

HOW TO MAKE DEVELOPMENT PLANS SUITABLE FOR VOLATILE CONTEXTS

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Abstract

Development plans are central tools in spatial planning practice. They create a vision of how places should develop and prescribe how desired patterns of development will be realized. However, development plans are increasingly regarded as inflexible and even rigid when confronted by changes in their context. Conceptualizing urban districts in terms of Complex Adaptive Systems (CAS), this paper identifies ways in which more flexible development plans can be designed. This is investigated through a case study of a development plan for Blauwestad in the Netherlands, which enabled sources of rigidity to be analysed. The paper concludes with the view that from a CAS perspective, development plans are part of the structures necessary to facilitate self-organization and if designed with certain principles in mind, can play a key role in assisting the endogenous evolution of spatial developments.

Keywords: adaptive capacity, complex adaptive systems, rigidity, development plan, Blauwestad

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1 Introduction

Spatial planning practices typically involve formulating plans that embody normative / ideal futures and ways of attaining them (De Roo, 2010). Development plans are a central tool of such practices. Produced by local and regional authorities, these official documents guide and regulate land use change at a strategic level (Healey & Shaw, 1993; Kaiser & Godschalk, 1995). Development plans must be robust to engender the levels of certainty necessary to mobilize development actors such as landowners, project developers and citizens, and stimulate the requisite investments (Neuman, 1998). However, the underlying drivers of spatial development, such as technological innovation, socioeconomic changes and lifestyle trends, and also local demands and capacities, frequently transform spatial configurations more quickly than development plans assume. Such changes are difficult to predict and account for in the design of development plans, revealing the volatile context in which plan-making and implementation occur. Development plans have thus been criticized for exhibiting rigidity in their lifetimes and are said to offer limited utility in instances where there is a high degree of uncertainty (see e.g. Booth, 1996; Staley & Cleays, 2005; Larsson, 2006).

This paper draws on notions of Complex Adaptive Systems (CAS) from Complexity Science to explore how development plans can be designed to be sufficiently robust to provide the certainty necessary to stimulate investment, while remaining sufficiently flexible to respond to changes in the drivers of spatial development which arise during a development plan's lifetime. Casting an urban area as a CAS and the directly and indirectly involved actors as its agents enables spatial planners to explore and recognize the relationship between urban areas and their contexts, with a CAS approach implying change through interaction with a dynamic environment. Viewed in this way, the problem with rigid development plans is one of preventing CAS evolution. We identify a number of ways to resolve this issue, exploring some of the tensions which can arise if the CAS approach is promulgated further and leads to significant changes in the requirements for designing development plans. Although the production of development plans include various dimensions (Conroy & Berke, 2004), we concentrate on the visionary product – the design – as an effective instrument to stimulate urban change (Neuman, 1998). We focus on district-level development plans (5–15 years) because they incorporate the challenges of the variety of actors involved owing to their size, and a high level of uncertainty owing to their life spans, while often incorporating concrete implementation measures alongside their strategic goals.

The remainder of this paper is structured as follows: the key concepts of CAS are discussed briefly in the second section, exploring how CAS portrays reality and what kind of consequences this approach could have for planning and governing spatial processes. The third section contains a review of a development plan in Dutch planning practice: the Blauwestad development plan. We analyse in what sense the rigidity of a development plan was problematic and what sources of rigidity can be identified in this particular plan. The fourth section identifies possible lessons for planning practitioners on how CAS-based principles for designing and implementing development plans could increase the flexibility of these plans. We conclude with a discussion.

2 Complex adaptive systems: a perspective of becoming

Friedman (1987) noted that much of planning is concerned with the relationship between knowledge and action. While in the post-war period context-independent scientific knowledge was highly prized, more recently it has been suggested that notions of Complex Adaptive Systems (CAS) could provide a useful dynamic perspective on spatial development. Insights derived from CAS have offered an understanding of the spatial in which change is considered to be quite an autonomous process, a consequence of multiple drivers at various levels of scale and often progressing beyond the scope of planners (De Roo, 2010). During the 1990s, Batty and Longley (1994), Allen (1997) and Portugali (1999) showed the relevance of mechanisms of change based on CAS in discovering new patterns of emergence in cities. In the years that followed, this research has been extended to, for example, consensus building (Innes & Booher, 2010), city development and property rights (Webster, 2003; 2010), transitions in urban-rural integration (Rauws & De Roo, 2011) and governance and decision-making (Gerrits, 2008; Portugali, 2010; De Roo & Rauws, 2012). A central argument in all these studies is that a CAS approach enables discontinuous and unexpected transformations, which lie at the heart of spatial issues, to be recognised as a normal part of development processes rather than being viewed as exceptions or failures. As such, a CAS approach could alter our view of how development plans should be designed so that they support urban environments that can be responsive to these transformations.

What analytical framework does CAS provide for evaluating spatial planning and governance, and in particular the design of development plans (for an overview see Table 1)? Proponents of CAS argue that it challenges planners to develop adaptive planning strategies rather than strategies based on the Newtonian view

which incorrectly assumes a world of knowable entities independent of time (De Roo, 2012; Bettencourt, 2013). From a CAS perspective, spatial structures and their functions are situated in time and space and continuously adapt in response to changes in their context, for example a city responding to financial crises or climate change. These interactions are expected to proceed non-linearly, suggesting that cause-effect relationships are likely to be disproportionate – a small change can have a great impact, and vice versa. It suggests that predictability is low and uncertainty high in many situations, and challenges planners to accept and anticipate often remote (in time and space) causes that affect planned interventions and associated outcomes. Thus, spatial relationships can fundamentally shift over time – structure and/or function revised – requiring designs that remain vital under a variety of circumstances.

A CAS approach also advocates a multilayered view, as it suggests that non-linear, sometimes fundamental, changes cannot be attributed to actors and factors at a single level of aggregation (Liljenström & Svedin, 2005). Rather, CAS are seen as open and 'nested' systems, emphasizing interdependence between processes at different levels of scale and moments in time, together producing unexpected outcomes (Byrne, 2005). In general, contextual and internal processes influence a system's adaptation (Portugali, 2006; Wolfram, 2002). Contextual interference may trigger reconfiguration of a CAS in an attempt to create the best possible 'fit' with its environment. In planning this means that sufficient capacity should be maintained to enable an urban system to reorganize and, in trying to do so, planners can anticipate likely paths of development with the help of comparative analyses between relative similar urban systems (Rauws & De Roo, 2011). At the same time, self-organization provides an internal mechanism of adaptation. In such processes, constituents (actors) in the system (e.g. individuals, informal coalitions and organizations) alter their behaviour and act to change the very frameworks which constitute their behaviour in the absence of external coordination (Heylighen, 2008). This means that CAS are able to self-stabilize and self-innovate. Viewed in this way, it provides an argument for planning strategies focused on creating the conditions under which an urban system can develop and redevelop itself, and allow areas to coevolve in response to ongoing changes.

The idea of coevolution highlights the notion that changes in a system and its environment are interdependent (Gerrits, 2012). In the context of this study this can be understood as a two-way process of actor coalitions, formed to manipulate the functioning of an urban environment according to the actors' respective needs during the design and implementation of a plan, and the urban environment itself

changing in response to these same planning activities. Coevolution prevents the attainment of a clearly defined end-goal set in advance. The CAS approach therefore posits a powerful aspect of 'becoming', in which visioning, designing and decision-making on spatial issues should not only be sought in 'being', based *only* on an understanding of what is present, but as part of on-going trajectories of change – in 'becoming'. This suggests planners should not merely respond to change reactively but must also proactively influence processes of coevolution by stimulating or mitigating specific feedback loops.

From a CAS approach – embracing the idea of becoming – the rigidity of development plans is particularly problematic. While the aim of planning is to support the making of better future places, most development plan design processes are known to take the *present* physical, economic and institutional configuration as their point of departure, i.e. development plans are designed in light of knowledge of *being* rather than of how things may *become*. Consequently, development plans, by setting out a predefined trajectory of change, may be insufficiently responsive. According to Alfasi (2006) and Staley and Claeys (2005), the rigidity of development plans can discourage further spatial innovation and obstruct bottom-up development initiatives. In addition, Larsson (2006) and Van der Valk (2002) argue that the strong determining power of development plans can lead to bureaucratic situations in which matching dynamic reality with a rigid plan is time-consuming. In other words, it is argued that development plans tend to lack the requisite flexibility to provide urban developments under construction with the capacity to mediate and respond to emergent change.

Accordingly, applying a CAS approach suggests that development plans should incorporate mechanisms that enable initial targets to coevolve in terms of nature or speed. Further on in the paper we will outline some examples of such mechanisms. First, however, we will explore the issue of rigidity and its consequences on a more practical level, analysing a development plan in Dutch planning practice in the next section.

Properties of a CAS approach	Implications for spatial planning and governance
<p><i>Non-linear change</i></p> <ul style="list-style-type: none"> - cause-effect relations are disproportional - systems may shift fundamentally in structure and function 	<p><i>Adaptive strategies</i></p> <ul style="list-style-type: none"> - remote (in time and space) causality between planned interventions and associated outcomes - designs have to be vital under different circumstances
<p><i>Contextual interferences</i></p> <ul style="list-style-type: none"> - search for best possible 'fit' with environment 	<p><i>Anticipative</i></p> <ul style="list-style-type: none"> - room for manoeuvre - uncovering likely development paths
<p><i>Self-organization</i></p> <ul style="list-style-type: none"> - Developments emerge out of the interaction between actors without external coordination - The ability of systems to self-stabilize and self-innovate 	<p><i>Facilitation</i></p> <ul style="list-style-type: none"> - support and create conditions that stimulate autonomous, self-unfolding urban developments
<p><i>Coevolution</i></p> <ul style="list-style-type: none"> - A two-way process between actors manipulating a system and systems changing in response to these manipulations 	<p><i>Guiding the 'becoming'</i></p> <ul style="list-style-type: none"> - stimulating or mitigating specific feedback loops

Table 1: Analytical framework provided by a CAS approach

3 Rigidity pitfalls for development plans: exploring challenges to practice

In this section we draw on the Blauwestad development plan to explore some of the implications of rethinking development plans on the basis of a CAS approach. Located in the Northern Netherlands, Blauwestad is a comprehensive development which aims to realize a variety of seemingly heterogeneous outcomes. In this analysis the Blauwestad development is viewed as a CAS, with the actors involved as its agents, e.g. initiators, (future) inhabitants, project developers, planning authorities, water boards and politicians. Seen in this way, any changes beyond the district level are viewed as contextual interferences emanating from the system's environment. Although Blauwestad is not representative of all Dutch development plans, it is akin to similar plans such as 'Meerstad' (Van den Brink et al., 2006) and 'Wieringerrandmeer' (Woltjer & Al, 2007); and crucially, it forms part of a category of 'grand vision' development plans that would not be pursued in their current form if a CAS approach were widely adopted in planning.

Before presenting an in-depth analysis of Blauwestad, we consider key aspects of the Dutch planning system to provide insights into the function of development plans in Dutch planning practice. The Dutch planning system is a legislative rather than a political system, which emphasizes protection and legal security (Janssen-Jansen & Woltjer, 2010). Development plans play an important role in this system as they guide future development. Although development plans are prepared by public planners, private and civil actors participate in such processes. This deep-rooted belief in consensus-building (Van de Valk, 2002) often leads to comprehensive designs for a geographical area, which are subsequently embodied in a development plan and thereby formalized and carefully followed through to completion. As a consequence, the potential to negotiate the scope and substance of developments once a development plan has been adopted is quite limited (Janssen-Jansen & Woltjer, 2010).

Reviewing the role of development plans in Dutch planning practice with a CAS approach converges with the current reorientation under way in Dutch planning. Resistance to modernist planning approaches, a growing diversity of demands and the present-day economic crisis have prompted a search for alternative development strategies (Gerrits et al., 2012; Hajer, 2011). Alternative strategies include Organic Development Strategies (e.g. Vinke et al., 2005) and the Spontaneous City Movement (e.g. PBL, 2012; Urhahn Urban Design, 2010), which focus on small-scale, gradual spatial development and redevelopment

based on bottom-up civil initiatives with the aim of responding to current economic changes and shifts in demand. Rethinking development plans from a CAS perspective focuses attention on how design can support and accommodate non-linearity and fundamental change, of which the consequences of economic crisis can be considered as an example indeed. However, a CAS approach assumes such disturbances are not exceptions and suggests that situations are never in complete balance. Therefore, creating a properly functioning and sustainable urban system is about finding configurations able to adapt to change effectively in general, whether it is due to a global economic crisis or a spontaneous local initiative to start a smart energy grid.

3.1 The Blauwestad development plan

The development plan for Blauwestad (Blue city) was designed to boost a region that had experienced both demographic and economic decline. The plan comprised an area of 1450 hectares that mainly served as an agricultural production area. While part of a region with a rich history of economically successful agriculture (Hidding, 2002), during the 1980s the vitality of the region was in decline. A number of agricultural plots had been left fallow as a result of EU policies. Industrial sites had been closed down and unemployment had consequently increased, causing young and highly educated people to leave the region (Dammers et al., 2004).

A broadly shared sense of urgency thus raised support for a large-scale spatial intervention. This took the form of the Blauwestad development plan, which emerged from an initial idea of creating a massive lake, first put forward in 1989 by two locals, Jan Timmer (architect) and Wim Haaksen (policymaker for the Ministry of Agriculture and former local politician). This eventually led to the development of a public-private partnership (PPP) which aimed to invest approximately EUR 272 million (NRK, 2010).² The Blauwestad development plan is a grand vision. It has been lauded for its integrated approach, combining economic development, housing, nature and leisure development, and water management measures. Indeed, it was a winner of the 'Gouden Piramide 2005', a national prize for inspired commissioning, and was nominated in the World Architecture Festival 2008 category of 'Nature'.

The construction of a man-made lake (800 hectares) on former agricultural land is at the heart of the Blauwestad development plan. In and around this lake, the construction of approximately 1200 luxury homes (later this was increased to

² Including acquisition of the land. No insight into the current total cost can be obtained. A national newspaper suggested costs had increased to a total of EUR 785 million in 2010 (NRC, 2010).

However, the Blauwestad did not proceed as anticipated. The investment needed to complete the planned development was higher than expected (NRK, 2010). In response, the private sector project developers were granted permission to build an additional 280 houses and to use the profits from this extra quota to address the financial shortfall (NRK, 2010). More seriously, the estimated demand for luxury houses written into the development plan appeared to greatly exceed the levels of real demand. Planners expected an inflow of house buyers from outside the region based on the presumption of higher house prices and lower levels of supply elsewhere, and that Information Communications Technology (ICT) would allow people to be more mobile – even to enable them to run their business in the Randstad region, some 200 kilometres away. However, these outcomes did not materialize – not in the years before the financial crises and certainly not after.

Initiatives to loosen strict design regulations embodied in the development plan were rejected by the regional authorities on the grounds that they would damage the desired image of luxury living in a high-quality environment (NRK, 2010). However, the project, with its peripheral location, was becoming increasingly regarded as a failure and the sale of plots for private housing almost came to a halt. ‘The idea of moving to Blauwestad was regarded as being similar to emigrating to another country’ was the general view (NRK, 2010, p. 110). Aggravating this, some potential buyers were unable to move to Blauwestad because they were finding it difficult to sell their current homes. This was due to the near stagnant national real estate market, a consequence of the financial crisis. This meant that a central aspect of the plan, a neighbourhood block called ‘The Village’, which had been designed to include local shops and other community services, went unbuilt, as the lagging development had not provided the necessary funds for its construction and the residents who would have spent money there were largely absent.

In 2007 two of the three participating private developers pulled out and the financial risks to the public parties involved increased substantially. In 2009 the PPP was dissolved and the regional government was forced to take on the financial loss (EUR 28.8 million) and full responsibility and financial risk for completing the development (NRK, 2010). In 2010, with only 183 of the 1480 plots sold (Province of Groningen, 2010), the development plan was adjusted, extending the duration of implementation and rescheduling the expected number of plots to be sold each year from 150 to 40 (Province of Groningen, 2010).

3.2 Sources of rigidity in Blauwestad

The development plan for Blauwestad presented a powerful vision. It was able to mobilize and bring together a diverse set of actors (e.g. project developers, various local and regional authorities and the water management board) around an innovative and inspiring idea of a new future for an area in decline. However, the development also displays some of the difficulties that can arise when an initial development plan needs to be adjusted in response to changing circumstances. Below we review the Blauwestad development plan to identify some of the root causes of its rigidity.

Why was Blauwestad so vulnerable to different types of changes? Primarily, the plan included an integrated development strategy which required the spatial qualities of the site to be upgraded before the rest of the plan could be implemented. Therefore, high upfront investments had to be made (EUR 118 million by public actors, NRK, 2010) for land acquisition, construction of the road infrastructure providing access to the building plots, and construction of the artificial lake. This was considered necessary to 'put the area on the map', before a single plot could be sold and the first house built. Such upfront investment and the associated costs of borrowing were to be recouped from subsequent housing development.

A sound balance sheet required a minimum number of plots to be developed each year and a total number to be developed to cover, at the very least, public investment. The initial balance was tight – raising EUR 73 million³ from the profits of 1480 houses means collecting EUR 50,000 per house on average, omitting the interest paid on the investment and excluding EUR 37.6 million in subsidies (NRK, 2010). Slower development, other types of land use or a lower total number of plots developed would automatically result in a financial loss. Moreover, the full construction of the lake, street grid and even the street lighting in advance, determined the spatial design trajectory, embodied in the development plan, for a long time.

This resulted in a rather prescriptive real estate programme, which focused on attracting wealthy people from regional and national markets. It was anticipated that the group from outside the region would boost the region's economy, although some questioned the feasibility of this strategy. The projected number of 1480 'high-end' plots was somewhat optimistic when considered in light of limited national demand for luxury housing (RIGO, 1995). Moreover, only 28

³ In 2009 this had already increased to EUR 118 million (NRK, 2010).

percent of the plots sold by 2007 in Blauwestad were bought by people from outside the Northern Netherlands (Companen, 2006, p. 65). Other plots were acquired by regional home owners, who could afford to buy these 'high-end' investments. A proportion of these were delayed investment, in anticipation of the construction of the Blauwestad (Companen, 2006). Thus, the supply of house plots exceeded demand and investment in the region was being redistributed rather than new investment being attracted. Furthermore, the real estate programme did not allow alternative functions, such as the development of a holiday park.

The high upfront investments, prescriptive real estate programme and disappointing sales of plots led to financial lock-in that revealed the development's rigidity. While it might have been possible to develop a Blauwestad plan that left room to reconsider parts of it, the need for high upfront investment written into the original development plan made it almost impossible to reconsider the remainder of the plan – future choices were taken hostage as the actors involved had to recoup their investments. The financial burden which resulted and the seemingly obdurate spatial design dramatically reduced the responsiveness of the plan. Ultimately, the Blauwestad development plan was relatively robust but insufficiently flexible to meet demands arising from changes in the context.

4 Rethinking the design of development plans

In the preceding section, we reviewed a development plan which illustrated the problem of rigidity. While such plans need to be robust to engender stakeholder confidence, equally they must also be able to better respond to contextual changes that drive spatial developments – technological, social, economic and ecological change. The CAS approach highlights the need to develop more flexible development plans, with spatial strategies that support self-organization and coevolution being required. However, CAS does not imply that self-organization proceeds in the absence of design and, by extension, designed development plans. Spatial change is simultaneously self-organizing and self-structuring – at different times and scales. Marshall (2012) rejects the choice between designing or not designing, stating that 'any settlement or built environment will feature design somewhere, at some level: and so the question becomes an argument of scale'. Thus, with this in mind, below we draw on a number of key insights inspired by the CAS approach that could enable more flexible development plans to be formulated. First, to assist in this process we provide a framework that sets out a way of thinking about development plans. Second, we set out some

practical design principles which could usefully inform the design of more flexible development plans. Finally, we demonstrate reflexivity by critically reviewing our proposals to identify the conceptual and practical challenges associated with them.

4.1 A framework for development plans

To retain the persuasive capacity of a plan while increasing its flexibility during implementation, we suggest that visionary elements and implementation measures can co-exist in development plans. Drawing on Marshall (2012), we argue that determining where a visionary element should effectively reside in planning is a question of scale. We argue that the visionary elements, which give plans persuasive value, should be considered at a strategic level. However, in order to realize persuasive visions, concrete implementation measures are required at an operational level. Relating the two, CAS-based principles are required to guarantee a development plan which strengthens the adaptive capacity of the urban development area under construction (see Figure 2).

By definition, operational decisions differ in their scale, characteristics and the overall ambition of the visionary elements they express. The visionary element thus bounds or frames operational decisions. This does not mean that separate plans are needed, especially since the visionary and operational elements of development plans should be interlinked. Indeed, making two separate plans could lead to a disconnection between ambition and strategic choices and more concrete operational planning regulations and measurements. In turn, this could lead to situations in which societal ambitions are blocked by bureaucratic and rigid planning rules, which by and large stand alone.

Visionary elements and implementation measures can be evaluated at different levels while remaining part of the same plan. This could help the actors involved acknowledge the implications of the unknown futures they are confronted with when realizing a development, despite potential synergies, mobilizing effects and innovative ideas. The next section discusses how CAS-based principles can connect the two levels, through their visionary elements and implementation measures, respectively.

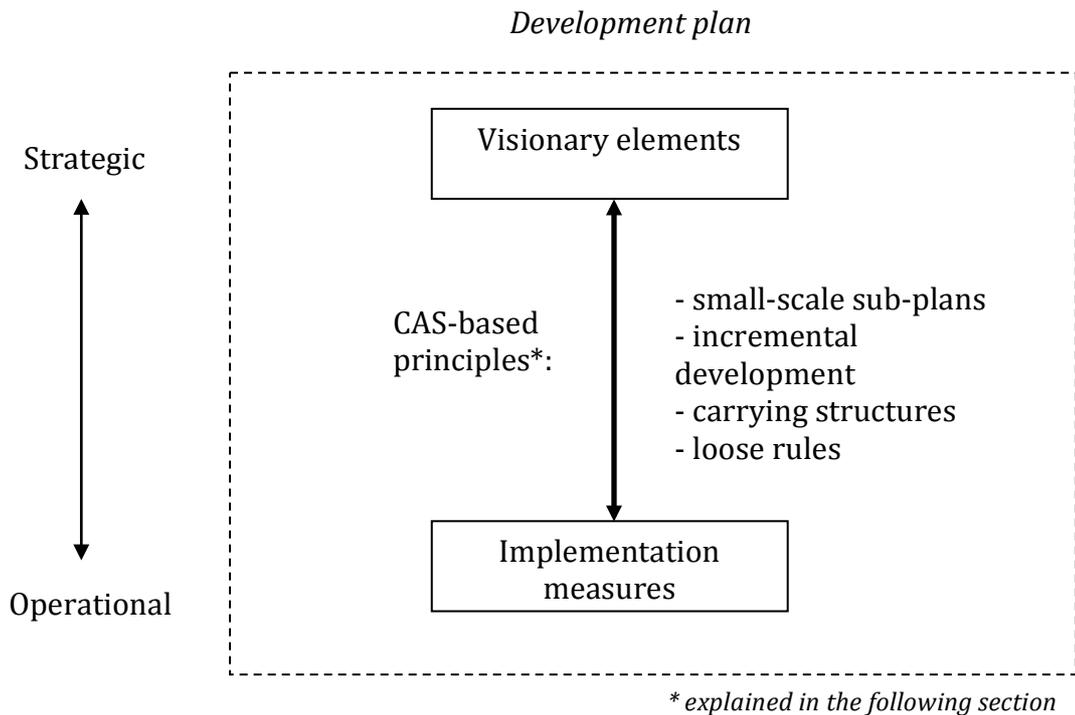


Figure 2: A framework for flexible development plans. CAS-based principles can help link the visionary elements and concrete implementation measures in such a way that the adaptive capacity of urban development areas under construction is strengthened.

4.2 Practical design principles for flexible development plans

The main flaw of the Blauwestad may not have been its visionary ambition or the end-state image pursued. Uncertainty does not mean that we should stop making plans. On the contrary, plans help create a sense of urgency, direction and agreement (Rosenhead, 2001; Albrechts, 2004). Blauwestad may just have been one of the many plans which turn out not to be viable in implementation, unrealistic when circumstances alter dramatically, for example as a result of a global financial crisis. However, it remains difficult in this case to argue that a lack of viability did not lead to serious implications. A key issue with the Blauwestad plan was not that it was an ambitious plan drafted *on paper*, but the extent of the upfront *physical and financial* investment required. Making a plan is an innocent act, but embarking on an ambitious operational programme of investments resulted in serious challenges later on. Such investments made it difficult to (i) develop Blauwestad at a slower pace, (ii) change the future land

use, (iii) refrain from implementing or replacing parts of the plan. Indeed, the dramatic changes in context faced by the Blauwestad development demonstrates the need to address these three measures.

Drawing on the CAS approach, we present four principles that cast new light on these issues and could usefully be adhered to when designing development plans at the district level:

- The overarching development plan should comprise multiple independent smaller scale plans
- Apply incremental development strategies
- Install requisite carrying structures
- Define loose rules

In doing so, we also identify links with researchers who have explored the implications of complexity theories and evolutionary approaches to planning and explore what planners can learn from urban designers by revisiting some of the classic design principles in the context of the CAS approach. The aim is to show the significance of these in the design of development plans.

First, we suggest that an overarching development plan at the district level should comprise multiple *independent smaller scale plans* (e.g. at the neighbourhood level). From a CAS approach, a mosaic of self-sufficient small-scale plans is preferable to large-scale plans as it assumes fundamental uncertainty in future development paths (see also Alfasi & Portugali, 2004). Large-scale plans have a long-term span due to their size, making contextual changes (political, economic or societal) very likely. On the other hand, small-scale plans cover a relatively short period, making them less susceptible to changes in context. In addition, if a degree of self-sufficiency is aimed at in small-scale plans then they will be less dependent on the success of other developments in the vicinity. This resonates with the New Urbanist idea of mixed-use neighbourhoods providing local facilities (Talen, 2013), and with Marshall (2009), who argues that each intervention should deliver spatial areas that are viable today. Interestingly, in the Blauwestad case division into a number of sub-plans would have meant increased functionality for these individual compartmentalized plans in future situations where others might be delayed or even aborted. The risk of high upfront costs would have thereby been limited.

Second, *incremental development strategies* could provide a useful way to support coevolution and involve evaluating former steps to enhance those that follow (see also Lynch, 1981; Greenberg, 2009). