Modeling actor decisions in the context of Brownfield redevelopment

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Abstract
Several important changes have recently influenced urban planning and redevelopment process. At first, the scope and scale of urban redevelopment projects increased. Secondly, a traditional linear planning process from government to the building industries has been replaced by public-private collaborations that changed the characteristics of the developer and governmental agencies; their roles play now the major influence in urban development processes. Therefore, an important cause for stagnation in redevelopment of Brownfield is the lack of consensus amongst key actors due to shared, overlapping concerns or individual conflicting interests. In particular, this research focuses at possible stagnation in relation to: (a) the features of a Brownfield, (b) the preferences of actor's groups (c) the characteristics in the negotiation process between the two groups of actors. To structure the features a Fuzzy Delphi Method is used. Conjoint analysis provides an insight in the individual preferences of actor groups. The outcomes of the decision-making process are not only depending on an individual choice made, but also including the influence of the choices of an actor's opponent. Therefore, we focus specifically on biding games (Game Theory) aiming on finding possible strategies in negotiations concerning Brownfield redevelopment. Based upon these findings, interaction between the selected actors will be simulated, calculated and modeled. The final outcomes of the research project will assist decision makers to predict possibility of stagnation and to overcome the challenges of conventional negotiation. The construction of alternative plan proposals within these models is a relative unstructured process. Little work has been done to develop models that systematically relate the characteristics of the Brownfield areas and redevelopment plans to the behavior of actors thereby giving an insight in the most important points of interest and in possible sources of conflicts.

Key words: Development process, real estate features, actor's decision making, negotiation, game-theory

1. Introduction

This research contributes to the problem solving on the stagnation of Brownfield redevelopment in urban environment. The focus is on the multiple (public and private) actors' interests this changing role of government is characteristic for the urban development today. Thus the goal of this research is to analyze these interactive processes, analyze interests of developers to become involved, try to 'steer' this decision-making. This article gives an overview of my research approach for reaching this goal.

A Brownfield constitute an interesting environment for understanding the process of the change in urban planning practice concerning augmented scope and scale and the changing role of private and public involvements. Following EPA (1990), Post (1998), Alker et al. (2000) and Yount (2003) "A Brownfield site is any land or premises which has previously been used or developed and is not currently fully in use, although it may be partially occupied or utilized. It may also be vacant, derelict or

contaminated. Therefore a Brownfield site is not available for immediate use without intervention" (Alker et al. 2000). This definition (Figure 1) is regarded as the most valuable because it summarizes previous existing definition in Europe and also elaborating US examples. There is a serious need for redevelopment of a large number of the Brownfields nationally and internationally. Restoration and redevelopment of a Brownfield can provide a range of economic, social, and environmental benefits, including restoration of environment quality and provision of land for many purposes.

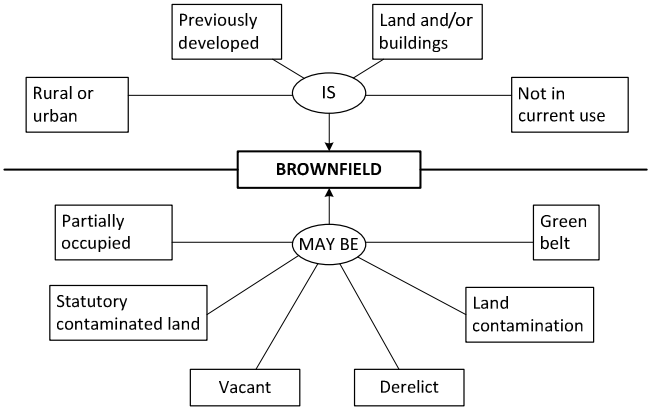

Figure 1. Criteria within the definition of Brownfield (Alker et al., 2000)

The change in the urban planning practice in general and in the Brownfield redevelopment in particular relates to the collaboration between public and private development organizations thus supports more open market approach, and results in various forms of cooperative effort. This cooperative effort requires a shift from sequential approximation forms of decision-making to ways of accommodating strategic, front-end approaches that allow flexibility. The role of the private developer is critical in this process. This role became the *conditio sine qua non* of urban redevelopment. Simultaneously, the role of government moved from the traditional urban govern role by local administration to *urban governance*, in which governmental agencies and private parties collaborate more closely. Therefore, policy making and development in market oriented society nowadays include the roles of a number of actors and shareholders, all members of two important groups: private sector (market) and community (civil society). Civil society commonly embraces a diversity of spaces, actors and institutional forms, varying in their degree of formality, autonomy and power (Edwards, 2004; Bryson, 2004). For example to the extent of *private city development* new ways of thinking are challenged (Low, 2001; Landman, 2007; Uduku et al. 2007).

The shifting planning process also has major implications for the design of decision support systems. Virtually all these systems (Brail, 2008) are based on a planning model that assumes a leading role of government where government institutions are deemed for developing alternative plans or scenarios. In addition, these systems articulate a set of goals or objectives, typically relevant for society at large. The model underlying the system then simulates or predicts the impact of the alternatives designs, plans or scenarios on human behavior and this information in turn is then used to derive a set of performance indicators. The state of the art in decision support technology does not incorporate mechanisms of cooperation between actors nor about performance indicators that are relevant to the multitude of different actors. If one wishes to develop a decision support tool for collaborative multi-actor planning one needs an appropriate model of the decision making process. Unfortunately, except for some anecdotal evidence, a formal model of the collaborative decision process has not been

developed for this domain. The current research project therefore aims at making a contribution to this gap in the literature. In particular, the goal is to better understand how interactive decision making of the main actors in the Brownfield redevelopment processes can be modeled. A better understanding of these processes is a key requirement for the development of multi-actor planning systems.

