

# **From hierarchy to network**

An agent-based model about the effects on spatial development in the urban area

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## **Abstract**

Governance and urban governance has changed over the last few decades. In the literature, a shift from a hierarchical to a more network form of governance is observed. While a hierarchical form of governance has vertical actor relations, the network form of governance has horizontal actor relations and uses negotiation as logic of action. This shift in governance is also observed in the Netherlands and, in the beginning of the new century, reactions to this change in society were visible in the new policies. Some policy effects related to the shift to a network form of governance are related in the existing literature to the end of the original compact city and the idea of a central place. Although compact development is still desirable for financial and environmental reasons, a possible effect could be the emergence of urban sprawl, which means excessive spatial development could be observed. There is some uncertainty if a network type of governance is actually the most capable form of governance to achieve the actual desired urban patterns: network cities without excessive spatial growth. However, although it is a common assumption made in the existing literature, we do not know if a network form of governance actually leads to less compact development. This study is aiming to provide insight about the effects of different governance types on the structure of urban development.

In this study, an agent-based model is constructed to simulate two land development strategies related to either a hierarchical or a network form of governance. The land development strategies are linked to many aspects of networks and hierarchies in the existing literature. The public land development model and the public-private partnership model, both relevant in the context of Dutch planning process, will represent the hierarchical and network governance types and are simulated in the model. It seems that the structure of spatial development is not particularly determined by the logic of action, but rather by the preferences of the relevant decision-making actors in the process of land development. This study will show that the difference in core business, values and strategies are the main cause for a significant difference in the structure of development. It is argued that the public actor itself has to determine whether the advantages of networks and a public-private partnership outweigh the disadvantages.



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# 1 Introduction

## 1.1 Project framework

Governance and urban governance has changed in the last decades. Governance is not a synonym for government, but signifies a change in the meaning of government, referring to a new process of governing (Rhodes, 1996, p.652-3). It basically refers to what governments do (Healey, 1997, p.206). In 1989, Harvey observed a shift in urban governance from managerialism to entrepreneurialism. A shift that seemed to suggest a considerable autonomy of local action, where urban governments had to be much more innovative and entrepreneurial (Harvey, 1989, p.7-14). He observed that a potential problem was to devise a strategy for inter-urban linkage that mitigates inter-urban competition and shifts political horizons away from the locality and into a more generalisable challenge to capitalist uneven development, which were emerged with the shift in governance (Harvey, 1989, p.16). An observation that by the end of the twentieth century lead to efforts in many parts of Europe to produce strategies for cities, subregions, and regions (Salet & Faludi, in Albrechts et al., 2003, p.113). These efforts involved the construction of new institutional arenas within government structures and the underlying concepts were, according to Albrechts et al. (2003, p.113-115), inter alia, positioning of city regions in a global economic space, changes in the financing of local government, decentralization and the formation of alliances, and image formation in the face of globalization. A movement to reduce hierarchies of levels in governance while building stronger institutional capacity at regional and subregional levels was noticeable in Europe (Albrechts et al., 2003, p.114). When local action was assigned a considerable autonomy, the administrative practice of the government changed with it. Hill & Lynn Jr. (2005, p.173) mention that the growing acceptance of governance as an organizing concept for public management reform reflects a widespread belief that the focus of administrative practice is shifting from hierarchical government toward greater reliance on horizontal, hybridized, and associational forms of governance. A shift in governance, so is argued by Frederickson and Smith (in Hill and Lynn Jr., 2005, p.174), that created a state that is less bureaucratic, less hierarchical, and less reliant on central authority to mandate action. This horizontal shift is often called as a shift to a more network type of governance. In line with this designation, Hajer (in Healey, 2006, p.300) argued that this new form was emerging for a network society. Governments became more involved in facilitating the self-organization of partnerships, networks, and governance regimes (Jessop, in MacLeod & Goodwin, 1999, p.522).

This shift in society from a more hierarchical type to a more network type of governance is also observed in the Netherlands. For the situation in the Netherlands, Van der Cammen and De Klerk (2003, p.375) state that the fundament for a hierarchical type of governance was no longer present

when the hierarchical relations in society disappeared. As a result, they say, spatial planning became a product of decisions made by multiple actors, communicating with each other in networks (2003, p.376). In line with this change in governance, a new planning policy for the long term was determined in the Netherlands in the beginning of the new century. Interesting aspects of this new planning policy were an interactive planning process, the linking of city and region, and the broad content, which contained more than just spatial planning in particular (Van der Cammen & De Klerk, 2003, p.381). These aspects can be associated with the recent shift to a network society, as a society with less hierarchical relations. The next step in creating this new planning policy was the establishment of the *Nota Ruimte* by the Dutch government in 2006. The *Nota Ruimte* is a policy for spatial development where, motivated by the recent changes in society and governance, a new management philosophy is explained, which is in line with planning policy earlier described (Ministry of Housing, Spatial Planning and the Environment [VROM] et al., 2006, p.17). It shows the recent changes in society and governance were, and perhaps are, a broad issue in policy and planning policy. In an extension from the *Nota Ruimte*, published by the Ministry of VROM (2006, p.16), four main goals of the new policy for spatial development are explained. These goals are: increasing the international competitiveness of the Netherlands, fostering powerful cities and a vital rural area, developing international spatial values, and guaranteeing a safe environment for citizens. The main way to achieve the goals for cities and networks is described in the *Nota Ruimte* as the development of urban networks (Ministry of VROM et al., 2006, p.73). These urban networks are based on the idea of 'network cities', a concept that consists of multiple urban centers and nodes and introduced in the Netherlands in 1999 by then minister Jan Pronk (Van der Cammen & De Klerk, 2003, p.421). The emergence of this idea is often linked in the literature to the end of the original compact city and the idea of a central place (Batten, 1995, p.318; Meijers, 2007; Van der Burg & Dieleman, 2003; Van der Cammen & De Klerk, 2003, p.382). Although this means the compact city and the idea of a central place did not exist anymore in their original form, the goal of compact development on itself is still not outdated. Previous research on the effects of urban sprawl (e.g. Burchell et al., 2002; Grabkowski, n.d.; Johnson, 2001) shows us compact development should be and still is a desired goal in spatial planning.

Overall, the shift in governance determines not so much a change in the goals of Dutch spatial planning policies, but essentially a change in the strategies used to achieve these goals. Both hierarchical and network forms of governance have their own typical aspects and values and this is visible in the land development strategies associated with these different forms of governance. The public land development model as described in an article by Samsura et al. (2010) could be linked to a hierarchical form of governance. In this model the municipality is the only deciding actor in creating

a development plan and the processes of acquiring and servicing the potential building plot. It is important to note that this is a model and therefore it is a simplification of the actual process. This means in the actual land development process more actors could be involved. The public land development model suggests a typical hierarchical structure, either within the government itself as in the complete process of land development. On the other hand the public-private partnership model as described by Samsura et al. (2010, p.568-9) could be linked to a network form of governance. In this model the municipality has to negotiate with private actors during the process. Certain aspects in this particular land development strategy, like the frequency of interaction between actors, suggest the process of the public-private partnership model is an example of spatial planning as product of decisions made by multiple actors, communicating with each other in networks, which is in line with the description of Van der Cammen and De Klerk (2003, p.376) of the new, network form of governance in spatial planning. Although the shift in governance is essentially a change in the strategies used to achieve the goals of Dutch spatial planning policies, it is interesting to see if the outcomes on the structure of spatial development will be the same when using these different strategies.

As we have seen, the new planning policy in the Netherlands is defined for the long term. This means, considering the official new planning policy *Nota Ruimte* was established in 2006, we are in the middle of the process where network governance is a main subject. But despite these recent developments, research on the effects from the observed switch from a hierarchical to a network form of governance is still limited. Many case studies have been analyzed and they are very informative and contributing to our perception of governance, but a more systematic analysis of the effects of governance on spatial structure is lacking. Provan and Kenis (2007, p.231) agree, stating that mechanisms of governance are generally discussed in terms of specific activities performed for a particular network, rather than in a comparative way. Therefore, there is some uncertainty if this type of governance is actually the most capable form of governance to achieve the goals in Dutch spatial planning policies. Also, we are not sure if this new form of governance leads to less compact development, although that is a common assumption made in the existing literature, considering the links made with the end of the original idea of the compact city and the idea of a central place. The relevance of this study is therefore the insights it can provide about the effects of certain types of governance on the structure of urban development. These insights are meant to be beneficial for urban developers and policymakers, who can possibly make better advised and substantiated future decisions and policies when there is more information available about the effects of different forms of governance in relation to spatial planning. An extension to existing knowledge on this subject can therefore be of significant importance for urban developers and policymakers.

