieves the allocation of multiple (smaller) media villages, but in practice the model has allocated one large media village.

Appendix 4.3: The allocation of all units of a specific function to the same area

The incorporation of the allocation of all units of specific functions to the same area is very similar to the feature that has been discussed in the previous subparagraph. The four steps will be discussed further on the basis of an example, which is [F1]. For the remaining functions [F2-F9], in the allocation model the same procedure as [F1] has been completed, the four steps are:

(1) Adding a 'binary integer' to each zone/ function-combination;
(2) Connecting each 'binary integer' to the specific zone/ function-combinations and define the minimum requirement of Ha per function;
(3) Defining that the function could be allocated solely one time, and
(4) Incorporation of the possibility of clustering for (relative small) zones.

(1) Adding a 'binary integer' to each zone/ function-combination.

As mentioned in the previous subparagraphs, the 'Binary Integer'-command in the 'What's Best!'-program allows the USE to restrict adjustable cells to being binary integers, so that these specific cells will only return a zero or one. By doing this, it will be possible to define the number of zones that will accommodate a specific function [F1-F9]. As an example, the sum of the binary integers of all possible zone/function-combinations for [F1] is defined as:

WBBIN_F1_TOT = WBBIN ([Z1]/ [F1]) + WBBIN ([Z2]/ [F1]) + WBBIN ([Z3]/ [F1]) + WBBIN ([Z4]/ [F1]) + WBBIN ([Z5]/ [F1]) + WBBIN ([Z6]/ [F1]) + WBBIN ([Z7]/ [F1]) + WBBIN ([Z8]/ [F1]) + WBBIN ([Z9]/ [F1]) + WBBIN ([Z10]/ [F1]) + WBBIN ([Z11]/ [F1]) + WBBIN ([Z12]/ [F1]) + WBBIN ([Z13]/ [F1]) + WBBIN ([Z14]/ [F1]) + WBBIN ([Z15]/ [F1]) + WBBIN ([Z16]/ [F1]) + WBBIN ([Z17]/ [F1]) + WBBIN ([Z18]/ [F1]) + WBBIN ([Z19]/ [F1]) + WBBIN ([Z20]/ [F1])

(2) Connecting each 'binary integer' to the specific zone/ function-combinations and define the minimum requirement of Ha per function.

Each binary integer (WBBIN) of the zone/ function-combinations is connected to the minimum requirement of gross surface area for that specific function, below the example of [Z1] has been elaborated. For the allocation model this feature would signify that if [F1] is allocated to that specific zone, then at least with the quantity of (a_sv_ih_olympic), which is the value of the exogenous determined size of [F1]. This is illustrated in the following example:

[Z1]/ [F1] ≥ WBBIN ([Z1]/ [F1] * a_sv_ih_olympic

(3) Defining that the function could be allocated solely one time.

The sum of the binary integers of all possible zone/function-combinations (WBBIN_F1_TOT) for the development of [F1] is equal to one, since these functions could only be allocated solely one time. This is illustrated in the following equitation:

WBBIN_F1_TOT = 1

Appendix 4.3: The allocation of all units of a specific function to the same area

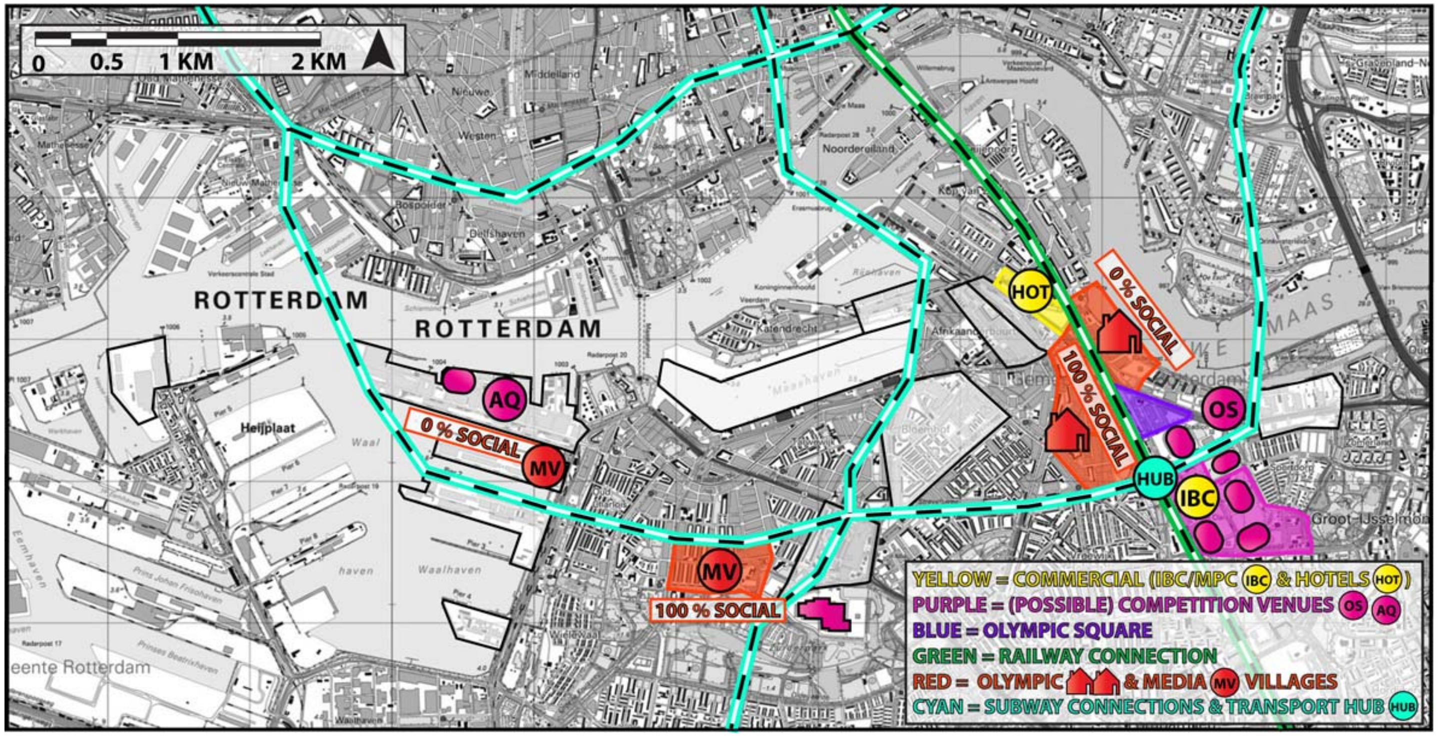
(4) Incorporation of the possibility of clustering for (relative small) zones.