An important cause for stagnation in redevelopment of Brownfield is lack of consensus amongst key actors like municipalities and private developers due to shared, overlapping concerns or individual conflicting interests. Characteristics of a specific Brownfield as well as the preferences of involved actors may lead to successful redevelopment or be a source or potential threat for stagnation. We focus at possible stagnation in relation to: (a) the real estate features (REF) of Brownfield, (b) the preferences of groups of actors and (c) characteristics in the negotiation process between the groups of actors. Therefore, the following research questions will be addressed: 1. What are the most significant Brownfield redevelopment REF's?; 2. How will each of the groups of actors appreciate the chances for redevelopment of a Brownfield regarding their preferred REF's?; 3. How could the negotiation situations between these actors be represented in relation to possible or potential stagnation in decision process?; 4. How could a possible problematic negotiation situation be improved by interventions in terms of governance rules?

Each of the research questions is addressed by different research method. One of the challenges frequently present in many researches is to make an appropriate choice of research method for individual question and even more to make these methods compatible amongst each other. Regarding this, to structure and identify the most important features a Fuzzy Delphi Method is used. Conjoint analysis provides an insight in the individual preferences of actor groups. The outcomes of the decision-making process are not only depending on an individual choice made, but also including the influence of the choices of an actor's opponent. Therefore, we focus specifically on biding games (Game Theory) aiming on finding possible strategies in negotiations concerning Brownfield redevelopment. Based upon these findings, interaction between the selected actors will be simulated, calculated and modeled. The final outcomes of the research project will assist decision makers to predict possibility of stagnation and to overcome the challenges of conventional negotiation.

This research paper consists of following chapters. Chapter 2 delineates the set-up environment upon which different experts make decisions. Chapter 3 describes the research design theoretical background and its implementation in the described problem environment. Chapter 4 suggests the plausible government tool expressed through concept model based on determinate methodology with its pros and cons. Finally, chapter 5 discusses the contribution of this research to the urban development practice and its social significance.

2. Delineation

The experts based their decision to acquire the land or not on the specific setting of the experiment or defined institutional-economic environment. At first, they consider Brownfield as previously described (Alker et al., 2000). Secondly, we have delineated the problem to the initiative and land acquisition phase of a Brownfield redevelopment on the urban district scale. Thirdly, size of a Brownfield is in the range of 1 to 10 hectares. Next, considering the determined size of a Brownfield we made an assumption that probably there will be more than one land use (ex. housing, business, services, green, etc.). Finally, we assumed that different physical, legal, and financial attributes would be more or less important depending on the region of the research (this research focuses on the Netherlands).

The development process and the selection of the main actors require additional argumentation and insight. Therefore, we presented these as the following subchapters.

2.1 Development process

The table 1 illustrates how a redevelopment process of a Brownfield can be interpreted in major terms. During the first phase (initiative), actors such as market parties, users, and governmental representatives are identified in terms of their organizational properties like internal organization, constraints, demands and powers to influence and affect a development process. The end of this phase is marked by the delivery of the program for the re-use of the Brownfield and concerned organizational solutions for redevelopment. For initiative phase, the development process brings forward certain market knowledge to an idea. A major implicit deliverable of this phase is the assessment of the risks for stagnation of the redevelopment process that are mostly identified in the first two phases of the (re)development. That is the reason we choose initiative and land acquisition phase as the research area. In particular, we focus at information and knowledge concerning the first possibilities of stagnation in decision making for redevelopment, which are part of the feasibility study for redevelopment and its program in brief.

Phase	Market	Stakeholders	Process	Products
Initiative	Land market	• developer • owner/user • investor • broker • market research company	*market → idea* initiative feasibility definition	• market analysis • feasibility study • program in brief • project plan
Land Acquisition	(Brownfield) market	• landlord • developer • municipality • notary	*idea → location* location assessment	• location analysis • soil research • program in brief
Plan Development	Market for design services	• urban design architect • civil engineer • other advisors	*location → design* design test re-adjust design	• sketch design • preliminary design • final design • changes in zoning plan • specification • construction design • building permission
Financing	Capital market	• bank • stockholder	*design → finance*	• financial plan
Realization	Contractor market	• contractor • real estate developer	*design → building* architectural specification price estimation planning, realization, monitor, test	• on-site drawing plan • action/activity plan • tender invitation
Renting/Sale	Real estate market	• real estate developer • investor • broker • notary	*building → owner* contract making	• rent/buying contract
Managment /	Real estate management	• real estate management • owner • user	*owner → user* real estate management contract making	• real estate management agreement
Demolition		• real estate developer • contractor	*user → market demand and idea*	

Table 1. Development phases and their characteristics (Hieminga, 2006)

2.2 Involved actors and their positions

The decreasing governmental manageability of the development process of an urban district leads to a change in the importance of the involved actors. Nowadays, the orientation of actors apparently focuses to opportunities (Bryson, 2004; Heurkens, 2008; Loon and Wilms, 2006). This refers to the idea of shifting from urban central planning toward a process management approaches based upon actors decision making.

In this research project the definition of an actor is used as described by Pahl-Wostl (2005): “An actor is an individual or an aggregated social entity (collective actor) that has the ability to make

autonomous decisions and act as a unit – e.g., a company or an association is a collective actor with overall accepted rules for collective choice and can thus be regarded as a single social entity".

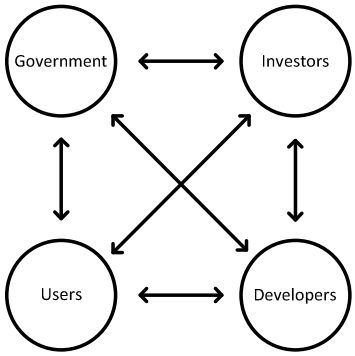

Figure 2. Main actors involved in an urban district development process

We regard investors, developers, users and governmental agencies as the four main actors involved in development processes for urban districts (Figure 2).

Each of the defined actors has its own characteristics (Heurkens, 2008; Loon and Wilms, 2006) and perceives the information of an urban district in a different way that easily leads to different decision actions. However, a general theoretical model that includes both physical and social complexities and their influences in an economic system is lacking (Batty, 2008; Bettencourt et al. 2007). To be able to deal with complexity amongst the actors (Bryson, 2004), we focus on the strategic decision making behavior of two interacting actors (Figure 3): private developers and local governmental agencies. The focus on developers originates from the assumption that the developer is the most influential actor in market-oriented society and deals with urban land at the same time (Andersson, 2005). Furthermore, they are often able to react to or interact with governmental agencies. Although these two main actors are at the front of our study, the presence of the two others is inevitable for modeling decision making of Brownfield redevelopment. To that account the assumption is made that the users as actor are considered to be linked to the government as being part of society. Investors as actor are considered to be connected to developers.

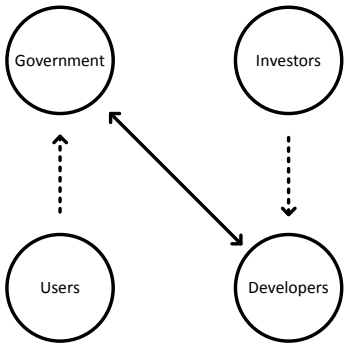

Figure 3. Selection of two interacting actors involved in an urban district development process

The actor group of the developers in fact consists of a rather wide variety of real world parties; each of them interpreting a little bit different their developing roles and strategic behavior in decision

making. Therefore in this research project an inventory of relevant developing parties and their functional roles is necessary in order to select and model the most relevant developing party. For the actor group of governmental agencies the focus will be on the level of the local communities.

3. Research design

The goal of this research project implies that we want to analyze and predict the occurrence of conflicting interests in redevelopment processes, and we want to offer recommendations concerning process governance interventions, in order to avoid the occurrence of conflicts (such as auctions) – and thus to accelerate Brownfield redevelopment. Game Theory seems a suitable method for this, because (a) game theory is based on the premise of relational interdependency between actors; (b) in game theory, players make decisions based on their utility function, which is directly related to their needs and interests; and (c) the application of game theory gives insight in the strategies of biding depending on the various interests, and in possible actions to predict the others value estimation.

The construction of a game-theoretic survey consist of two parts, namely a descriptive part which describes the game under scrutiny, and an interpreting part, in which respondents make strategic decisions based upon the described game. Principles from game theory are used for analysis of the outcomes of these interactive decisions.

In the descriptive part, it is desirable to design situations in which the structure of potential interests can be precisely described and where people's attention can be directed to the specific, controlled features. The Conjoint Analysis approach seems appropriate for describing the game; by designing fictive redevelopment projects composed from a limited set of important project- and process-characteristics, insight can be gained in dependencies between the specific interactive actor decision making and these specific characteristics. Most important part in the conjoint analysis approach is the selection of the most important characteristics. In order to make this selection thoroughly, the Fuzzy Delphi Method (FDM) is used.

To deliver the required output the research project is divided into two consecutive parts (Figure 4). The 1st phase starts with qualitative research (FDM) to explore the choice of the selected actors concerning real estate features and closes with quantitative research to verify and solidify the output: A set of criteria that private developers on one hand and governmental representatives on the other hand mostly use to decide to start activities for the redevelopment of a Brownfield. The second phase is focused on modeling the decision making of the two main actors based on preferred real estate features of Brownfield avoiding stagnation.

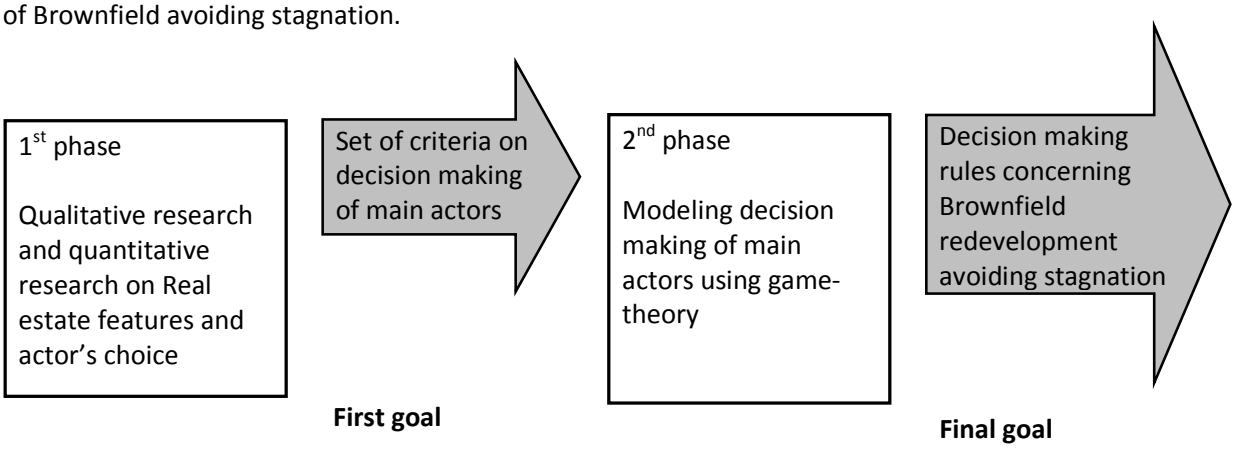

Figure 4. Schematic representation of the research design

3.1 Research phase 1

The experts needed for the research project will be selected with regard to their experiences about the initiative and acquiring of the Brownfield redevelopment cases. Respondents will be questioned in the survey. The first research phase, visualized in the scheme of Figure 5, consists of two sets of activities.

a. Research activity 1.1: Qualitative research: identifying Real Estate Features. To structure the features a FDM (Murray et al. 1985) is used.

b. Research activity 1.2: Quantitative research: This part of the research will deliver models for actor's choice behavior. To get insight in the individual preferences of both actor groups, the Conjoint Analysis will be used (Louviere et al. 2000).

3.1.1 Research activity 1.1

A literature survey provided numerous factors influencing urban development. Lewis (1990) developed a checklist of more than 1.000 factors that need to be considered before purchasing land. Such a high number of different factors are hard to handle within the research project. Reducing this number is a necessity. By categorizing the large list of REF's a number of 17 REFs within 3 main categories were derived. Figure 5 represents the research steps for reducing the number of features. Two main sources are: 1) Site evaluation factors from professional perspective (Peiser, 2003; Lewis, 1990; Miles et al. 2007) 2) Risks involved in urban development (Bandt and Hartmann, 1998; Doorn et al. 2005; Grimsey and Lewis, 2002; Newman et al. 2005; Xu 2002; Doh and Ramamurti, 2003).

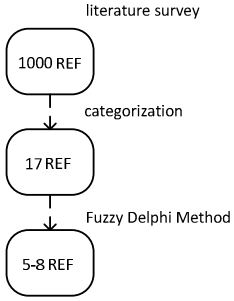

Figure 5. Categorization and Prioritization of REFs

Categorization starts with revealing two main characteristics. Typical real estate development, as described in Miles et al. (2007) and Peiser and Frej (2003), assumes the existence of especially two characteristics: a) the institutional factors enabling investment and rewards for undertaking a project; b) the urban infrastructure to which the project is expected to connect the technologies and construction used in development. Institutional factors and infrastructure are both preconditions that, if not present, significantly increase the risk of the project. Both are strongly dependent on governmental policy and mechanisms.

Problematic institutional factors particularly including those involved in real estate (property rights, exchange and financial mechanisms, taxation, local governance, governmental agencies) represent obstruction to effective urban land development. For example, a project risk in less developed countries is based on a disconnection between government institutions on one hand and those that would inhabit and benefit from such projects. Further more, Doh and Ramamurti (2003) point out that infrastructure projects are plagued by many kinds of risk, including the risk of governments' bargaining on their commitments. Another problem that might occur is the involvement of insufficient physical preconditions for successful urban development.

Categorizing based on critical observation abbreviates the initial list of more then 1000 REFs described in literature survey. The product is the list of 17 REFs divided in 3 main categories as Table 2 shows. That list serves as an input for the prioritization (FDM).

Aspect	Code - REF
Place	A1 - Proximity to key city location
	A2 - Accessibility by car
	A3 - Accessibility by public transport
	A4 - Usage
	A5 - Contamination level
	A6 - Skyline
	A7 - Morphology
	A8 - Soil properties
	A9 - Ecology
	A10 - Cultural heritage
	A11 - Archeology site
	A12 - Neighborhood image
Legal	A13 - Ownership
	A14 - Administrative support
	A15 - Approval process
Finance	A16 - Financial stimulus
	A17 - Value capturing

Table 2. Real Estate Features after categorization

Fuzzy Delphi derived from the traditional Delphi method and fuzzy set theory. Various researchers contribute to the origin of this approach (ex. Murray et al., 1985; Ishikawa et al., 1993; Noorderhaven, 1995; Hsu and Chen, 1996). The traditional Delphi method questionnaires have tendency that both the questions and the answers are indistinct. Additionally, there is a notable problem to solve the fuzziness in expert consensus in group decision making.

Murray, Pipino & Gigch (1985) first proposed the application of Fuzzy theory to the Delphi method. Further on elaborated by (Ishikawa et al., 1993) that used the Maximum-Minimum Method together with cumulative frequency distribution and fuzzy scoring to compile the expert opinions into fuzzy numbers. The expert prediction interval value was then used to derive the fuzzy numbers, resulting in the Fuzzy Delphi Method. Noorderhaven indicated that applying the Fuzzy Delphi Method to group decision can solve the fuzziness of common understanding of expert opinions.

The benefits of using Fuzzy Delphi Method (FDM) underline practical matter such as saving the survey time and reduce the number of questionnaires. More important is that it takes into account the fuzziness that confronts every survey process assuring that there is no misinterpretation of an expert's prime opinion thus genuinely reports their responses. In this way the efficiency and quality of questionnaires are improved.

Table 3 illustrates the Delphi survey procedure (Schmidt et al. 2001) that will follow. In questionnaire 1, experts validate the list of categorized features. Additionally, they can add missing ones and regroup them. There are giving their opinion based on the strict definitions of the features, defined environment and the phase of development (Table 1). Questionnaire 2 ranks the chosen features. The experts within each panel will individually submit the mark on the scale from 1 to 10, indicating relevance from none to extreme, for every feature. Fuzzy Delphi calculation will be used to assemble the ranking list for each panel.

PHASE 1 Brainstorming	• For this phase only threat experts as individuals not panelists • Starting point factors from the literature – academic experts • Remove exact duplicates, and unify terminology, merge two lists • *Questionnaire 1*: Send consolidate list to experts for validation • Refine final version of consolidated lists
PHASE 2 Ranking	• *Questionnaire 2*: Experts rank factors • Calculate with Fuzzy Delphi • Final result is two rank lists, one for each panel

Table 3. Survey procedure (adapted from Schmidt et al. 2001)

The outcome of this survey and generally from this qualitative part of the research is, to provide the most important real estate features relevant for Brownfield redevelopment selected by expert developers in practice and corresponding government agencies. These findings will be used as a starting point for the research activity 1.2.

3.1.2 Research activity 1.2

The second research activity (Figure 4) concerns searching for the (most) preferred combination of REF for the two main actors, needed to start a Brownfield redevelopment assignment. Therefore the REF will be further elaborated and represented in terms as attributes with specified ranges of values. Based upon these representations choice analysis will be executed. This implies that the attributes will be combined according to a fractional factoring design. Next, the resulting attribute profiles will be placed into choice sets. Experts will then be asked to choose from each choice set individually and jointly the profiles they like best. Discrete choice models can then be used to estimate the contribution of each attribute to the overall utility and the probability of choice. Moreover, the relative influence of each actor can be derived (Wiley and Timmermans, 2008).

3.2 Research phase 2

The second phase of the research project starts with a focus at strategic interactive choice behavior (Blokhuis et al., 2009). In this, strategy can be defined as the position that an actor occupies (Ajzen et al. 2005), the design of the course of (inter)action that he makes in consideration of his goals. This research project will not focus on strategic handling of an individual actor, but on the strategic handling of the two main actors in inter-dependency situations. Based upon the choice analysis we can distinguish the rules of the different payoffs situation leading to the stagnation of Brownfield redevelopment - research activities 2.1 (Figure 4). The way in which we find appropriate biding game is explained below. The final concluding research activities 2.2. (Figure 4) are dealing with possible interventions in order to improve auction and make it operational for the organizer.

3.2.1 Finding biding system in Brownfield redevelopment projects using Game Theory

The outcomes of the decision-making process are not only depending on an individual choice made, but also including the influence of the choices of an actor's opponent. In other words, the payoffs of all parties are interdependent.

Based on the assumption that Game Theory (Neumann et al. 1944; Myerson 1991) is a suitable theory to test behavior of involved actors in interactive decision making situations. Game theory mainly aims to give insights on situations in which decision-makers interact (Osborne, 2004). Both cooperative and non-cooperative types of games can be used to study actors' interaction (Nash, 2001). The cooperative branch can be used to study the formation of coalitions among actors while the non-cooperation branch can be used to study how actors strategically behave toward each other when the

cost of bargaining and coordination is too high. Therefore, we focus specifically on non-cooperative games, and aim on finding possible strategies in biding where auction is regarded as the form of negotiations concerning Brownfield redevelopment.

As stated in the introduction to the research design, the descriptive part of the game exists of fictive, changing redevelopment negotiation settings, composed from a limited set of important attributes, resulting from FDM (chapter 3.1.1). In the interpreting part, non-cooperative, non-zero sum games with perfect information are created, and represented in strategic form. The players are the project developers. The concept of strategic equilibrium is used which is an essential part of game theory. Equilibrium is a profile of strategies that given a profile of beliefs and equilibrium behavior cannot be unilaterally improved, implying that the beliefs are consistent with actual courses of action prescribed by the equilibrium strategies. The Nash equilibrium is a profile of strategies of best responses to one another, or a profile of strategies that involve optimal reactions to optimal reactions. The Nash equilibrium is applied in this research, because it is the pure form of the basic concept of strategic equilibrium.

The expected results of this research phase are exploring whether the prediction of the respondents about the outcome corresponds to the game-theoretic prediction of the game-outcome – giving insight in the suitability of the application of game theory in predicting real-world actor choice behavior.

Based on the outcomes of the analyses, and making use of the principles of game theory in order to improve game outcomes, interventions can be designed through which process governance can be executed. This process governance is aimed at supporting the establishment of cooperation between relevant parties, reducing the number of conflict occurrences and accelerating the real-world realization of the Brownfield redevelopment projects from a public, social importance. In the next section, the design of interventions is explained.

3.2.2 Possible interventions

The final set of research activities that will be performed is aiming at construction of interventions. Based upon the findings of the research on biding games (5.1.1) expectations of possible stagnations in the interaction between the selected actors will be simulated, calculated and modeled. Interventions concerning urban development governance in terms of specific rule sets to avoid or to handle stagnation will be developed. The interventions concerning game rules in general consist of three elements: a) Changing the information for the involved players (Rasmusen, 1990), b) Changing the pay-offs, c) Changing the *playing rules*.

The research activities on the above items will bring forward the required interventions. Interesting strategies for these interventions are explored in Jost et al. (2007); Harrenstein (2004) and Fang et al. (1993).

The final outcomes of the research project will assist decision makers to predict possibility of stagnation and to overcome the challenges of conventional negotiation. This can be reached through a range of analytical tools to clarify interests, identify tradeoffs, and recognize party satisfaction. Optimal solutions might be generated and become more feasible by matching the most appropriate private developers and their opponent public developers to the challenges of redevelopment and transformation of a Brownfield.

4. Expected results

In this research, the problem of stagnation in the Brownfield redevelopment projects addresses the development processes or more precise the strategic decisions in land development by different actors. Therefore, to be able to address formulated research questions we previously strictly defined the

decision' institutional-economical environment and focused on the specific decision in certain phase of development.

Samsura et al. distinguish four prime models for the land development strategy in the Netherlands (Table 4). Within these models role of the municipality can be active or facilitative. All models are characterized by initial situation on the market or ownership, defined parties that acquires the land, the one that service and re-parcel the land, and the parties that acquire the building plots.

Land development strategy	**Initial situation on land market**	**Acquisition of a land**	**Servicing and reparceling the land**	**Acquisition of building plots**
Active Land Policy by municipality				
(1) **Public land development model**	Original owners	Municipality acquires all land	Municipality	Private developers; end users
(2) **Building claim model**	Private developers with intentions to build houses	Municipality acquires all land	Municipality	Private developers with building claim
(3) **PPP model**	Original owners	Joint venture company (including land-owning private developer)	Joint venture company	Private developers with building claim
	Private developers with intentions to build houses	Joint venture company (excluding land-owning private developer)		
Facilitating Land Policy by municipality				
(4) **Private land development model**	Original Owners	Private developers; end users	Private developers; end users	End users; end users already own building plots

Table 4. Land development strategies (Samsura et al. 2010)

The explained land development strategies (Table 4) are also available in the urban Brownfield areas in the Netherlands. We will contribute the academic research in urban development and its institutional implementation by introducing a biding system within the existing models (Table 5). The biding is regarded as a formal substitute of negotiation present in every model. The major benefit of this model is to eliminate long negotiation processes and be able to involve as much as possible available developers and end users thus achieving the greatest value for the developed land. In this way we provide an insight in possible governance policy tool to fasten-up the negotiation processes and therefore contribute to the problem of the stagnation in Brownfield redevelopment. Application of the biding system can be introduced to every existing model.

Land development strategy	**Acquisition of a Brownfield**	**Acquisition of building plots**
(1) **Public land development**	by original owners	by municipality
(2) **Building claim model**	by original owners	
(3) **PPP model**	by original owners; by municipality for the selection purpose	
(4) **Private land development model**	by original owners	by developers

Table 5. Application of a biding system in existing models.

Namely: Application in model (1, 2, 3, 4) - Biding can be organized by original owner in the acquisition of a Brownfield. The application special interest is when the owner is unique or consists of a small number of parties that are not emotionally attached to the land. The bid would be evaluated by

the original owner(s). Application in model (1) - in this model, a biding system can be introduced in the acquisition of the building plots where the municipality will be organizer and evaluator of the biding; application in model (3) - In PPP projects a biding system can be utilized as a selection tool for the municipality to make a partnership with the most suitable private developer; application in model (4) - In this model as well, a biding system can be introduced in the acquisition of the building plots where the developer will be organizer and evaluator of the biding.

As an additional contribution we would like to highlight the possibility of using a biding model as a separate land development strategy (Table 6). This potential change in governance rules together with the promising biding system can resolve the stagnation in the Brownfield redevelopment. At first, same as for the application of the biding system itself, the benefit is to eliminate long negotiation processes and be able to involve as much as possible developers and end users thus achieving the greatest value for the developed land. Secondly, the difference comparing to the other active land use policies is that servicing and reparcelling the land is done by private developers and/or end users. More freedom in development is regarded as an additional incentive for the private developers. Specifically, the concept design (project in brief leading to detailed urban plan) under certain boundaries conditions (general urban plan) is regarded as a reward for making more development risks in servicing the land. We made an assumption that all possible incentives are highly appreciated in Brownfield areas and augmenting the chances for their redevelopment.

Land development strategy	**Initial situation on land market**	**Acquisition of a Brownfield**	**Servicing and reparceling the land**	**Acquisition of building plots**
(5) **Biding model**	Original owner(s)	Municipality acquires all land	Private developers; end users	End users; end users already own building plots

Table 6. Biding Land Development strategy

In this model, the biding system can be applied in both acquisition parts (Table7). Initial owners can organize and evaluate the biding when selling the land to the municipality. This corresponds to the amicable acquisition the most preferable instrument for the land assembly by the municipality. Secondly, in this acquisition stage the municipality can organize biding itself to select the most appropriate developer. At the end developers will sell the building plots to the final users and in this moment the biding system can be implemented as well.

Land development strategy	**Acquisition of a Brownfield**	**Acquisition of building plots**
(5) **Biding model**	by original owners; by municipality for the selection purpose	by developers

Table 7. Application of the biding system in biding model

Additional strength of this model would be the new Dutch legislation on cost recovery (the Land Development Act, issued July 1st, 2008). It regulated that municipality have a right to reclaim the investments in infrastructure from developers thus avoiding “free riders” (Louw 2008). Although the private developers are already servicing and reparceling the land this act assures the local authorities that the goals and objectives on bigger scale can be implemented on the scale of the urban districts.

This research would contribute to better understanding and the implementation of the biding systems in urban development practice. As we already explained the research and its model is consists of two main phases. In the first, we indentified the most important REF and create the utility function

for different developers in conjoint analysis. In the second phase, this value is used as an input for the auction in game theory environment. The goal is to select the best auction type in urban development practice for the Brownfield and make it operational. The conclusions that derive from the game theory analysis of biding games we will use to advanced a biding protocol (Arentze and Timmermans 2004) that have an operational significance. This model is represented in its concept design (Figure 6). Additionally, we introduced a similar and more general model for newly proposed development strategy (Figure 7). We can summarize the research steps:

Research phase 1:

1. Identify the most important REF (5-8) with FDM.
2. Create the utility value of each developer with conjoint analysis and use it as an input for the game theory. Here we predefined the utility function on the three major parts. As the first, the utility of the current situation where the features from the land acquisition phase are used to estimate the model. Secondly, for the developers it is important what would be the potential of the future project therefore we distinguish this as a part of general utility function for the certain Brownfield. Finally, the last part of the function is the ownership status that is one of the major obstacles of the development.

Research phase 2:

3. Design and select the most suitable biding games (ex. war of attraction, dollar auction, vickrey auction) for urban development practice.
4. The conclusions of the selection of the best game and the game itself are used to advanced existing protocol.

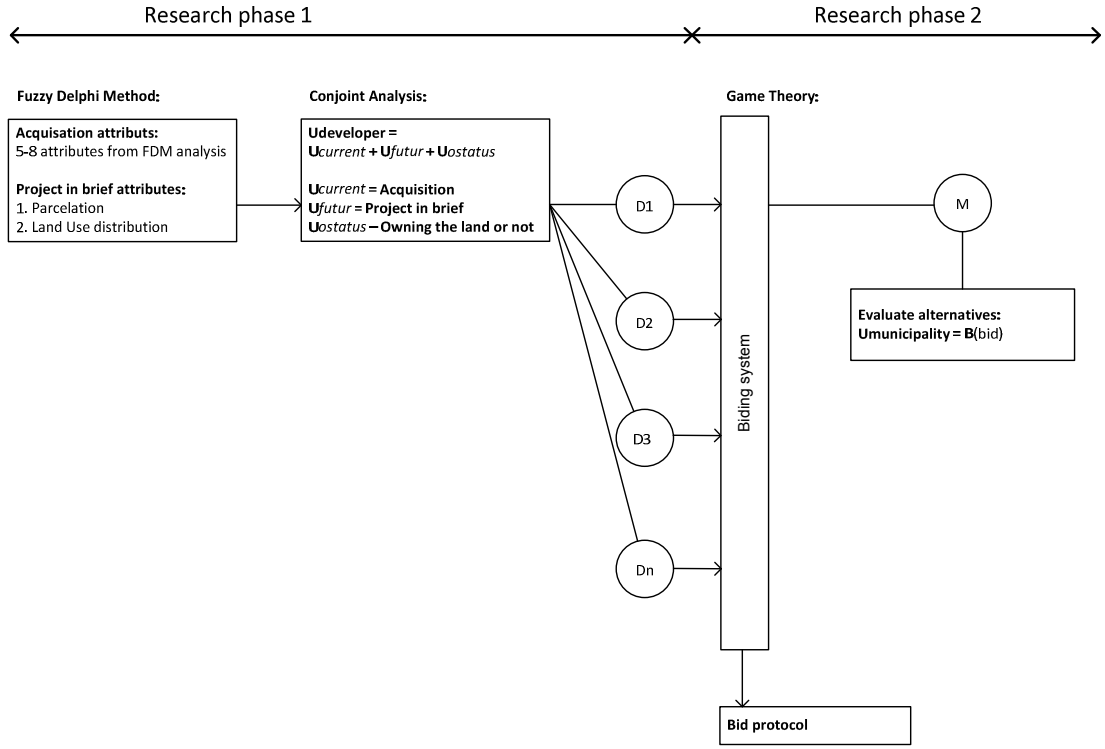

Figure 6. Concept Model Design in application for established models (land development strategies)

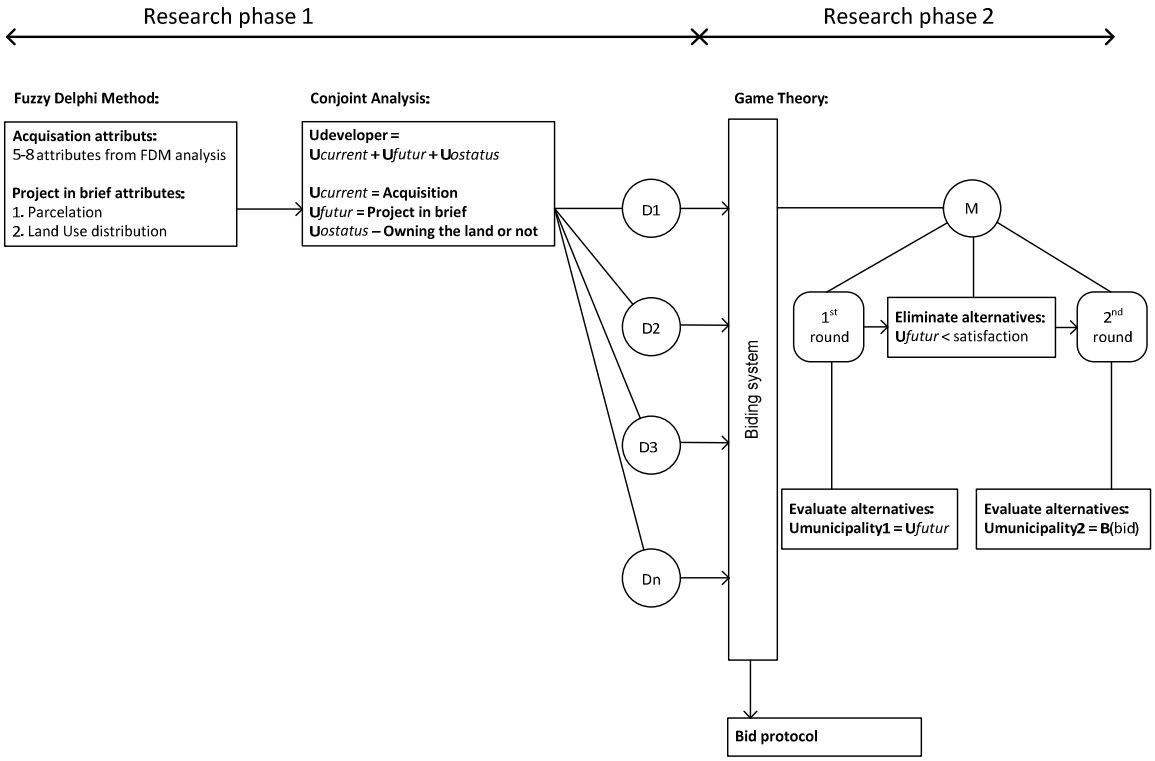

Figure 7. Concept Model Design for the biding model (land development strategies)

5. Discussion

Understanding the characteristics of redevelopment assignments of a Brownfield in relation to main actor's preferences and their interaction in decision making will benefit a wide variety of interest groups in the society. It will stimulate understanding the complex (re-) development assignments of urban districts also in terms of process features and governance interventions. The majority of fast urban growth on the large scale during the next decades will be found in developing countries world wide (Mokhtar, 2008; Mahadeo, 2008). In such urban areas, challenges for new economies, for approaches for new *urban development associations* as well as pitfalls for human tragedies will be possible.

Already in 1969, Arnstein mentioned the concept of citizen participation in urban renewal, thereby arguing for a more substantive role for the public in planning decision-making. In current urban redevelopment projects in the Netherlands, we observe a growing level of citizen and market party empowerment, resulting in more complex decision-making processes (Blokhuis et al 2009). This growing process complexity asks for a shift in planning approach, because the traditional – rational – planning approaches can only be successful in coherent situations in which consensus on values in society exists (Veneris, 1993). This is a very rare case in current spatial planning in which most tasks involve dealing with conflicts, often resulting from differing interests (Golobic and Marusic, 2007). Therefore, a shift was proposed towards a more collaborative and participative planning approach. Among others, Forester (1989), Healey (1992, 1996, 1998) and Innes (1996, 1998,1999) emphasized the need for increasing the role of communication, collaboration and interaction in planning practices, aiming for better consensus in development processes.

This resulted in a search for scientific methods and tools enabling planners to support actors' decision making on the level of content and context. In recent years, the potential use of group dynamic techniques was explored extensively, resulting in the application of several techniques: visualization

techniques (e.g. Al-Kodmany, 1999; Alshuwaikhat and Nkwenti, 2002), GIS-applications (Ceccato and Snickars, 2000; Peng, 2001; Rinner, 2001), Group Decision Support Systems (Mayer and De Jong, 2004), Planning Support Systems (Geertman, 2002), Multi-Agent Systems (Arentze and Timmermans, 2003) and Simulation Gaming (Mayer et al. 2005). The development of alternative solutions (plan proposals) stands central in the majority of these techniques, thereby incorporating that – to be able to construct viable alternatives – insight is needed in preferences and choice behavior of involved actors.

However, the construction of alternative plan proposals within these models is a relative unstructured process. Little work has been done to develop models that systematically relate the characteristics of the Brownfield areas and redevelopment plans to the behavior of actors thereby giving insight in the most important points of interest and in possible sources of conflicts. The research outcomes will support the further development of theory concerning *scientific process management*.

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