## 1.2 Research goal and –question

### 1.2.1 Research goal

This study will focus on providing insights about the effects of certain types of governance on the structure of urban development. This follows from the project framework as described earlier, where we have noticed recent changes in governance related to spatial planning and the absence of comprehensive knowledge on this issue. Therefore, the following research goal is defined for this study:

*The goal of this research is to deliver a contribution to the theories about the effects of network governance and different land development strategies on the structure of spatial development in the urban area by using theories about network governance, hierarchical governance, and land development strategies, and create and run an agent-based model with the acquired information from these theories.*

With the information acquired from the existing literature we create an agent-based model. This model will give us the opportunity to simulate the effects of different land development strategies on spatial development. Although a model has limits and simplifications, it can be very important for urban developers and policymakers, as it could give them useful insights about certain changes in land development strategies. By taking a closer look at the existing theories, we will be able to define several variables able to use in the model.

### 1.2.2 Research question

With this research goal in mind, we define the following main question for our research:

*To what extent does a network form of governance and the associated land development strategies lead to less compact development, as compared to a hierarchical form of governance?*

What we define in this research as a network form of governance and a hierarchical form of governance will be further explained in the second chapter of this thesis, which includes the theoretical framework and our conceptual model. Compact development is defined as a purely spatial phenomenon. It is considered in this research as the opposite of urban sprawl, which is a widely explored field in the existing literature (see e.g. Brueckner & Fansler, 1983; Rand et al., 2002; Zellner et al., 2010). This means the less sprawl is observed, the more compact we consider the spatial development.

Besides this information we will obtain from our literature review and the process of creating our model, we have defined one subquestion to support our main question:

*Which specific aspects of each form of governance and land development strategies affect spatial outcomes?*

The answer to this question will be obtained by the outcomes of our agent-based model.

## 2 Theory

As we have seen in our project framework, this thesis is based on recent changes associated with the phenomenon of 'governance'. As we have mentioned in our project framework: governance is not a synonym for government, but signifies a change in the meaning of government, referring to a new process of governing (Rhodes, 1996, p.652-3). We can consider governance as the shaping of the rights, rules, preferences and resources that structure political outcomes (March & Olsen, in Bogason & Musso, 2006, p.5). In modern societies, governance basically refers to what governments do (Healey, 1997, p.206). In public management, governance refers to the funding and oversight roles of government agencies (Hill & Lynn Jr., in Provan & Kenis, 2007, p.230). In the context of a regional approach, Fürst et al. (2002, p.5) give us five basic models of governance that can occur: market, hierarchy, organization, networks and solidarity. As we have seen in our project framework, the main shift that has been made is the shift from a more hierarchical to a more network type of governance.

### 2.1 Literature

#### 2.1.1 Network- and hierarchical governance

In the literature, network governance is explained in many ways and perspectives. In the very essence, networks are constructed when individuals, or agents, interact (Salancik, 1995). As logic of action – how the involved agents interact with each other – network governance uses negotiation (Fürst et al., 2002, p.5). Rhodes (1996, p.658) uses the term network to describe the several interdependent actors involved in delivering services. He states networks are made up of organizations which need to exchange resources to achieve their objectives, to maximize their influence over outcomes, and to avoid becoming dependent on other players in the game. Negotiation is an essential aspect in definitions of networks found in the literature. A useful definition of governance networks is given by Hajer and Versteeg (2005, p.341):

*“Governance networks are relatively stable sets of interdependent, but operationally autonomous and negotiating actors, focused on joint problem solving. Governance networks characteristically consist of a polycentric, often trans-national and almost by necessity intercultural collaboration of multiple actors.”*

An aspect in this definition essential for our research is the interdependency, but operationally autonomy of the negotiating actors. The negotiation that is taking place in these networks is marked by the condition of institutional ambiguity and multi-signification (Hajer & Versteeg, 2005, p.341). The authors explain that institutional ambiguity is caused by the absence of agreements upon norms,

procedures, or constitution to predetermine where and how a legitimate decision is to be taken. They also explain multi-signification refers to the fact that actors may conceive of the world in different terms, which means that the very meanings at stake for the participants are often unclear to each other. In addition to previous definition, Torfing (2005, p.307) defines governance networks a bit differently, but also with an emphasis on the aspect of negotiation:

*“Governance networks can be defined as relatively stable horizontal articulations of interdependent, but operationally autonomous actors who interact with one another through negotiations which take place within a regulative, normative, cognitive and imaginary framework that is self-regulating within limits set by external forces and which contributes to the production of public purpose.”*

Including most features commonly ascribed in previous research, Torfing (2005, p.307) aims at capturing the essence of what which is commonly referred to by the notion of governance networks. His definition consists of five defining aspects, which he further explains in his article (2005, 307-8). First, governance networks articulate a number of public, semi-public and private actors who, on the one hand, are dependent on one another’s resources and capacities in order to get things done, and on the other hand, are operationally autonomous in the sense that they are not commanded by superiors to act in a certain way. This means the relations between the actors, or agents, in the network is rather horizontal, although that does not imply that they are equal in terms of authority and resources. This either does not mean a single actor can exercise their power to exert hierarchical control over anyone else. Second, the members of networks interact through negotiations that combine elements of bargaining with elements of deliberation. Third, the negotiated interaction between the network actors proceeds within a relatively institutionalized framework, which is more than the sum of its parts, but does not constitute a homogenous and completely integrated whole. Fourth, governance networks are relatively self-regulating, as they are not part of a hierarchical chain of command and do not submit themselves to the laws of the market. Fifth, governance networks contribute to the production of public purpose within a certain policy area. A public purpose is considered here an expression of visions, values, plans, policies and regulations that are valid for, and directed towards, the general public. Spatial planning is considered such a public purpose in our research.

A useful complement to these definitions of networks comes from the management literature. Network governance is defined in many ways. This is also observed by Jones et al. (1995, p.914), who noticed the broad extent of definitions clustered around two key concepts. These key concepts were patterns of interaction in exchange and relationships, and flows of resources between independent

units. Jones et al. (1997, p.914) propose their own definition. A definition which, however, is given in the context of industries and firms, but could be seen in broader context:

*“Network governance involves a select, persistent, and structured set of autonomous firms (as well as non-profit agencies) engaged in creating products or services based on implicit and open-ended contracts to adapt to environmental contingencies and to coordinate and safeguard exchanges;. These contracts are socially – not legally – binding.”*

This definition uses several key concepts that are further explained by Jones et al. (1995, p.914-6). First, ‘select’ indicates that network members do not normally constitute an entire industry. They rather form a subset in which they exchange frequently with each other but relatively rarely with other members. Second, ‘persistent’ means that network members work repeatedly with each other over time. Third, ‘structured’ indicates that exchanges within the network are neither random nor uniform, but are rather patterned, reflecting a division of labor. Fourth, ‘autonomous firms’, which can be easily substituted by ‘agents’, means each element of the network has the potential to be legally independent. And last, ‘implicit and open-ended contracts’ refers to means of adapting, coordinating, and safeguarding exchanges that are not derived from authority structures or from legal contracts. Complementing this definition, Jones et al. (1997, p.911) define network governance as a type of coordination characterized by informal social systems rather than by bureaucratic structures and formal contractual relationships, which can be seen as a distinct form of coordinating economic activity (Powell, 1990, p.301). It facilitates integrating multiple autonomous, diversely skilled parties under intense time pressure to create complex products or services (Jones et al., 1997, p.921).

Referring to the situation in the Netherlands, the main aspect of a network form of governance is involvement of interdependent actors, both public and private, with divergent goals and perceptions (Bruijn, 2008, p.300). Provan and Kenis (2007, p.231) argue that networks work together to achieve not only their own goals, but also a collective goal. Powell (1990, p.324) emphasizes that the ability to disseminate and interpret new information is one of the key advantages of networks. There are many arguments present for network governance. Networks are, according to Powell (1990, p.304), linked to situations where efficiency and reliability is higher. Entwistle et al. (2007, p.63) state network governance can promise better policy- and strategy-making, more effective or efficient delivery, and reduce the unintended consequences of policies. This is in line with the advantages described by Provan and Kenis (2007, p.229). They state the main network advantages are, inter alia, enhanced learning, more efficient use of resources, increased capacity to plan for and address complex problems, greater competitiveness, and better services for clients and customers. When we

see this in the context of spatial development, clients and customers are of course the residents of a certain area. All together, the basic thrust of networks is, like Powell (1990, p.315) stated, assumed to be the ability to pursue new strategies of innovation through collaboration without abrogating the separate identity and personality of the cooperating partners. Jones et al. (1997, p.926) suggest that network governance provides comparative advantage over other governance when adopted correctly.

Unlike a network form of governance, a hierarchical structure has clear departmental boundaries, clean lines of authority, detailed report mechanisms, and formal decision-making procedures (Powell, 1990, p.303). A key feature of hierarchy is that it requires some form of overt rule-driven design and direction (Thompson, 2003, p.22). Within hierarchies, individual employees operate under a regime of administrative procedures and work roles defined by higher level supervisors, the strength of such an organization is its reliability and accountability (Powell, p.303). Essential for a hierarchical form of governance is that communication between two agents flows in only one direction (Salancik, 1995, p.345). Hierarchy in the public sector can be considered as coordination by administrative means, where it requires political decisions in the first instance, which are then followed up by directive action to implement those decisions (Thompson, 2003, p.23). Theoretically, hierarchies vary much from networks. A hierarchical control of the state differs from networks in at least three different ways (Torfing, 2005, p.309): in terms of relationship between the actors, in terms of decision-making, and in terms of ensuring compliance with collectively negotiated solutions. Entwistle et al. (2007, p.65) state the essence of hierarchies is coordination through the allocation of decision-makers, which promises systematic planning and controlled implementation on the basis of five conditions of perfect administration: a unitary administrative system, uniform rules and objectives, perfect obedience or perfect control, perfect information and communication, and the absence of time pressure.

Much literature considers network governance as the more ideal form of governance (Goldsmith & Eggers, 2004; Entwistle et al., 2007; Jones et al., 1997; Provan & Kenis, 2007). Main advantages of network governance in the public sector are the ability to specialize and innovate, higher speed and flexibility, and the increased reach of their network in terms of finance and connection to customers of governments services (Goldsmith & Eggers, 2004, C.2). Provan and Kenis (2007, p.233) argue that networks in general can produce positive outcomes that would not be possible in a hierarchy. In line with this statement, they state that the presence of flexibility gives networks the main advantage over hierarchies, which can be cumbersome and bureaucratic (2007, p.244). Jones et al. (1997, p.911) state that network governance has advantage over hierarchical governance in adapting, coordinating and safeguarding exchanges. In contrast to hierarchies, network governance is

characterized by informal social systems rather than by bureaucratic structures, so they extend the previous given advantages (1997, p.911). Considering all this, we can state the way involved agents interact with each other, is the main difference between the two forms of governance we are using in this research.

In our research we compare the outcomes in terms of urban structure of a network form and a hierarchical form of governance, and their associated land development strategies. The scenarios in this study are either focused on networks or hierarchies. Entwistle et al. (2007, p.66) state that governments cannot have the best of all worlds, which means for example we cannot have all the benefits from networks and hierarchies together in one governance form. To provide a theoretical illustration Entwistle et al. (2007, p.65-66) give us figure 2.1. In this figure the three different dimensions extending from O represent the so-called ideal types of governance: hierarchy (A), market (B), and network (C). In our research we assume we are near point A, which represents the hierarchical form of governance, or near point C, which represents a network form of governance. The land development strategies in this study are not completely hierarchical, nor networks, because they are examples of planning practice. As is also stated by Entwistle et al. (2007, p.66), in practice, all social structures blend the different forms of governance to some degree.

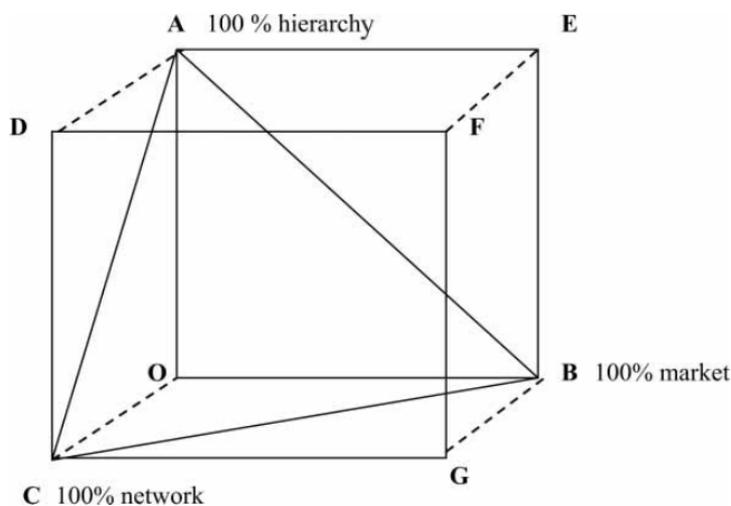


Figure 2.1

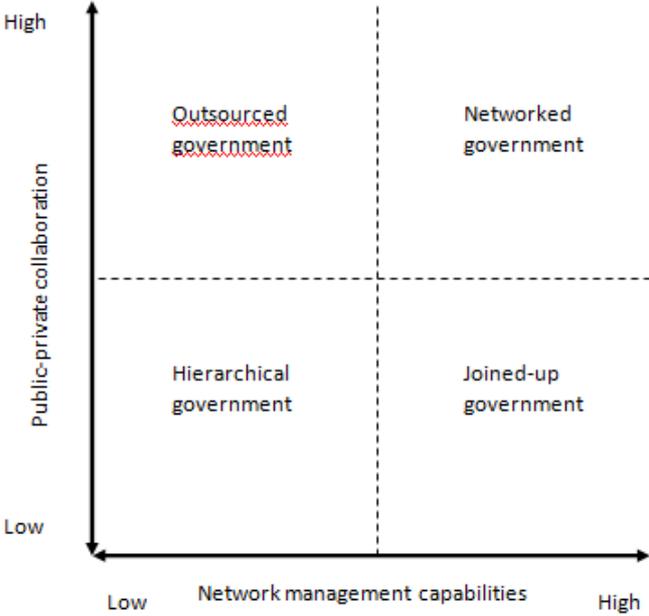
Theoretical illustration of the so-called 'ideal' types of governance according to Entwistle et al.: hierarchy, network and market.

Entwistle et al., 2007, p.66

### 2.1.2 Land development strategies

Goldsmith and Eggers (2004, p.20) link hierarchical- and network forms of governance to different types of land development strategies. As we have prefaced in the project framework, this study links a hierarchical type of governance to the public land development model and a network type of governance to the public-private partnership model, both as described by Samsura et al. (2010, p.568-9). This distinction is made on the basis on Goldsmith and Eggers (2004, p.20), who oppose

hierarchical- and network forms of governance and specifically appoint the presence or absence of public-private partnerships in both governance modes, see figure 2.2. They state network governance combines high levels of public-private collaboration characteristics of third-party government with the robust network management capabilities of joined-up government (2004, p.19).



The land development strategies in this study are based on previous research by Samsura et al. (2010). They describe in their article four possible strategies for municipalities to develop a greenfield location for residential use within the Dutch context. These strategies are displayed in figure 2.3. As we have prefaced earlier, this study will focus on two land development strategies, namely the 'public land development model' and the 'public-private partnership model' to represent hierarchical- and network forms of governance.

<b>Land development strategy</b>	<b>Initial situation on the land market</b>	<b>Acquisition of agricultural land</b>	<b>Servicing and reparcelling the land</b>	<b>Acquisition of building plots</b>
<b>Public land development</b>	Original owners	Municipality acquires all land	Municipality	Private developers buy numerous building plots / End user buys single building plot
<b>Building claim model</b>	Private developers with intentions to build houses	Municipality acquires all land	Municipality	Private developers with building claim buy building plots
<b>Public-private partnership model</b>	Original owners / Private developers with intentions to build houses	Joint-venture company	Joint-venture company	Private developers with building claim buy building plots
<b>Private land development model</b>	Original owners	Private developers / End users	Private developers / End users	End users buy building plots / End users already own building plots

Figure 2.3

Four possible strategies for municipalities to develop a greenfield location for residential use within the Dutch context.

Samsura et al., 2010, p.569

We decided to exclude the ‘building claim’ strategy, because in this study we assume that the farmland is owned by their original owners instead of a private developer with the intention to build houses. Also, we decided to exclude the ‘private land development’ strategy, because municipalities do not often use it for residential development, as it is also stated by Samsura et al. (2010, p.569). Both chosen strategies are part of an active land policy. A main reason for municipalities to adopt an active land policy is the higher amount of influence they can exert on the spatial development process compared to the situation in which they adopt a facilitating land policy (Samsura et al., 2010, p.670). They prefer to adopt an active land policy to make sure that the plan is implemented (Needham, in Samsura et al., 2010, p.568), and to exert more influence on the spatial development process compared to adopting a facilitating land policy. The case of greenfield residential land development is chosen, because the number of stakeholders is much more limited than is the case in brownfield residential land development, and because greenfield development has more influence on urban sprawl.

The public development model:

*“... means that the municipality acquires all the land to be developed, services the land, readjusts parcels into building plots suitable for the desired development and after that releases them to builders/developers and end users.” (Van der Krabben & Needham, in Samsura et al., 2010, p.568)*

The other approach we focus on in this study is the public-private partnership model. In a public-private partnership:

*“... the public and private stakeholders involved establish a joint venture land development company which takes over the role of the municipality in the public development model. This joint venture company will come to an end, as soon as all building plots are sold. The shareholders in this joint venture generally agree not to make any profits, but to accept that only the costs of land development will be covered by the sale of building plots. In turn, the private developers, will have the first right to buy serviced building plots, against prices that may be below market value, depending on the negotiations between the municipality and the private developer. To support the development strategy of the joint venture company, the municipality usually agrees to use its land policy tools, if necessary, including the possibility of a pre-emption right and expropriation powers.” (Samsura et al., 2010, p.568)*

Public-private partnerships can be described as a durable collaboration between public and private actors for development of a public purpose and where risks are shared between these actors. The goal is to achieve something that could not be achieved without these partnerships (Klijn & Teisman, in Klijn & Twist, 2007, p.2). This kind of cooperation is meant to reduce risks and financial burden for each side (Tan et al., 2009, p.964)

Wolting (2006, p.14) defines public-private partnerships in urban development as a cooperative venture where public- and private parties realize a project on the basis of a clear task- and risk allocation, while maintaining their own identity and accountability. He states public-private partnerships in urban development only make sense when both parties attain added value in a financial, spatial and societal way, because cooperation is not free of charge. Actors foresee additional benefits and expect that these will outweigh the cost of cooperation (Klijn & Teisman, 2003, p.137). Added value is attained as e.g. profit, limitation of risks, creativity, knowledge and the final result. Wolting (2006, p.14) describes six characteristics of public-private partnerships in urban development:

- There is a non-optional interaction between public- and private parties
- Costs and risk are shared between both parties
- Cooperation is aimed at synergy in realizing convergent goals
- It has both commercial- and societal characteristics
- Cooperation takes place given that both the identity and accountability of the involved actors will be conserved
- Agreements are fixed in an agreement of civil law

Interestingly, the legally bond networks are partially contradicting the definition of networks given by Jones et al. (1997, p.914) and which is discussed earlier in this chapter. The presence of a legal agreement can presumably be imputed to the preference of the government to coordinate economic activity.

There are three conceptual issues significant for partnership equity, according to Miraftab (2004, p.92): the definition of partners' roles and responsibilities in partnership processes and of what is meant by the public and the private sector; associated action and how people understand and achieve horizontal power relations among partners; and to what extent and how the state should play a mediating role in both enabling and regulating the partnership. These conceptual issues are very important and, according to Miraftab, not regularly satisfied and made clear in the agreement of civil law. We can speak of a definitional ambiguity of public-private partnerships. This leads to unclear horizontal relations and can smudge the distinct areas of different stakeholders.

This described definitional ambiguity and its consequences is also mentioned in Klijn & Teisman (2003, p.137), who describe that partners have difficulties with joint decision-making and organization and tend to revert to traditional forms, by contracting out and separating responsibilities. Klijn & Teisman (2003, p.138) acknowledge decision-making in public-private partnerships can be very complex, because decisions are faced not only with institutional complexity, but also with strategic complexity. Each actor chooses their own strategy, as is also seen in figure 2.4. There is a division between a public- and private domain, which are considered as two ethical systems with different moral syndromes (Klijn & Teisman, 2003, p.142). On one side is the public domain, characterized by the guardian syndrome, on the other side is the private domain, characterized by the commercial syndrome. The guardian syndrome has typical values as avoiding trade and commerce, the absence of a profit motive, an orientation towards continuity, and respecting tradition and hierarchy, where the commercial syndrome has values such as respect for contracts, appreciation of zeal and initiative, and competitiveness (Jacobs, in Klijn & Teisman, 2003, p.142-3; Simon, in Klijn & Teisman, 2003, p.143).

	<b>Public actors</b>	<b>Private actors</b>	<b>Tensions</b>
<b>Core business</b>	Public objectives Political conditions	Realizing profits Financial conditions	Political risks in expectations versus market risks in annual figures
<b>Values</b>	Loyalty Devoted to a self-defined public cause Controllability of process and approach Emphasis on risk avoidance and preventing expectations	Competitive Devoted to consumer preferences Controlled by shareholders on the basis of results Emphasis on market opportunities and risk and innovations	Government reluctant in process versus private party reluctant with knowledge Government reluctant in result versus private parties reluctant with their own effort
<b>Strategies</b>	Search for ways to guarantee substantive influence Minimizing expectations and insecurity of implementation costs	Search for certainties to produce and/or obtain a contract Minimizing political risks and organizational costs as a consequence of public viscosity	Confrontation leads to a mutual locking-up of agreements and thus to tried and tested types of cooperation
<b>Consequences for public- private partnerships</b>	Emphasis on limitation of risks and on agreements that lead to agreed procedures and public sector dominance	Emphasis on certainty of market share and profit which leads to an expectant attitude and limited investments until the moment when the contract is acquired	The creation of added value through cross-border interaction is not realized

Figure 2.4

Public- and private actors both have different values and strategies. This leads to strategic complexity in decision-making in public-private partnerships.

Klein & Teisman, 2003, p.143

One of the most important value differences between public- and private actors is the public actors' devotion to a self-defined public cause versus the private actors' devotion to consumer preferences. We assume the public actor wants to keep development concentrated. The consumer preferences our private actors are devoted to, are considered a main preference for suburban living (Kährik & Leetmaa, 2009; Van Dam et al., 2002; Visscher, 2011), with low-rise housing, private gardens and nice natural surroundings away from polluted environment, but close to jobs, services, urban social and technical infrastructure (Kährik & Leetmaa, 2009, p.15). Various reports suggest – Van Dam et al.

(2002, p.467) concluded the same interest and demand in their own survey – the existence of a significant demand for rural living in the Netherlands, where an increasing consumer preference for ‘greener living’ is observed (Van Dam et al., 2002, p.461).

Wolting (2006, p.96) states that when initiating a public-private partnership, it is for both the public- and the private actor important to provide insights in either their own risks, costs and benefits, but also the risks, costs and benefits of their potential partner. It is important to distribute the costs, risks and say between the parties in the public-private partnership, which is displayed in figure 2.5. Wolting (2006, p.96) states that the distributions of costs, risks and say are in fact the communicating pillars in the partnership. A developer, for example, could not expect to have a lot of say, without taking a greater part in risks and costs of the project. Therefore, this distribution is a main subject in the negotiation linked to the public-private partnership model.

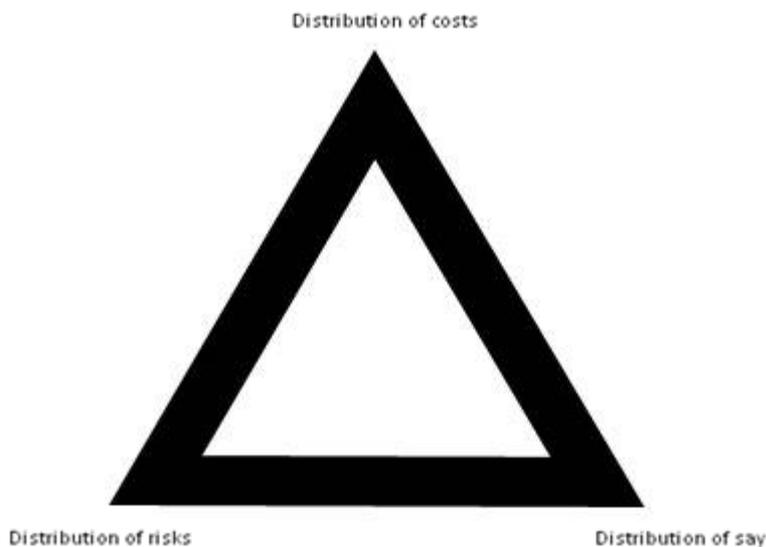


Figure 2.5

It is important for the public-private partnership to have an agreement on how to distribute the costs, risks and say between the actors in the partnership.

Wolting, 2006, p.96

### 2.1.3 Urban sprawl

In our project framework and research goal- and question urban sprawl and compact development. We have said compact development is defined in this study as a pure spatial observed phenomenon. It is considered as the opposite of urban sprawl, which means the less sprawl is observed, the more compact we consider the spatial development. Following Brueckner (2000, p.161), we define urban sprawl as an excessive spatial growth of cities. Excessive is the key word here, because cities have to grow spatially to accommodate an expanding population. When urban sprawl is observed, the claim is that too much spatial growth occurs. Spatial growth by itself is therefore not always a valid indicator for the presence of urban sprawl. Excessive urban expansion is unwanted, because it means overly long commutes, which generate traffic congestion while contributing to air pollution. It is also thought to reduce the incentive for redevelopment of land closer to city centers, contributing to the

decay of downtown areas. Also, by spreading people out, low-density suburban development may reduce social interaction, weakening the bonds that underpin a healthy society (Brueckner, 2000, p.160). These disadvantages of urban sprawl, combined with earlier studies and recommendations regarding this subject (Burchell et al., 2002; Grabkowski, n.d.; Johnson, 2001), shows us compact development should be and still is a desired goal in spatial planning.

Brueckner (2000) links sprawl to the emergence of suburban growth and development. A type of growth that suits the consumer preferences we have discussed earlier, namely the typical preferences observed for suburban living (Kährik & Leetmaa, 2009; Van Dam et al., 2002; Visscher, 2011).

## **2.2 Theoretical framework**

Both types of governance will be represented by a land development strategy that is typical for either a hierarchical- or a network form of governance. The public land development model described earlier will represent a hierarchical form of governance. The public land development model has clear departmental boundaries, clean lines of authority, detailed report mechanisms, and formal decision-making procedures. It is visible in figure 2.3 that in the public land development model, the municipality is the only actor that has decision-making abilities in the process of acquiring and servicing the land. Because the municipality is a public actor and can decide by itself, departmental boundaries, clean lines of authority, detailed report mechanisms and formal decision-making procedures are all present in this case. An overt rule-driven design and direction is present, because we have defined a clear goal for the municipality, namely compact development to prevent urban sprawl. In the public land development model communication flows in only one direction, because there is no negotiation phase in this specific land development strategy. Coordination requires political decisions in the first instance, and is followed up by directive action to implement those decisions. Relations between the public- and private actors in the public land development model are typically vertical. Looking at figure 2.4, the public actors' core business will be public objectives. They will be devoted to a self-defined public cause and want control, process and approach and will search for ways to guarantee substantive influence in the decision-making process.

Opposed to the public land development model, the public-private partnership model will represent a network form of governance. Goldsmith and Eggers (2004, p.20) showed that a network form of governance combines with high levels of public-private collaboration. The public-private partnerships in this study consist of agents that are stable, interdependent, but operationally autonomous and focused on joint problem solving. This means the agents all have their own utility function and decision-making abilities, but are interdependent for creating any spatial development. The public-

and private actors interact with one another through negotiations which take place within a regulative framework and which contribute to the production of a public purpose, namely the development of residential areas. The relations between the public- and private actor are horizontal in the public-private partnership model, which means no agent has significant more power than others. Looking at figure 2.4, private actors' core business will be realizing profits and they are devoted to consumer preferences, while searching for certainties to produce and obtain a contract. Given the differences in the process of both land development models and the differences in action between the public and private actors, a different outcome in the structure of spatial development is considered a possibility.

A network form of governance uses negotiation as logic of action (Fürst et al., 2002, p.5). The negotiation phase of the public-private partnership model in this study is inspired on a study by Arentze and Timmermans (2010). Essential elements for a negotiation phase that are present in our model is the ability of all actors to state their preferences according to their own assessment in a given situation and all parties have the opportunity to decide for themselves whether or not they want to participate in the partnership. The public- and private actors in the public-private partnership model form a joint venture, as we can see in figure 2.3, which means they both have decision-making abilities in the processes of acquiring and servicing the land. In the negotiation phase the municipality first indicates locations available for development. The municipality therefore takes the initiative for starting a public-private partnership. Given the available locations developers can construct a proposal for developing a site. The planner decides which proposal suits their preferences the most and approves it. Whether one proposal is approved or not is no more than a formality, as the municipality indicated locations available for development prior to the plan-formation process (Arentze & Timmermans, 2010, p.394).

### **3 Methodology**

This study will be using the method of agent-based modeling. Agent-based models are computer-based programs that can be used to study the global consequences of local interactions (Millner & Page, in Zellner et al., 2010, p.410) Agent-based modeling is a tool for empirical research, which offers a natural environment for the study of connectionist phenomena (Epstein, 1999, p.41). In agent-based modeling, a system is modeled as a collection of autonomous decision-making entities called agents. The method consists of system of agents and the relationship between them (Bonabeau, 2002, p.7280). It is a method that is applied multiple times in studies focused on land-use change and policy (e.g. Brown et al., 2004; Kii and Doi, 2005; Polhill et al, 2001; Valbuena et al., 2010; Zellner et al., 2010).

Agent-based models have certain benefits over other model techniques. An agent-based model can capture emergent phenomena, provide a natural description of a system and is flexible. Due to its focus on the participating actors in a process, it enables one to deal with more complex individual behavior, including learning and adaptation (Bonabeau, 2002, p.7280; Epstein, 1999, p.47). It is a useful method when the interactions between the agents are complex, nonlinear, discontinuous, or discrete. It is useful when space is crucial and the agents' positions are not fixed, when the population is potentially heterogeneous, and when agents exhibit complex behavior, including learning and adaptation (Bonabeau, 2002, p.7287). Useful is the possibility to integrate the social, economic and environmental aspects that drive land-use and land-cover processes and to help us to understand the dynamics of integrated urban-environment systems (Zellner et al., 2010, p.410). Also relevant is the potential of agent-based models to bridge different approaches, which is a key challenge for regional studies (Levy, 2012, p.4).

Agent-based modeling is a bottom-up approach. In agent-based modeling we specify which agents are involved, how each agent behaves in response to the set of conditions they will face, and how agents' actions are coordinated with one another (Levy, 2012, p.4). The agents are situated in the environment. Agents observe this environment in a certain way act upon it (Ligtenberg et al., 2001, 22).

Agent-based modeling is not a method without challenges and issues. The ideas behind the method are in contrast with the ideas behind classical emergentism. While classical emergentism holds that the parts cannot explain the whole, agent-based modeling constitutes the whole explanation of the sufficient parts. The method tries to demystify the gap between micro and macro by identifying microspecifications that are sufficient to generate – robustly and replicably – the macro (Epstein,

1999, p.55). Challenges for agent-based modeling are in the introduction of agent technology – agents sometimes behave in a way that is still poorly understood with potentially irrational behavior, subjective choices and complex psychology – and in the tendency to use it as a predicting tool rather than a learning tool (Bonabeau, 2002, 7284-7). The model will be computer simulated. By computer simulating a model, rule makers are not stuck with an intuitive argument, and one that is poor in detail, judging market interaction by only the measure of competition (Bonabeau, 2002, p.7280). The model can therefore provide results that are contra-intuitive.

Our model will be simulated using a program called NetLogo. Netlogo is a multi-agent programmable modeling environment for simulating natural and social phenomena and is used by thousands of users worldwide (Wilensky, 1999). Due to time limitations this study will not include an expert validation for our model. An expert validation is used by e.g. Valbuena et al. (2010) and is useful to substantiate results. However, because the assumptions made in our model are based on a thorough literature review, we will still consider it as a valid approach.

## 4 Model

In the theoretical framework we have discussed the decision to focus this study on the public land development model and the public-private partnership model as discussed by Samsura et al. (2010), both displayed in figure 4.1. The two strategies represent two different processes of developing building land. In the public land development model, the municipality (the public actor) is the only decision-making actor in the process of defining a strategy, acquiring and servicing the land. The developer, the private actor, is making decisions on whether or not to acquire serviced building plots. In the public-private partnership model both the municipality and the private developers have decision-making abilities in the entire process. This means both public- and private actors are involved from the beginning of the process of land development. In this chapter we discuss the agent-based model designed for this study step by step for both land development strategies. The model will always present a grid of 31x31 cells, which are all potential building plots not owned by either the municipality or a private developer. All cells have a land price, which is calculated using a logarithmic formula:

$$P_{land} = 0.5 \cdot \ln (Acc)$$

A logarithmic formula is chosen to create less marginal differences when the variable Accessibility (*Acc*) is higher. This means the marginal advantages and disadvantages will be smaller when a cell is further away from the center. Accessibility of a cell is calculated from the distance to the center of a specific cell. The larger the distance between a specific cell and the center patch, the lower is the accessibility of that cell. The cells also have fixed service costs, which are assigned randomly for each cell. The utility functions of the municipality and the private developers that are discussed in this chapter are routinely used utility functions in literature, e.g. Filatova et al. (2011).

Land development strategy	Initial situation on the land market	Acquisition of agricultural land	Servicing and reparablelling the land	Acquisition of building plots
<b>Public land development</b>	Original owners	Municipality acquires all land	Municipality	Private developers buy numerous building plots
<b>Public-private partnership model</b>	Original owners	Joint-venture company	Joint-venture company	Private developers with building claim buy building plots

Figure 4.1

This study focuses on two land development strategies, namely the public land development model and the public-private partnership model. Both models have a different process of developing building land.