Some of the zones are too small for accommodating certain functions. Therefore, the aggregation level of the zones should be adapted; the relative small zones have been clustered. For example [F6], of which the value exogenous is determined (a_sv_cx_aquatics = 12.0). With the incorporation of requirement_general_1, zones smaller than 12.0 Ha, which are [Z5, Z11, Z13, Z14 and Z18], would not be able to accommodate [F6]. Zone 5 [Z5] is isolated, which means that there are no possibilities for connecting that zone to others. Zone 13 is situated adjacent to zone 14; therefore these two zones have been connected, the value of the adjustable cells of [Z13/F6] and [Z14/F6] has been accumulated. Below the principle of the clustering of zone 13 and 14 has been illustrated:

[Z13/F6] + [Z14/F6] ≥ WBBIN ([Z13, Z14]/ [F6]) * a_sv_cx_aquatics

Appendix 5.1: Graphical reproduction of the 'Social' Games
Appendix 5.2: Preference-matrix the 'Social' Games

	SPORTS VENUES						PUBLIC	COMMERCIAL		DWELLINGS OLYMPIC VILLAGE						DWELLINGS MEDIA VILLAGE					
	DEV.1			DEV.2			MUN	DEV.3	DEV.4	DEV.5			CORP. 1			DEV.6			CORP. 2		
	A_SV_IH_OLYMPIC	A_SV_IH_SMALL	A_SV_IH_TRAINING	A_SV_SS_SMALL	A_SV_CX_TENNIS	A_SV_CX_AQUATICS	A_PUB_SQUARE	A_COM_IBC-MPC	A_COM_HOTELS	A_DWU_DEV5_4S	A_DWU_DEV5_8S	A_DWU_DEV5_12S	A_DWU_CORP1_4S	A_DWU_CORP1_8S	A_DWU_CORP1_12S	A_DWU_DEV6_4S	A_DWU_DEV6_8S	A_DWU_DEV6_12S	A_DWU_CORP2_4S	A_DWU_CORP2_8S	A_DWU_CORP2_12S
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20	F21
Z1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z2	0	5	0	5	5	5	0	0	1	0	0	5	0	0	1	0	0	5	0	0	1
Z3	0	1	0	1	1	1	0	0	1	0	0	5	0	0	1	0	0	5	0	0	1
Z4	0	1	0	1	1	1	0	0	1	0	0	5	0	0	1	0	0	5	0	0	1
Z5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Z6	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	5	5	0
Z7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z9	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	5	5	0
Z10	0	0	0	0	0	0	0	0	0	0	0	5	0	0	1	0	0	5	0	0	1
Z11	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	0	1	1	0	1	1
Z12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z13	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
Z14	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
Z15	0	0	0	0	0	0	0	0	0	0	0	5	0	0	1	0	0	5	0	0	1
Z16	0	0	0	0	0	0	0	0	0	0	1	0	5	5	0	0	1	0	5	5	0
Z17	0	0	0	0	0	0	0	5	0	0	1	1	5	5	1	0	1	1	5	5	1
Z18	5	5	5	5	5	5	5	1	0	0	1	5	5	5	1	0	1	5	5	5	1
Z19	5	5	5	5	5	5	0	0	0	1	0	0	1	1	1	1	0	0	1	1	1
Z20	5	5	5	5	5	5	1	5	5	0	0	0	0	0	0	0	1	5	1	1	0
Z_DUMMY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Appendix 5.3: Constraint-matrix the 'Social' Games

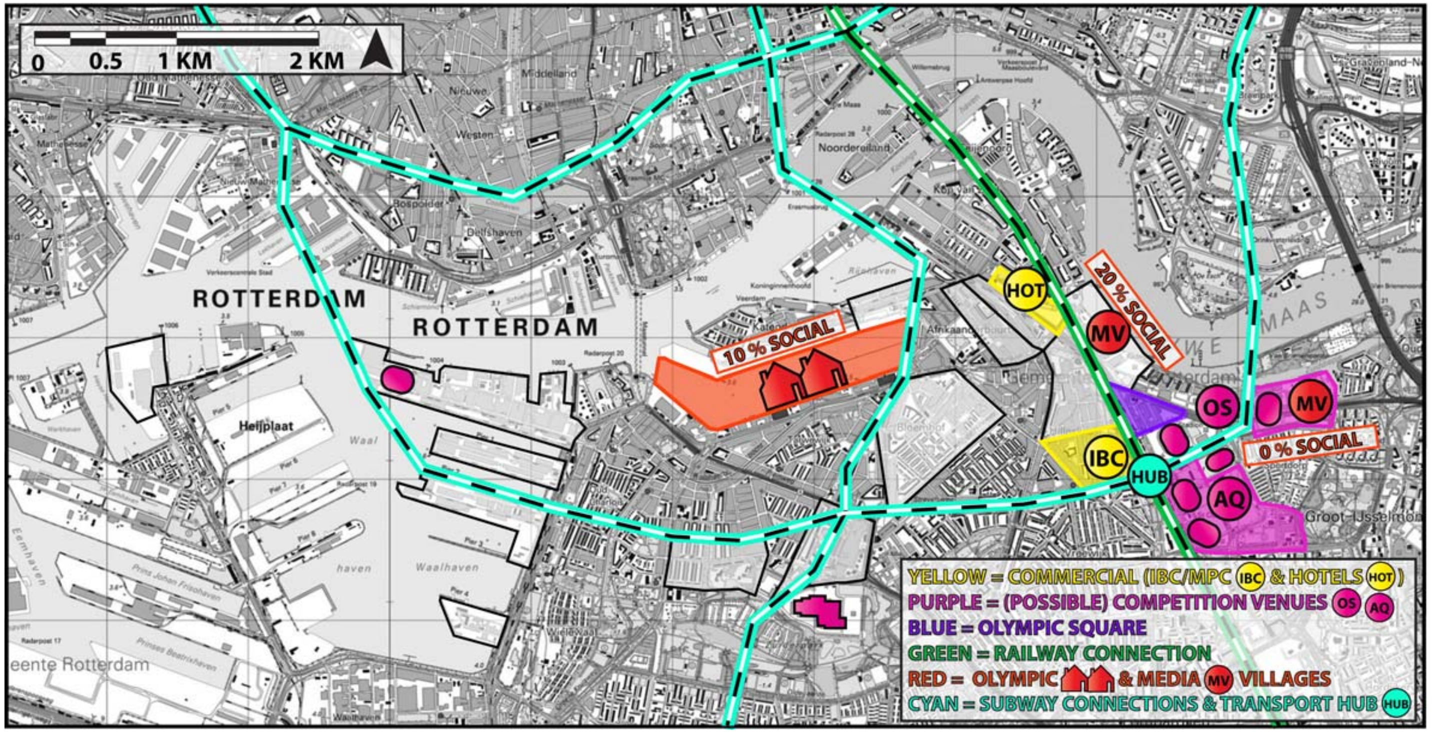
	SPORTS VENUES						PUBLIC	COMMERCIAL		DWELLINGS OLYMPIC VILLAGE						DWELLINGS MEDIA VILLAGE						DEFINITIONS									
	DEV.1			DEV.2			MUN	DEV.3	DEV.4	DEV.5			CORP. 1			DEV.6			CORP. 2			4S_OV	8S_OV	12S_OV	4S_MV	8S_MV	12S_MV	TOT			
	A_SV_IH_OLYMPIC	A_SV_IH_SMALL	A_SV_IH_TRAINING	A_SV_SS_SMALL	A_SV_CX_TENNIS	A_SV_CX_AQUATICS	A_PUB_SQUARE	A_COM_IBC/MPC	A_COM_HOTELS	A_DWU_DEV5_4S	A_DWU_DEV5_8S	A_DWU_DEV5_12S	A_DWU_CORP1_4S	A_DWU_CORP1_8S	A_DWU_CORP1_12S	A_DWU_DEV6_4S	A_DWU_DEV6_8S	A_DWU_DEV6_12S	A_DWU_CORP2_4S	A_DWU_CORP2_8S	A_DWU_CORP2_12S	A_DWU_4S_OV_TOT	A_DWU_8S_OV_TOT	A_DWU_12S_OV_TOT	A_DWU_4S_MV_TOT	A_DWU_8S_MV_TOT	A_DWU_12S_MV_TOT	A_DWU_TOT			
SUMPRODUCT	6.0	8.0	2.0	10.5	9.5	12.0	10.0	11.3	6.1	0.0	0.0	21.5	41.4	11.0	0.3	0.0	0.0	5.7	17.2	0.0	0.0	41.4	11.0	21.7	17.2	0.0	5.7	97.2			
of both matrixes is	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=										
861.8	6.0	8.0	2.0	10.5	9.5	12.0	10.0	11.3	6.1	0.0	0.0	21.5	41.4	11.0	0.3	0.0	0.0	5.7	17.2	0.0	0.0										
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20	F21										
Z1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	17.8
Z2	0.0	0.0	0.0	10.5	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								22.5	<=	53.9
Z3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	0.0	0.0	0.0								5.7	<=	18.3
Z4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	26.2
Z5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	9.8
Z6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.2	0.0	0.0								17.2	<=	24.7
Z7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	13.8
Z8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	14.0
Z9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	47.3
Z10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	59.6
Z11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	11.2
Z12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	15.0
Z13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	10.7
Z14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								6.1	<=	9.3
Z15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.5	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0								21.7	=<=	21.7
Z16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								29.0	=<=	29.0
Z17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								23.0	=<=	23.0
Z18	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								10.5	=<=	10.5
Z19	6.0	8.0	2.0	0.0	9.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								25.5	<=	44.9
Z20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								11.3	<=	20.4
Z_DUMMY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	400.0
de nition_equation_dwu_4s_ov_tot										-1			-1									1							0.0	=	0.0
de nition_equation_dwu_8s_ov_tot											-1			-1									1						0.0	=	0.0
de nition_equation_dwu_12s_ov_tot												-1			-1									1					0.0	=	0.0
de nition_equation_dwu_4s_mv_tot																-1			-1						1				0.0	=	0.0
de nition_equation_dwu_8s_mv_tot																	-1			-1						1			0.0	=	0.0
de nition_equation_dwu_12s_mv_tot																		-1			-1						1		0.0	=	0.0
de nition_equation_dwu_tot																						-1	-1	-1	-1	-1	-1	1	0.0	=	0.0
n_dwu_ov_tot																						29	58	87					3733.0	=	3733.0
n_dwu_mv_tot																									29	58	87		1000.0	=	1000.0
nmin_dwu_dev5_tot										29	58	87																	1866.5	>=	0.0
nmax_dwu_dev5_tot										29	58	87																	1866.5	<=	3733.0
nmin_dwu_dev6_tot																29	58	87											500.0	>=	0.0
nmax_dwu_dev6_tot																29	58	87											500.0	<=	1000.0
nmin_dwu_aff_ov													29	58	87														1866.5	=>=	1866.5
nmax_dwu_aff_ov													29	58	87														1866.5	<=	2053.2
pmin_dwu_aff_mv																			29	58	87								500.0	=>=	500.0
pmax_dwu_aff_mv																			29	58	87								500.0	<=	550.0
amax_dwu_ov_tot																						1	1	1					74.2	<=	150.0
amax_dwu_mv_tot																									1	1	1		23.0	<=	50.0
amax_dwu_tot																												1	97.2	<=	200.0

Appendix 5.4: Output (Endogenous variables) the 'Social' Games

Output (Endogenous variables)					
DESCRIPTION			**CODE**	**VALUE**	**UNIT**
TOTAL	**(ZONE 1-20 & FUNCTION 1-21)**	Required surface area for the allocation of the total program	A_FUNCTIONS_TOT	172.6	Ha
		Required surface area for allocation of the residential program	A_DWU_TOT	97.2	Ha
		Percentage Affordable Housing total	PERC_DWU_AFF_TOT	50	%
		Surface area developed with 4 storey high buildings	A_DWU_4S_TOT	58.7	Ha
		Surface area developed with 8 storey high buildings	A_DWU_8S_TOT	11.0	Ha
		Surface area developed with 12 storey high buildings	A_DWU_12S_TOT	27.5	Ha
		Number of apartments developed by CORP1 with 4 storey high buildings	N_DWU_4S_TOT	1701	DWU
		Number of apartments developed by CORP1 with 8 storey high buildings	N_DWU_8S_TOT	640	DWU
		Number of apartments developed by CORP1 with 12 storey high buildings	N_DWU_12S_TOT	2392	DWU
DESCRIPTION			**CODE**	**VALUE**	**UNIT**
OLYMPIC	**VILLAGE**	Percentage Affordable Housing Olympic Village total	PERC_DWU_AFF_OV_TOT	50.0	%
		Required surface area for allocation of the residential program in the Olympic Village	A_DWU_OV_TOT	74.2	Ha
		Surface area developed with 4 storey high buildings in the Olympic Village	A_DWU_OV_4S	41.4	Ha
		Surface area developed with 8 storey high buildings in the Olympic Village	A_DWU_OV_8S	11.0	Ha
		Surface area developed with 12 storey high buildings in the Olympic Village	A_DWU_OV_12S	21.7	Ha
		Total number of apartments developed in the Olympic Village	N_DWU_OV_TOT	3733	DWU
		Surface area developed with 4 storey high buildings in the Olympic Village	N_DWU_OV_4S	1201	DWU
		Surface area developed with 8 storey high buildings in the Olympic Village	N_DWU_OV_8S	640	DWU
		Surface area developed with 12 storey high buildings in the Olympic Village	N_DWU_OV_12S	1892	DWU
DESCRIPTION			**CODE**	**VALUE**	**UNIT**
MEDIA	**VILLAGE(S)**	Percentage Affordable Housing Media Village(s) total	PERC_DWU_AFF_MV_TOT	50.0	%
		Required surface area for allocation of the residential program in the Media Village(s)	A_DWU_MV_TOT	23.0	Ha
		Surface area developed with 4 storey high buildings in the Media Village(s)	A_DWU_MV_4S	17.2	Ha
		Surface area developed with 8 storey high buildings in the Media Village(s)	A_DWU_MV_8S	0.0	Ha
		Surface area developed with 12 storey high buildings in the Media Village(s)	A_DWU_MV_12S	5.7	Ha
		Total number of apartments developed in the Media Village(s)	N_DWU_MV_TOT	1000	DWU
		Surface area developed with 4 storey high buildings in the Media Village(s)	N_DWU_MV_4S	500	DWU
		Surface area developed with 8 storey high buildings in the Media Village(s)	N_DWU_MV_8S	0	DWU
		Surface area developed with 12 storey high buildings in the Media Village(s)	N_DWU_MV_12S	500	DWU
DESCRIPTION			**CODE**	**VALUE**	**UNIT**
COMMERCIAL	**DEVELOPER (5)**	Total surface area developed by DEV5	A_DWU_DEV5_TOT	21.5	Ha
		Surface area developed by DEV5 with 4 storey high buildings	A_DWU_DEV5_4S	0.0	Ha
		Surface area developed by DEV5 with 8 storey high buildings	A_DWU_DEV5_8S	0.0	Ha
		Surface area developed with by DEV5 12 storey high buildings	A_DWU_DEV5_12S	21.5	Ha
		Total number of apartments developed by DEV5	N_DWU_DEV5_TOT	1867	DWU
		Number of apartments developed by DEV5 with 4 storey high buildings	N_DWU_DEV5_4S	0	DWU
		Number of apartments developed by DEV5 with 8 storey high buildings	N_DWU_DEV5_8S	0	DWU
		Number of apartments developed by DEV5 with 12 storey high buildings	N_DWU_DEV5_12S	1867	DWU
DESCRIPTION			**CODE**	**VALUE**	**UNIT**
COMMERCIAL	**DEVELOPER (6)**	Total surface area developed by DEV6	A_DWU_DEV6_TOT	5.7	Ha
		Surface area developed by DEV6 with 4 storey high buildings	A_DWU_DEV6_4S	0.0	Ha
		Surface area developed by DEV6 with 8 storey high buildings	A_DWU_DEV6_8S	0.0	Ha
		Surface area developed with by DEV6 12 storey high buildings	A_DWU_DEV6_12S	5.7	Ha
		Total number of apartments developed by DEV6	N_DWU_DEV6_TOT	500	DWU
		Number of apartments developed by DEV6 with 4 storey high buildings	N_DWU_DEV6_4S	0	DWU
		Number of apartments developed by DEV6 with 8 storey high buildings	N_DWU_DEV6_8S	0	DWU
		Number of apartments developed by DEV6 with 12 storey high buildings	N_DWU_DEV6_12S	500	DWU
DESCRIPTION			**CODE**	**VALUE**	**UNIT**
HOUSING	**CORPORATION (1)**	Total surface area developed by CORP1	A_DWU_CORP1_TOT	52.7	Ha
		Surface area developed by CORP1 with 4 storey high buildings	A_DWU_CORP1_4S	41.4	Ha
		Surface area developed by CORP1 with 8 storey high buildings	A_DWU_CORP_8S	11.0	Ha
		Surface area developed with by CORP1 12 storey high buildings	A_DWU_CORP1_12S	0.3	Ha
		Total number of apartments developed by CORP1	N_DWU_CORP1_TOT	1867	DWU
		Number of apartments developed by CORP1 with 4 storey high buildings	N_DWU_CORP1_4S	1201	DWU
		Number of apartments developed by CORP1 with 8 storey high buildings	N_DWU_CORP1_8S	640	DWU
		Number of apartments developed by CORP1 with 12 storey high buildings	N_DWU_CORP1_12S	26	DWU
DESCRIPTION			**CODE**	**VALUE**	**UNIT**
HOUSING	**CORPORATION (2)**	Total surface area developed by CORP2	A_DWU_CORP2_TOT	17.2	Ha
		Surface area developed by CORP2 with 4 storey high buildings	A_DWU_CORP2_4S	17.2	Ha
		Surface area developed by CORP2 with 8 storey high buildings	A_DWU_CORP2_8S	0.0	Ha
		Surface area developed with by CORP2 12 storey high buildings	A_DWU_CORP2_12S	0.0	Ha
		Total number of apartments developed by CORP2	N_DWU_CORP2_TOT	500	DWU
		Number of apartments developed by CORP2 with 4 storey high buildings	N_DWU_CORP2_4S	500	DWU
		Number of apartments developed by CORP2 with 8 storey high buildings	N_DWU_CORP2_8S	0	DWU
		Number of apartments developed by CORP2 with 12 storey high buildings	N_DWU_CORP2_12S	0	DWU

Appendix 6.1: Graphical reproduction of the 'Compact' Games
Appendix 6.2: Preference-matrix the 'Compact' Games

	SPORTS VENUES						PUBLIC	COMMERCIAL		DWELLINGS OLYMPIC VILLAGE						DWELLINGS MEDIA VILLAGE					
	DEV.1			DEV.2			MUN	DEV.3	DEV.4	DEV.5			CORP. 1			DEV.6			CORP. 2		
	A_SV_IH_OLYMPIC	A_SV_IH_SMALL	A_SV_IH_TRAINING	A_SV_SS_SMALL	A_SV_CX_TENNIS	A_SV_CX_AQUATICS	A_PUB_SQUARE	A_COM_IBC-MPC	A_COM_HOTELS	A_DWU_DEV5_4S	A_DWU_DEV5_8S	A_DWU_DEV5_12S	A_DWU_CORP1_4S	A_DWU_CORP1_8S	A_DWU_CORP1_12S	A_DWU_DEV6_4S	A_DWU_DEV6_8S	A_DWU_DEV6_12S	A_DWU_CORP2_4S	A_DWU_CORP2_8S	A_DWU_CORP2_12S
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20	F21
Z1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z2	0	5	0	5	5	5	0	0	1	0	0	5	0	0	1	0	0	5	0	0	1
Z3	0	1	0	1	1	1	0	0	1	0	0	5	0	0	1	0	0	5	0	0	1
Z4	0	1	0	1	1	1	0	0	1	0	0	5	0	0	1	0	0	5	0	0	1
Z5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Z6	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	5	5	0
Z7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z9	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	5	5	0
Z10	0	0	0	0	0	0	0	0	0	0	0	5	0	0	1	0	0	5	0	0	1
Z11	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	0	1	1	0	1	1
Z12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z13	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
Z14	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
Z15	0	0	0	0	0	0	0	0	0	0	0	5	0	0	1	0	0	5	0	0	1
Z16	0	0	0	0	0	0	0	0	0	0	1	0	5	5	0	0	1	0	5	5	0
Z17	0	0	0	0	0	0	0	5	0	0	1	1	5	5	1	0	1	1	5	5	1
Z18	5	5	5	5	5	5	5	1	0	0	1	5	5	5	1	0	1	5	5	5	1
Z19	5	5	5	5	5	5	0	0	0	1	0	0	1	1	1	1	0	0	1	1	1
Z20	5	5	5	5	5	5	1	5	5	0	0	0	0	0	0	0	1	5	1	1	0
Z_DUMMY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Appendix 7.3: Constraint-matrix the 'Waterfront' Games

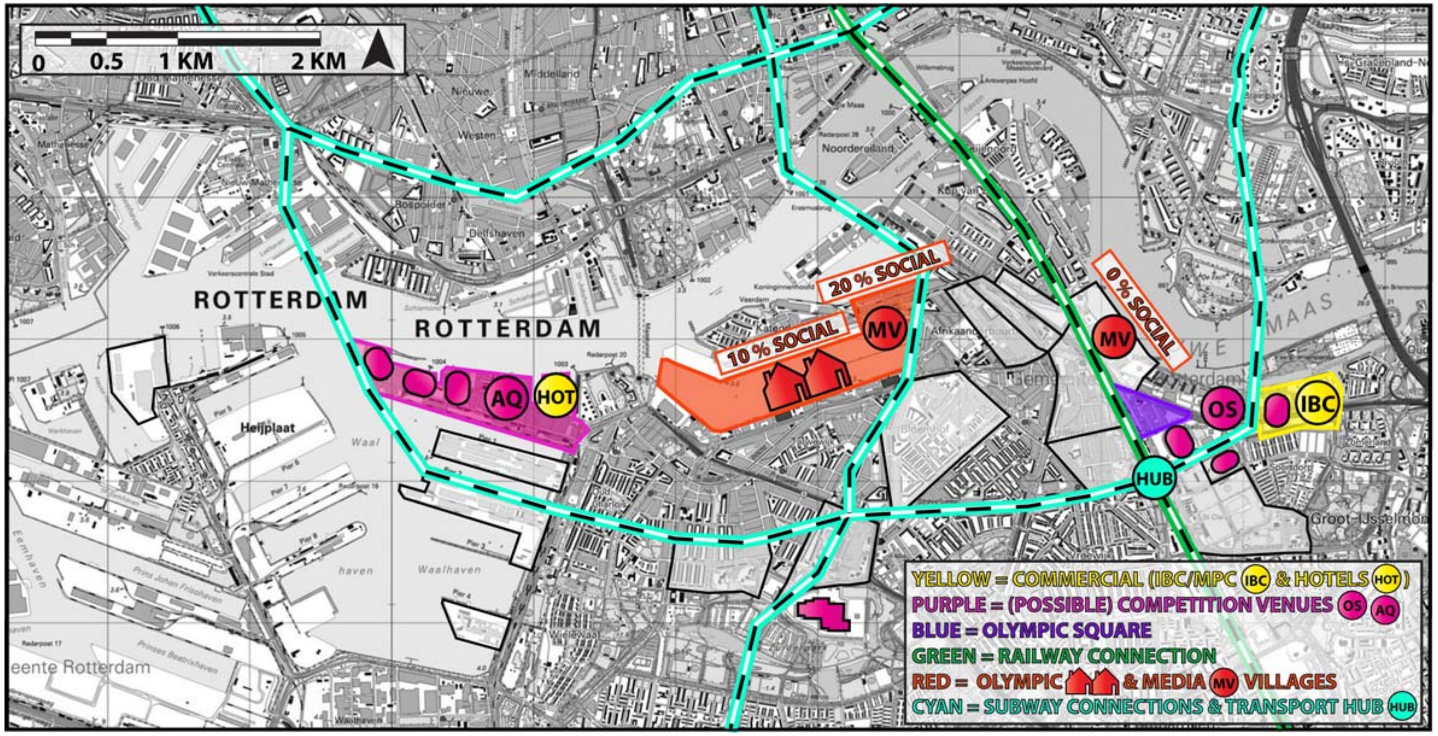
	SPORTS VENUES						PUBLIC	COMMERCIAL		DWELLINGS OLYMPIC VILLAGE						DWELLINGS MEDIA VILLAGE						DEFINITIONS									
	DEV.1			DEV.2			MUN	DEV.3	DEV.4	DEV.5			CORP. 1			DEV.6			CORP. 2			4S_OV	8S_OV	12S_OV	4S_MV	8S_MV	12S_MV	TOT			
	A_SV_IH_OLYMPIC	A_SV_IH_SMALL	A_SV_IH_TRAINING	A_SV_SS_SMALL	A_SV_CX_TENNIS	A_SV_CX_AQUATICS	A_PUB_SQUARE	A_COM_IBC/MPC	A_COM_HOTELS	A_DWU_DEV5_4S	A_DWU_DEV5_8S	A_DWU_DEV5_12S	A_DWU_CORP1_4S	A_DWU_CORP1_8S	A_DWU_CORP1_12S	A_DWU_DEV6_4S	A_DWU_DEV6_8S	A_DWU_DEV6_12S	A_DWU_CORP2_4S	A_DWU_CORP2_8S	A_DWU_CORP2_12S	A_DWU_4S_OV_TOT	A_DWU_8S_OV_TOT	A_DWU_12S_OV_TOT	A_DWU_4S_MV_TOT	A_DWU_8S_MV_TOT	A_DWU_12S_MV_TOT	A_DWU_TOT			
SUMPRODUCT	6.0	8.0	2.0	10.5	9.5	12.0	10.0	11.3	6.1	0.0	0.0	38.6	0.0	6.4	0.0	0.0	0.0	10.3	0.0	1.7	0.0	0.0	6.4	38.6	0.0	1.7	10.3	57.1			
of both matrixes is	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=										
605.6	6.0	8.0	2.0	10.5	9.5	12.0	10.0	11.3	6.1	0.0	0.0	38.6	0.0	6.4	0.0	0.0	0.0	10.3	0.0	1.7	0.0										
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20	F21										
Z1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	17.8
Z2	0.0	8.0	0.0	10.5	9.5	12.0	0.0	0.0	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								46.1	<=	53.9
Z3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	18.3
Z4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	26.2
Z5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	9.8
Z6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	24.7
Z7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	13.8
Z8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	14.0
Z9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	47.3
Z10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.6	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0	0.0								43.2	<=	59.6
Z11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0	0.0	0.0	0.0	1.7	0.0								8.2	<=	11.2
Z12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	15.0
Z13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	10.7
Z14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	9.3
Z15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	0.0	0.0	0.0								5.7	<=	21.7
Z16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	29.0
Z17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	23.0
Z18	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								10.0	<=	10.5
Z19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	44.9
Z20	6.0	0.0	2.0	0.0	0.0	0.0	0.0	11.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								19.3	<=	20.4
Z_DUMMY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								0.0	<=	400.0
de nition_equation_dwu_4s_ov_tot										-1			-1									1							0.0	=	0.0
de nition_equation_dwu_8s_ov_tot											-1			-1									1						0.0	=	0.0
de nition_equation_dwu_12s_ov_tot												-1			-1									1					0.0	=	0.0
de nition_equation_dwu_4s_mv_tot																-1			-1						1				0.0	=	0.0
de nition_equation_dwu_8s_mv_tot																	-1			-1						1			0.0	=	0.0
de nition_equation_dwu_12s_mv_tot																		-1			-1						1		0.0	=	0.0
de nition_equation_dwu_tot																						-1	-1	-1	-1	-1	-1	1	0.0	=	0.0
n_dwu_ov_tot																						29	58	87					3733.0	=	3733.0
n_dwu_mv_tot																									29	58	87		1000.0	=	1000.0
nmin_dwu_dev5_tot										29	58	87																	3359.7	>=	0.0
nmax_dwu_dev5_tot										29	58	87																	3359.7	<=	4000.0
nmin_dwu_dev6_tot																29	58	87											900.0	>=	0.0
nmax_dwu_dev6_tot																29	58	87											900.0	<=	1500.0
nmin_dwu_aff_ov													29	58	87														373.3	=>=	373.3
nmax_dwu_aff_ov													29	58	87														373.3	<=	1119.9
pmin_dwu_aff_mv																			29	58	87								100.0	=>=	100.0
pmax_dwu_aff_mv																			29	58	87								100.0	<=	300.0
amax_dwu_ov_tot																						1	1	1					45.1	<=	100.0
amax_dwu_mv_tot																									1	1	1		12.1	<=	50.0
amax_dwu_tot																												1	57.1	<=	200.0

Appendix 6.4: Output (Endogenous variables) the 'Compact' Games

Output (Endogenous variables)					
DESCRIPTION			CODE	VALUE	UNIT
TOTAL	(ZONE 1-20 & FUNCTION 1-21)	Required surface area for the allocation of the total program	A_FUNCTIONS_TOT	129.9	Ha
		Required surface area for allocation of the residential program	A_DWU_TOT	54.5	Ha
		Percentage Affordable Housing total	PERC_DWU_AFF_TOT	10	%
		Surface area developed with 4 storey high buildings	A_DWU_4S_TOT	0.0	Ha
		Surface area developed with 8 storey high buildings	A_DWU_8S_TOT	0.3	Ha
		Surface area developed with 12 storey high buildings	A_DWU_12S_TOT	54.2	Ha
		Number of apartments developed by CORP1 with 4 storey high buildings	N_DWU_4S_TOT	0	DWU
		Number of apartments developed by CORP1 with 8 storey high buildings	N_DWU_8S_TOT	17	DWU
		Number of apartments developed by CORP1 with 12 storey high buildings	N_DWU_12S_TOT	4716	DWU
DESCRIPTION			CODE	VALUE	UNIT
OLYMPIC	VILLAGE	Percentage Affordable Housing Olympic Village total	PERC_DWU_AFF_OV_TOT	10	%
		Required surface area for allocation of the residential program in the Olympic Village	A_DWU_OV_TOT	43.0	Ha
		Surface area developed with 4 storey high buildings in the Olympic Village	A_DWU_OV_4S	0.0	Ha
		Surface area developed with 8 storey high buildings in the Olympic Village	A_DWU_OV_8S	0.3	Ha
		Surface area developed with 12 storey high buildings in the Olympic Village	A_DWU_OV_12S	42.7	Ha
		Total number of apartments developed in the Olympic Village	N_DWU_OV_TOT	3733	DWU
		Surface area developed with 4 storey high buildings in the Olympic Village	N_DWU_OV_4S	0	DWU
		Surface area developed with 8 storey high buildings in the Olympic Village	N_DWU_OV_8S	16	DWU
		Surface area developed with 12 storey high buildings in the Olympic Village	N_DWU_OV_12S	3717	DWU
DESCRIPTION			CODE	VALUE	UNIT
MEDIA	VILLAGE(S)	Percentage Affordable Housing Media Village(s) total	PERC_DWU_AFF_MV_TOT	10	%
		Required surface area for allocation of the residential program in the Media Village(s)	A_DWU_MV_TOT	11.5	Ha
		Surface area developed with 4 storey high buildings in the Media Village(s)	A_DWU_MV_4S	0.0	Ha
		Surface area developed with 8 storey high buildings in the Media Village(s)	A_DWU_MV_8S	0.0	Ha
		Surface area developed with 12 storey high buildings in the Media Village(s)	A_DWU_MV_12S	11.5	Ha
		Total number of apartments developed in the Media Village(s)	N_DWU_MV_TOT	1000	DWU
		Surface area developed with 4 storey high buildings in the Media Village(s)	N_DWU_MV_4S	0	DWU
		Surface area developed with 8 storey high buildings in the Media Village(s)	N_DWU_MV_8S	1	DWU
		Surface area developed with 12 storey high buildings in the Media Village(s)	N_DWU_MV_12S	999	DWU
DESCRIPTION			CODE	VALUE	UNIT
COMMERCIAL	DEVELOPER (5)	Total surface area developed by DEV5	A_DWU_DEV5_TOT	38.6	Ha
		Surface area developed by DEV5 with 4 storey high buildings	A_DWU_DEV5_4S	0.0	Ha
		Surface area developed by DEV5 with 8 storey high buildings	A_DWU_DEV5_8S	0.0	Ha
		Surface area developed with by DEV5 12 storey high buildings	A_DWU_DEV5_12S	38.6	Ha
		Total number of apartments developed by DEV5	N_DWU_DEV5_TOT	3360	DWU
		Number of apartments developed by DEV5 with 4 storey high buildings	N_DWU_DEV5_4S	0	DWU
		Number of apartments developed by DEV5 with 8 storey high buildings	N_DWU_DEV5_8S	0	DWU
		Number of apartments developed by DEV5 with 12 storey high buildings	N_DWU_DEV5_12S	3360	DWU
DESCRIPTION			CODE	VALUE	UNIT
COMMERCIAL	DEVELOPER (6)	Total surface area developed by DEV6	A_DWU_DEV6_TOT	10.3	Ha
		Surface area developed by DEV6 with 4 storey high buildings	A_DWU_DEV6_4S	0.0	Ha
		Surface area developed by DEV6 with 8 storey high buildings	A_DWU_DEV6_8S	0.0	Ha
		Surface area developed with by DEV6 12 storey high buildings	A_DWU_DEV6_12S	10.3	Ha
		Total number of apartments developed by DEV6	N_DWU_DEV6_TOT	900	DWU
		Number of apartments developed by DEV6 with 4 storey high buildings	N_DWU_DEV6_4S	0	DWU
		Number of apartments developed by DEV6 with 8 storey high buildings	N_DWU_DEV6_8S	0	DWU
		Number of apartments developed by DEV6 with 12 storey high buildings	N_DWU_DEV6_12S	900	DWU
DESCRIPTION			CODE	VALUE	UNIT
HOUSING	CORPORATION (1)	Total surface area developed by CORP1	A_DWU_CORP1_TOT	4.4	Ha
		Surface area developed by CORP1 with 4 storey high buildings	A_DWU_CORP1_4S	0.0	Ha
		Surface area developed by CORP1 with 8 storey high buildings	A_DWU_CORP_8S	0.3	Ha
		Surface area developed with by CORP1 12 storey high buildings	A_DWU_CORP1_12S	4.1	Ha
		Total number of apartments developed by CORP1	N_DWU_CORP1_TOT	373	DWU
		Number of apartments developed by CORP1 with 4 storey high buildings	N_DWU_CORP1_4S	0	DWU
		Number of apartments developed by CORP1 with 8 storey high buildings	N_DWU_CORP1_8S	16	DWU
		Number of apartments developed by CORP1 with 12 storey high buildings	N_DWU_CORP1_12S	357	DWU
DESCRIPTION			CODE	VALUE	UNIT
HOUSING	CORPORATION (2)	Total surface area developed by CORP2	A_DWU_CORP2_TOT	1.2	Ha
		Surface area developed by CORP2 with 4 storey high buildings	A_DWU_CORP2_4S	0.0	Ha
		Surface area developed by CORP2 with 8 storey high buildings	A_DWU_CORP2_8S	0.0	Ha
		Surface area developed with by CORP2 12 storey high buildings	A_DWU_CORP2_12S	1.1	Ha
		Total number of apartments developed by CORP2	N_DWU_CORP2_TOT	100	DWU
		Number of apartments developed by CORP2 with 4 storey high buildings	N_DWU_CORP2_4S	0	DWU
		Number of apartments developed by CORP2 with 8 storey high buildings	N_DWU_CORP2_8S	1	DWU
		Number of apartments developed by CORP2 with 12 storey high buildings	N_DWU_CORP2_12S	99	DWU

Appendix 7.1: Graphical reproduction of the 'Waterfront' Games
Appendix 7.2: Preference-matrix the 'Waterfront' Games

	SPORTS VENUES						PUBLIC	COMMERCIAL		DWELLINGS OLYMPIC VILLAGE						DWELLINGS MEDIA VILLAGE					
	DEV.1			DEV.2			MUN	DEV.3	DEV.4	DEV.5			CORP. 1			DEV.6			CORP. 2		
	A_SV_IH_OLYMPIC	A_SV_IH_SMALL	A_SV_IH_TRAINING	A_SV_SS_SMALL	A_SV_CX_TENNIS	A_SV_CX_AQUATICS	A_PUB_SQUARE	A_COM_IBC-MPC	A_COM_HOTELS	A_DWU_DEV5_4S	A_DWU_DEV5_8S	A_DWU_DEV5_12S	A_DWU_CORP1_4S	A_DWU_CORP1_8S	A_DWU_CORP1_12S	A_DWU_DEV6_4S	A_DWU_DEV6_8S	A_DWU_DEV6_12S	A_DWU_CORP2_4S	A_DWU_CORP2_8S	A_DWU_CORP2_12S
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20	F21
Z1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z2	0	5	0	5	5	5	0	0	1	0	0	5	0	0	1	0	0	5	0	0	1
Z3	0	1	0	1	1	1	0	0	1	0	0	5	0	0	1	0	0	5	0	0	1
Z4	0	1	0	1	1	1	0	0	1	0	0	5	0	0	1	0	0	5	0	0	1
Z5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Z6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z10	0	0	0	0	0	0	0	0	0	0	0	5	0	0	1	0	0	5	0	0	1
Z11	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	0	1	1	0	1	1
Z12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z15	0	0	0	0	0	0	0	0	0	0	0	5	0	0	1	0	0	5	0	0	1
Z16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z18	5	5	5	5	5	5	5	1	0	0	1	5	5	5	1	0	1	5	5	5	1
Z19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z20	5	5	5	5	5	5	1	5	5	0	0	0	0	0	0	0	1	5	1	1	0
Z_DUMMY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Appendix 7.3: Constraint-matrix the 'Waterfront' Games

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20	F21
	SPORTS VENUES						PUBLIC	COMMERCIAL		DWELLINGS OLYMPIC VILLAGE						DWELLINGS MEDIA VILLAGE					
	DEV.1			DEV.2			MUN	DEV.3	DEV.4	DEV.5			CORP. 1			DEV.6			CORP. 2		
	A_SV_IH_OLYMPIC	A_SV_IH_SMALL	A_SV_IH_TRAINING	A_SV_SS_SMALL	A_SV_CX_TENNIS	A_SV_CX_AQUATICS	A_PUB_SQUARE	A_COM_IBC/MPC	A_COM_HOTELS	A_DWU_DEV5_4S	A_DWU_DEV5_8S	A_DWU_DEV5_12S	A_DWU_CORP1_4S	A_DWU_CORP1_8S	A_DWU_CORP1_12S	A_DWU_DEV6_4S	A_DWU_DEV6_8S	A_DWU_DEV6_12S	A_DWU_CORP2_4S	A_DWU_CORP2_8S	A_DWU_CORP2_12S
SUMPRODUCT	6.0	8.0	2.0	10.5	9.5	12.0	10.0	11.3	6.1	0.0	0.0	38.6	0.0	6.4	0.0	0.0	0.0	10.3	0.0	1.7	0.0
of both matrixes is	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
605.6	6.0	8.0	2.0	10.5	9.5	12.0	10.0	11.3	6.1	0.0	0.0	38.6	0.0	6.4	0.0	0.0	0.0	10.3	0.0	1.7	0.0

DEFINITIONS						
4S_OV	8S_OV	12S_OV	4S_MV	8S_MV	12S_MV	TOT
A_DWU_4S_OV_TOT	A_DWU_8S_OV_TOT	A_DWU_12S_OV_TOT	A_DWU_4S_MV_TOT	A_DWU_8S_MV_TOT	A_DWU_12S_MV_TOT	A_DWU_TOT
0.0	6.4	38.6	0.0	1.7	10.3	57.1

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20	F21			
Z1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<=	17.8
Z2	0.0	8.0	0.0	10.5	9.5	12.0	0.0	0.0	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.1	<=	53.9
Z3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<=	18.3
Z4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<=	26.2
Z5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<=	9.8
Z6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<=	24.7
Z7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<=	13.8
Z8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<=	14.0
Z9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<=	47.3
Z10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.6	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0	0.0	43.2	<=	59.6
Z11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0	0.0	0.0	0.0	1.7	0.0	8.2	<=	11.2
Z12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<=	15.0
Z13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<=	10.7
Z14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<=	9.3
Z15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	0.0	0.0	0.0	5.7	<=	21.7
Z16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<=	29.0
Z17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<=	23.0
Z18	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	<=	10.5
Z19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<=	44.9
Z20	6.0	0.0	2.0	0.0	0.0	0.0	0.0	11.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.3	<=	20.4
Z_DUMMY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<=	400.0

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20	F21	4S_OV	8S_OV	12S_OV	4S_MV	8S_MV	12S_MV	TOT			
de nition_equation_dwu_4s_ov_tot										-1			-1									1							0.0	=	0.0
de nition_equation_dwu_8s_ov_tot											-1			-1									1						0.0	=	0.0
de nition_equation_dwu_12s_ov_tot												-1			-1									1					0.0	=	0.0
de nition_equation_dwu_4s_mv_tot																-1			-1						1				0.0	=	0.0
de nition_equation_dwu_8s_mv_tot																	-1			-1						1			0.0	=	0.0
de nition_equation_dwu_12s_mv_tot																		-1			-1						1		0.0	=	0.0
de nition_equation_dwu_tot																						-1	-1	-1	-1	-1	-1	1	0.0	=	0.0
n_dwu_ov_tot																						29	58	87					3733.0	=	3733.0
n_dwu_mv_tot																									29	58	87		1000.0	=	1000.0
nmin_dwu_dev5_tot										29	58	87																	3359.7	>=	0.0
nmax_dwu_dev5_tot										29	58	87																	3359.7	<=	4000.0
nmin_dwu_dev6_tot																29	58	87											900.0	>=	0.0
nmax_dwu_dev6_tot																29	58	87											900.0	<=	1500.0
nmin_dwu_aff_ov													29	58	87														373.3	=>=	373.3
nmax_dwu_aff_ov													29	58	87														373.3	<=	1119.9
pmin_dwu_aff_mv																			29	58	87								100.0	=>=	100.0
pmax_dwu_aff_mv																			29	58	87								100.0	<=	300.0
amax_dwu_ov_tot																						1	1	1					45.1	<=	100.0
amax_dwu_mv_tot																									1	1	1		12.1	<=	50.0
amax_dwu_tot																												1	57.1	<=	200.0

Appendix 7.4: Output (Endogenous variables) the 'Waterfront' Games

Output (Endogenous variables)					
DESCRIPTION			**CODE**	**VALUE**	**UNIT**
TOTAL	**(ZONE 1-20 & FUNCTION 1-21)**	Required surface area for the allocation of the total program	A_FUNCTIONS_TOT	132.5	Ha
		Required surface area for allocation of the residential program	A_DWU_TOT	57.1	Ha
		Percentage Affordable Housing total	PERC_DWU_AFF_TOT	10	%
		Surface area developed with 4 storey high buildings	A_DWU_4S_TOT	0.0	Ha
		Surface area developed with 8 storey high buildings	A_DWU_8S_TOT	8.2	Ha
		Surface area developed with 12 storey high buildings	A_DWU_12S_TOT	49.0	Ha
		Number of apartments developed by CORP1 with 4 storey high buildings	N_DWU_4S_TOT	0	DWU
		Number of apartments developed by CORP1 with 8 storey high buildings	N_DWU_8S_TOT	473	DWU
		Number of apartments developed by CORP1 with 12 storey high buildings	N_DWU_12S_TOT	4260	DWU
DESCRIPTION			**CODE**	**VALUE**	**UNIT**
OLYMPIC	**VILLAGE**	Percentage Affordable Housing Olympic Village total	PERC_DWU_AFF_OV_TOT	10	%
		Required surface area for allocation of the residential program in the Olympic Village	A_DWU_OV_TOT	45.1	Ha
		Surface area developed with 4 storey high buildings in the Olympic Village	A_DWU_OV_4S	0.0	Ha
		Surface area developed with 8 storey high buildings in the Olympic Village	A_DWU_OV_8S	6.4	Ha
		Surface area developed with 12 storey high buildings in the Olympic Village	A_DWU_OV_12S	38.6	Ha
		Total number of apartments developed in the Olympic Village	N_DWU_OV_TOT	3733	DWU
		Surface area developed with 4 storey high buildings in the Olympic Village	N_DWU_OV_4S	0	DWU
		Surface area developed with 8 storey high buildings in the Olympic Village	N_DWU_OV_8S	373	DWU
		Surface area developed with 12 storey high buildings in the Olympic Village	N_DWU_OV_12S	3360	DWU
DESCRIPTION			**CODE**	**VALUE**	**UNIT**
MEDIA	**VILLAGE(S)**	Percentage Affordable Housing Media Village(s) total	PERC_DWU_AFF_MV_TOT	10	%
		Required surface area for allocation of the residential program in the Media Village(s)	A_DWU_MV_TOT	12.1	Ha
		Surface area developed with 4 storey high buildings in the Media Village(s)	A_DWU_MV_4S	0.0	Ha
		Surface area developed with 8 storey high buildings in the Media Village(s)	A_DWU_MV_8S	1.7	Ha
		Surface area developed with 12 storey high buildings in the Media Village(s)	A_DWU_MV_12S	10.3	Ha
		Total number of apartments developed in the Media Village(s)	N_DWU_MV_TOT	1000	DWU
		Surface area developed with 4 storey high buildings in the Media Village(s)	N_DWU_MV_4S	0	DWU
		Surface area developed with 8 storey high buildings in the Media Village(s)	N_DWU_MV_8S	100	DWU
		Surface area developed with 12 storey high buildings in the Media Village(s)	N_DWU_MV_12S	900	DWU
DESCRIPTION			**CODE**	**VALUE**	**UNIT**
COMMERCIAL	**DEVELOPER (5)**	Total surface area developed by DEV5	A_DWU_DEV5_TOT	38.6	Ha
		Surface area developed by DEV5 with 4 storey high buildings	A_DWU_DEV5_4S	0.0	Ha
		Surface area developed by DEV5 with 8 storey high buildings	A_DWU_DEV5_8S	0.0	Ha
		Surface area developed with by DEV5 12 storey high buildings	A_DWU_DEV5_12S	38.6	Ha
		Total number of apartments developed by DEV5	N_DWU_DEV5_TOT	3360	DWU
		Number of apartments developed by DEV5 with 4 storey high buildings	N_DWU_DEV5_4S	0	DWU
		Number of apartments developed by DEV5 with 8 storey high buildings	N_DWU_DEV5_8S	0	DWU
		Number of apartments developed by DEV5 with 12 storey high buildings	N_DWU_DEV5_12S	3360	DWU
DESCRIPTION			**CODE**	**VALUE**	**UNIT**
COMMERCIAL	**DEVELOPER (6)**	Total surface area developed by DEV6	A_DWU_DEV6_TOT	10.3	Ha
		Surface area developed by DEV6 with 4 storey high buildings	A_DWU_DEV6_4S	0.0	Ha
		Surface area developed by DEV6 with 8 storey high buildings	A_DWU_DEV6_8S	0.0	Ha
		Surface area developed with by DEV6 12 storey high buildings	A_DWU_DEV6_12S	10.3	Ha
		Total number of apartments developed by DEV6	N_DWU_DEV6_TOT	900	DWU
		Number of apartments developed by DEV6 with 4 storey high buildings	N_DWU_DEV6_4S	0	DWU
		Number of apartments developed by DEV6 with 8 storey high buildings	N_DWU_DEV6_8S	0	DWU
		Number of apartments developed by DEV6 with 12 storey high buildings	N_DWU_DEV6_12S	900	DWU
DESCRIPTION			**CODE**	**VALUE**	**UNIT**
HOUSING	**CORPORATION (1)**	Total surface area developed by CORP1	A_DWU_CORP1_TOT	6.4	Ha
		Surface area developed by CORP1 with 4 storey high buildings	A_DWU_CORP1_4S	0.0	Ha
		Surface area developed by CORP1 with 8 storey high buildings	A_DWU_CORP_8S	6.4	Ha
		Surface area developed with by CORP1 12 storey high buildings	A_DWU_CORP1_12S	0.0	Ha
		Total number of apartments developed by CORP1	N_DWU_CORP1_TOT	373	DWU
		Number of apartments developed by CORP1 with 4 storey high buildings	N_DWU_CORP1_4S	0	DWU
		Number of apartments developed by CORP1 with 8 storey high buildings	N_DWU_CORP1_8S	373	DWU
		Number of apartments developed by CORP1 with 12 storey high buildings	N_DWU_CORP1_12S	0	DWU
DESCRIPTION			**CODE**	**VALUE**	**UNIT**
HOUSING	**CORPORATION (2)**	Total surface area developed by CORP2	A_DWU_CORP2_TOT	1.7	Ha
		Surface area developed by CORP2 with 4 storey high buildings	A_DWU_CORP2_4S	0.0	Ha
		Surface area developed by CORP2 with 8 storey high buildings	A_DWU_CORP2_8S	1.7	Ha
		Surface area developed with by CORP2 12 storey high buildings	A_DWU_CORP2_12S	0.0	Ha
		Total number of apartments developed by CORP2	N_DWU_CORP2_TOT	100	DWU
		Number of apartments developed by CORP2 with 4 storey high buildings	N_DWU_CORP2_4S	0	DWU
		Number of apartments developed by CORP2 with 8 storey high buildings	N_DWU_CORP2_8S	100	DWU
		Number of apartments developed by CORP2 with 12 storey high buildings	N_DWU_CORP2_12S	0	DWU

ELABORATION OF THE DUTCH OLYMPIC APPROACH

Design of decision support instruments for multiple Olympic urban decision arenas

J.W. (Johan) Zonderland

Master Thesis | November 2010