Samsura et al., 2010, p.569

#### 4.1 Public land development model

In the public land development model the municipality is the only decision-making actor in the process of acquiring and servicing the land and has no need to negotiate, because we assume all original landowners sell immediately. This assumption is, of course, a simplification of the real process, where the acquisition of land could be harder. The municipality is devoted to a self-defined cause, namely maximum concentration of development, to prevent the emergence of urban sprawl. Variable of influence is the accessibility of the cell ( $Acc$ ), which we have discussed earlier in this chapter. When the municipality chooses a plot of land to acquire and develop, it calculates the utility of each potential building plot using a logarithmic utility function for the same reasons as in the calculation of land price. In this function  $\alpha$  represents a changeable actor-specific preference weight of the accessibility variable:

$$U = \alpha \cdot \ln (Acc)$$

After acquiring the desired plot the land price will be paid the acquired plot will be serviced. Servicing of land will be done by the municipality and is a formality in our agent-based model, which means the land is directly serviced and the random service costs of the specific acquired cell will be paid.

The final step in the public land development model is selling the land to private developers. Developers obviously are not compelled to buy the building plots the municipality serviced, so they will calculate their utility for the desired plot first. Private developers are devoted to consumer preferences, which are discussed in the theory chapter. Because of this devotion to consumer preferences they do not only care about the accessibility of a certain plot, but also about the amount

of open space (*Env*) around the building plots, which is an amount dependent on the number of developed neighbors a specific cell has. The utility function of the private developers is then the following, where  $\beta$  and  $\gamma$  are the actor-specific preference weights for accessibility and open space:

$$U = \beta \cdot \ln (Acc) + \gamma \cdot \ln (Env)$$

In fact, the developer is facing a trade-off between open space and closeness to jobs, services, urban social and technical infrastructure. Not all developers will have the same utility, because the preference weights for accessibility and open space for each developer are randomly drawn from a normal distribution, which makes every developer heterogeneous in terms of its preferences. When the utility of the offered building plot is higher than a certain threshold, the private developer will form a bid, which is directly derived from the utility of the developer for this specific cell. Because the municipality already has the intention to sell the building plot for final development, it will always accept the highest bid if there are any bids at all. After the municipality sells the building plot, the developer with the highest bid will develop residential housing. Building of a residential plot changes the environment, and so the variables that describe the characteristics of each cell and the utility functions are recalculated.

#### **4.2 Public-private partnership model**

In the public-private partnership model both the municipality and the private developers have decision-making abilities in the process of acquiring and servicing the land. We have seen in our theoretical framework that the municipality and the private actor have different preferences and therefore need to negotiate if a public-private partnership is the intended land development strategy. First, the municipality takes the initiative for starting a public-private partnership. The municipality will designate a certain percentage of the cells in the grid to be potentially developed by a joint-venture company that consists of the municipality and one private developer. The private developers in the model will prepare a bid for the potential building plot with the highest utility. The utility function for the developer is the same as in the public land development model and is the following:

$$U = \beta \cdot \ln (Acc) + \gamma \cdot \ln (Env)$$

After choosing the potential building plot, each developer will make a bid for developing a plot, aiming to participate in the joint-venture company. A bid will consist of a location, a distribution of risks and distribution of costs in the public-private partnership. The location of the plot will be the location with the highest utility for the developer and the distribution of costs and risks will both be

defined random uniform for simplicity reasons. The municipality will judge these bids using the following utility function:

$$U = \delta \cdot Loc + \varepsilon \cdot (1 - Dis_{costs}) + \zeta \cdot (1 - Dis_{risks})$$

In this utility function  $\delta$ ,  $\varepsilon$  and  $\zeta$  are the actor-specific weights for the key features of the proposal. The distribution of costs and risks is subtracted from 1, because the developers propose the percentages they want to participate with themselves. A subtraction from 1 gives the percentages the municipality therefore has to participate with in the joint-venture company and which they judge. The value of the location is calculated with the utility function of the municipality, which is the same as in the public land development model:

$$U = \alpha \cdot \ln (Acc)$$

After the municipality defined the best proposal, it will form a joint-venture company with the concerned developer. As a joint-venture company they will acquire and service the desired plot and split the costs like agreed in the initial proposal. After servicing the plot, the developer will always develop residential housing, because they proposed to do so in the first place. Then the joint-venture will split up and the utility functions will be recalculated for each cell.

## 5 Analysis

### 5.1 Parameters

The agent-based model in this study has multiple parameters. Parameters in the model are the municipality's actor-specific preference weight for accessibility ( $\alpha$ ), the developers' actor-specific preference weight for accessibility ( $\beta$ ) and open space ( $\gamma$ ) and the municipality's preference weights for each of the three points in the public-private triangle: location of the plan ( $\delta$ ), distribution of costs ( $\epsilon$ ) and distribution of risks ( $\zeta$ ). As discussed in the theory and model chapters, two land development strategies will be modeled in this study, namely the public land development model and the public-private partnership model, both as described by Samsura et al. (2010). Keep in mind that variables  $\delta$ ,  $\epsilon$  and  $\zeta$  are not relevant in the public land development model, as this land development strategy does not have a negotiation phase. The parameter values that are used in our simulations are displayed in figure 5.1. When a value is higher it has more weight in the utility functions.

### 5.2 Output measures

This study focuses primarily on the effect of a network form of governance on the compactness and structure of spatial development. To create a useful measure of urban sprawl, we will use two numeric outputs of our agent-based model. The first numeric output is the measurement of development beyond a 15 cell radius of the center of the grid (DEV+15). This value is used in a study by Rand et al. (2003), who used the size of the largest cluster and development beyond a 30 cell radius of the center to measure the amount of sprawl in their agent-based model. By measuring the development beyond a certain radius of the center we will get a good first impression of how much leapfrogging or scattered development is seen in the model. The size of the largest cluster will not be measured in our model, because the shape of our output is not suitable to define and measure this value. The second numeric output is a derivative from the DEV+15 output, namely DEV+15 divided by the amount of buildings build (D/B). This number is always between 0 and 1. As discussed in the theory chapter, a larger city is not per se an indicator of the amount of sprawl, because spatial growth of a city is inevitable with a growing population. Urban sprawl is defined in this study as excessive spatial growth, so a ratio between the structure of spatial development and the amount of buildings in the city gives more valid results.

All measures in this analysis were done after 500 timesteps in our model. The model is designed to run either a complete public land development process or a public-private partnership process every timestep to create comparable results between the two land development strategies. This simplification is made, although it is possible that in practice one land development strategy may

take more time than the other. To create reliable results the output measures displayed are an average of 20 simulation runs of the model. By running the model multiple times, exceptions are of less influence in the final results.

### 5.3 Results

Land development strategy	$\alpha$	$\beta$	$\gamma$	$\delta$	$\epsilon$	$\zeta$	Threshold	Developable cells	DEV+15	D/B-ratio
PLD	1.00	0.50	0.50	-	-	-	Low	-	0	0
PLD	1.00	0.50	0.50	-	-	-	Average	-	0	0
PLD	1.00	0.50	0.50	-	-	-	High	-	0	0
PLD	1.00	0.25	0.75	-	-	-	High	-	0	0
PLD	1.00	0.75	0.25	-	-	-	High	-	0	0
PPP	1.00	0.50	0.50	0.33	0.33	0.33	-	10%	143	0.285
PPP	1.00	0.50	0.50	0.33	0.33	0.33	-	50%	141	0.283
PPP	1.00	0.50	0.50	0.60	0.15	0.15	-	10%	141	0.282
PPP	1.00	0.50	0.50	0.15	0.60	0.15	-	10%	146	0.292
PPP	1.00	0.75	0.50	0.33	0.33	0.33	-	10%	27	0.054
PPP	1.00	0.25	0.75	0.33	0.33	0.33	-	10%	263	0.526

Figure 5.1  
 The results of multiple simulations of the agent-based model. Visible is the minimized difference of the negotiation phase and the significant difference in spatial structure when preferences of one of the decision-making actors is changed.

When analyzing all results, it is, first of all, interesting to observe that the focus of the municipality in the negotiation phase does not seem to make a significant difference in the spatial structure, according to the DEV+15 and D/B-ratio displayed in figure 5.1. The power of the initial preferences for location of a new project appears to be too big to overrule a certain focus on either location, distribution of costs and distribution of risks in the negotiation phase of the process. Outcomes indicate a slight difference in the amount of sprawl, but not enough to appoint a significant difference in spatial structure. It appears that the construction of the negotiation phase in the public-private partnership model is solid and is not likely to cause significant differences in spatial structure. It seems therefore that the price of the potential building plot is not likely to influence the process of decision-making. The price of land is directly related to the utility function in the negotiation phase in our model. It appears that the price of the land with the maximum utility is subordinate to the

potential of the plot itself. However, it is important to be careful with possible conclusions, as the land price function is heavily simplified in the model. Also interesting is the effect of the initial freedom the private developers have to propose a location for development in the public-private partnership model. Also, when the amount of developable cells is significantly higher, it appears that almost the same amount of sprawl is observed. It appears that the freedom of location choice does not influence the ability of the private developers to find a most suitable spot for development, although we have to keep in mind that the developable cells are assigned randomly. They could be assigned following a certain strategy, so the outcomes could be different. The outcomes of all simulations are visible in figure 5.1.

When running the model with the land development strategy of the public land development model, the municipality is the only decision-making actor in the process of acquiring the land. This means the location of the potential building plot can be chosen in line with the self-defined public goal, which we assume to be maximum concentration of development to prevent urban sprawl. In the utility function for the municipality given in the model description, we therefore have seen accessibility is the only aspect the municipality is interested in when choosing a potential building plot. Figure 5.2 displays the results of the public land development model for one run of the model. In the figure it appears that in this situation the development is very concentrated. The DEV+15 is 0 and the D/B-ratio is 0 as well, which denotes an absence of urban sprawl. Because the municipality is the only decision-making actor in the public land development this result is not unexpected, as they have the opportunity to maximize results holding on to their initial strategy of concentrating development when no other actor is involved in the decision-making process of acquiring the land.

Although the municipality can choose the location of the potential building plot completely in line with their self-defined public goal, it is important to take note of the threshold of the private developers. In the public land development model the private developers are not obliged to buy the serviced building plots from the municipality. This means there is a possibility in the public land development model that the municipality is unable to sell a serviced plot. This could, for example, have negative financial consequences, as the municipality may miss certain income from selling the land. Figure 5.1 displays the results of the public land development model for one run of the model where the threshold for the private developers is low, while figure 5.3 displays the results of the public land development model for one run of the model where the threshold for the private developers is high. Developed plots are black in the model, while undeveloped, serviced plots are yellow. It shows that the municipality was unable to sell multiple plots in the case where the threshold for the private developers was high. The more the preferences of the private developers were focused on the amount of open space around a potential building plot, the more undeveloped

plots are visible. The threshold of the private developers does not seem to have influence on the amount of urban sprawl that is observed. The DEV+15 is 0 and the D/B-ratio is 0 as well. It seems that the municipality buys the same building plots in all public land development model scenarios, because the municipality does not adapt its utility function and preferences to meet the preferences of the private developers that eventually have to buy a serviced plot. However, it is a possibility that in practice the municipality considers this factor and adapts its original preferences to it. According to our model it appears that sprawl is kept to a minimum at the expense of not selling every possible building plot.

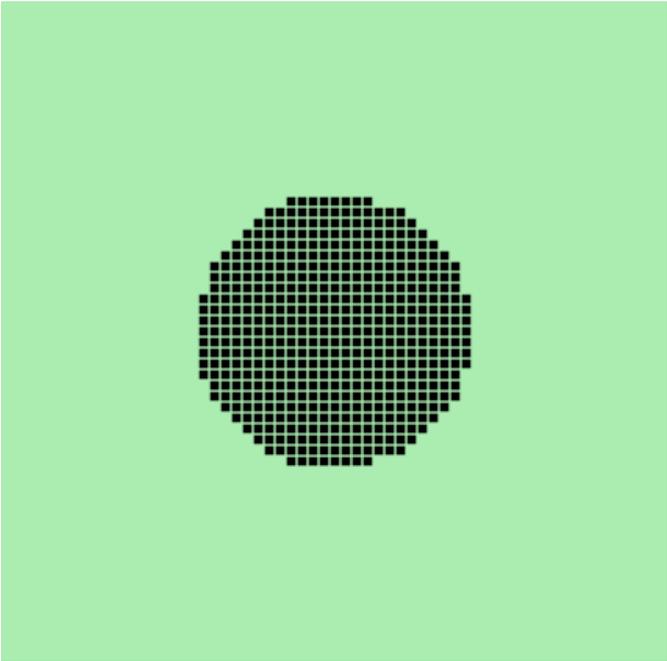


Figure 5.2  
Public land development model  
 $\alpha$  = 1.00  
 $\beta$  = 0.50  
 $\gamma$  = 0.50  
Threshold = Low  
DEV+15 = 0  
D/B = 0

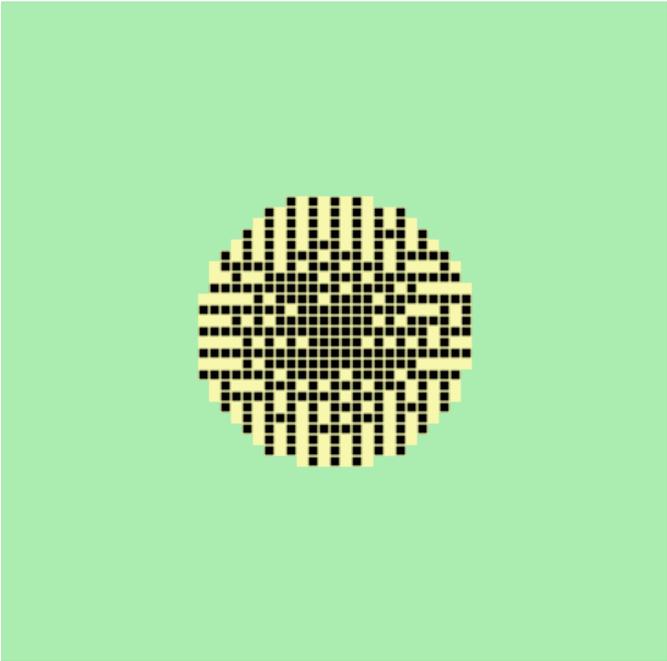


Figure 5.3  
Public land development model  
 $\alpha$  = 1.00  
 $\beta$  = 0.50  
 $\gamma$  = 0.50  
Threshold = High  
DEV+15 = 0  
D/B = 0

Interesting is the difference that can be observed when running a simulation with the other land development strategy, the public-private partnership model. Main differences between the public land development model and the public-private partnership model are the decision-making abilities of the private developers in acquiring and servicing the land, and the presence of a negotiation phase. According to the model, it appears that this differences lead to a significantly different spatial structure and the presence of more urban sprawl, as can be seen in figure 5.3. One main cause for the presence of more urban sprawl could be the presence of a private developer in the decision-making process. If we assume that consumers value suburban living and therefore open space substantially, then the presence of a private developer, which is devoted to consumer preferences, in the decision-making process is likely to create excessive spatial growth.

The amount of sprawl that can be observed with our model output differs significantly when the preferences of the private developers shift more to either accessibility or open space. When the private developers shift their preferences more to accessibility of the project, development appears to shift more to the center and less sprawl can be observed, which is displayed in figure 5.4. Urban sprawl seems to be less than a quarter of the urban sprawl observed in the public-private partnership model in figure 5.3. It is not an unexpected result, as the preferences of the private developers are more similar to the preferences of the municipality in this case. When the private developers shift their preferences more to open space – a preference that could be linked to a more rural location of the intended project – it appears that more sprawl could be observed, which is visible in figure 5.5. The output of the model indicates significantly more sprawl than the latter case.

With these results it is not possible to completely confirm or debunk Powell's statement that networks – in this study linked to the public-private partnership model – are linked to situations where efficiency and reliability is higher, because more output and more variables in the negotiation phase would be needed. The model does not include a ratio between costs, time and results to give a plain indication of the efficiency of networks compared to the public land development model. Reliability of the public-private partnership model is higher in the context of actual developing the intended building plot. In the public land development model the municipality is not sure whether they can sell the plot or not, while in the public-private partnership model the developer always develops, because otherwise they would not propose to develop that plot earlier. We can say that it seems that costs and risks are split in the public-private partnership model, for the cost of handing in some say in the negotiation by the municipality. It appears that basically a trade-off has to be made between the three corners of the public-private triangle discussed in the theory section. A trade-off that could lead to less compact development and less devotion to the original plan of the

municipality when the location preferences of the municipality and the private developer in the joint venture company differ significantly.

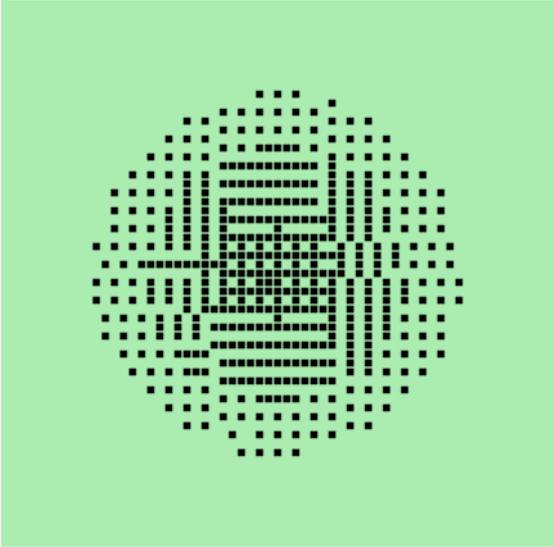


Figure 5.4  
Public-private partnership model

$\alpha$	= 1.00
$\beta$	= 0.50
$\gamma$	= 0.50
$\delta$	= 0.33
$\epsilon$	= 0.33
$\zeta$	= 0.33
DEV+15	= 143
D/B	= 0.285

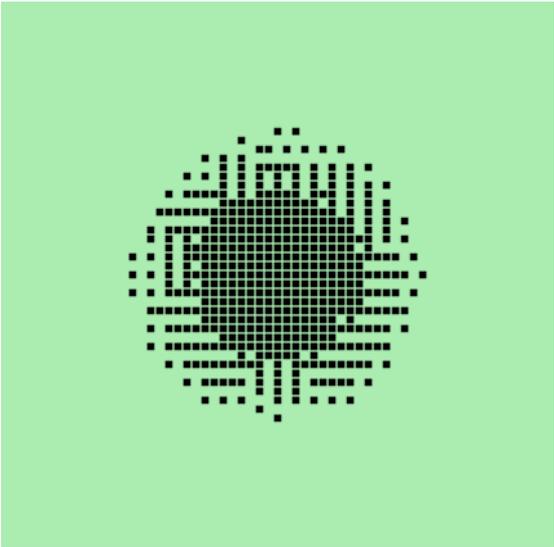


Figure 5.5  
Public-private partnership model

$\alpha$	= 1.00
$\beta$	= 0.75
$\gamma$	= 0.25
$\delta$	= 0.33
$\epsilon$	= 0.33
$\zeta$	= 0.33
DEV+15	= 27
D/B	= 0.054

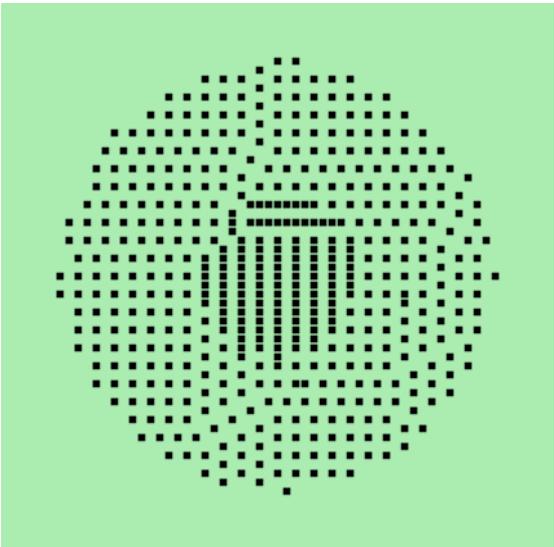


Figure 5.6  
Public-private partnership model

$\alpha$	= 1.00
$\beta$	= 0.25
$\gamma$	= 0.75
$\delta$	= 0.33
$\epsilon$	= 0.33
$\zeta$	= 0.33
DEV+15	= 263
D/B	= 0.526

## 6 Conclusion and recommendations

### 6.1 Conclusion

In this dissertation we have described an agent-based model for simulating urban land development in a context of hierarchical and network forms of governance. To simulate the change in governance observed in the last few decades, we used different land development models suitable for the Dutch context, as they are described in existing literature. In the model it was possible to simulate the development of a city with different types of governance and with different preferences for land development for the public and private actors active in the model. In our model the public-private partnership model matches the description of networks and the public land development model matches the description of hierarchies as they are described in the theory section

Our model provided results with regard to the effects of governance types on the structure spatial development. Less compact development and more urban sprawl could be observed when the model was simulated with the public-private partnership model compared to the public land development model. The main cause of the increase of sprawl seems to be the difference in preferences for the location of a potential project. The municipality and private developers, as public and private actors, have adopted a different core business, values and strategy, because they both are devoted to different goals. While the municipality is devoted to a self-devoted public cause, namely concentration of development, the private actors are devoted to consumer preferences, which we assume to be mainly a preference for suburban living. It seems that the spatial structure of the public-private partnership model is more suitable for serving consumer preferences, which could be expected when a private developer is involved in the decision-making process. In this context we could state that it appears that a network form of governance and the associated land development strategy can promise better policy- and strategy making, and more effective and efficient delivery. However, when this statement by Entwistle et al. (2007, p.63) is put in the context of the initial strategy of the municipality, it appears that they have to pay a price for the financial- and risk-related benefits of a public-private partnership model.

According to the model it appears that the negotiation phase on itself is solid and does therefore not particularly lead to significantly different outcomes when the focus of the negotiation changes. However, we have to keep in mind that although the distribution of costs is linked to the land price function in our model, links to other spatial features and preferences are not present. The distribution of costs and risks is assigned randomly per bid in our model and therefore conclusions regarding the negotiation phase should be interpreted carefully. However, it is interesting that the choice to adopt the public-private partnership model appears to lead to outcomes in terms of spatial

structure that are mainly caused by the prime differences between public and private actors and not by the logic of action of networks and public-private partnerships itself, namely the presence of a negotiation phase. In other words, the logic of action does not seem to create the difference in outcome between the public land development model and the public-private partnership model, while the prime differences do.

In this study we wanted to answer the following research question:

*To what extent does a network form of governance and the associated land development strategies lead to less compact development, as compared to a hierarchical form of governance?*

According to the output of our model it appears that a public-private partnership model, and therefore a network form of governance, may lead to less compact spatial development in the urban area. Considering the existing theories of network governance, where you will have advantages and disadvantages linked to this governance type, it is not an unexpected results. A main disadvantage for the municipality is the need to compromise the potential financial and risk-related benefits from adopting such a land development strategy. It is very likely that the need to compromise is present, because the public and private actors have adopted a different core business, values and strategies and therefore have a different point of view when considering participation in a public-private partnership. It is likely that a network form of governance will make the development more efficient when the public and private actors in the joint venture company of the public-private partnership have adopted the same preferences, but this is a rare proviso. We can therefore conclude that a network form of governance seems to lead to less compact development in most of the cases. We can also conclude that the disadvantage of less compact development and less devotion to the self-defined public cause is in most cases compromised with financial and risk-related benefits of a public-private partnership. It seems that networks are able to provide benefits for the public actor. However, these benefits are not related to spatial structure, but to other aspects of governance.

## **6.2 Limitations and further research**

The model in this study has given us insights related to the effects of different forms of governance and different land development strategies on the structure of spatial development in the urban area. Expanding the relatively simple model in this study will increase the credibility and usefulness of the outcomes for planners, developers and researchers. The model could be expanded by linking content of the bid of the private developer in the public-private partnership model to spatial features. Also,

the possibility that the municipality adapts to possible inability to sell by adopting other preferences could be included in the model. Besides that, several other problems remain for future research.

The model uses a buying-and-selling construction in both the public land development model and the public-private partnership model. The budget of the agents in the model fluctuates, because acquiring, servicing and selling the land affects this budget. A focus on the distribution of costs in the negotiation phase of the public-private partnership model could influence the results in this budget, but with the original output of the model it is not possible to have a good view on this. One of the reasons to adopt a public-private partnership strategy could be the financial benefits for the municipality (Pagdadis et al., in Krenn, 2010, p.9-10). We have seen the public actor usually takes the initiative for such partnerships, because they believe the benefits outweigh the costs of cooperating in such a network. There could be an increase of financial range for the public actor in the public-private partnership. Our model does not provide the output to give a good view on this, but it could be a relevant subject for future studies if such an output could be developed and optimized. This is related with the finance-related aspects in our model. The formula with the most influence is the calculation of the land price, which is heavily simplified in our model and only dependent of the accessibility of the plot. As a better finance-related perspective could improve results, these aspects could be optimized and be of more of an influence in the decision-making of actors. Further research can expand the model by creating a more complex function of land price or using a GIS map of an actual case to create more credible results. With better information about land prices and service costs for the case of focus in future research, the model will provide better results. The model can also be expanded by taking into account more minor expenses than acquiring and servicing the land. Also transaction costs are likely to be higher in the public-private partnership model compared to the public land development model. Including these aspects would create a more realistic display of the possible financial benefits in public-private partnerships.

Spatial development in the urban area could be expanded by using other sorts of development besides residential development, where this study focused on. A normal city consists of more than residential development and consumers may be interested in other aspects than accessibility and open space, which would expand the used utility function. An earlier research by Rand et al. (2003) included for example service centers in the process of development. The availability of multiple service centers, dependent on the amount of households in the city, influences the ratings of accessibility and therefore could change the shape of spatial development. Also other commercial development and industry could influence the preferences of the active agents in our model. The shape of the model output would be more realistic when a more precise urban development strategy is being used. Also, expert validation would make the model more valid and reliable as a whole. Due

to limited time to perform this study, expert validation was not a possibility. When expert validating - the model, the model could be more suitable for actual situations and display a better land development process. Therefore, the output of our model would be more valid and reliable.

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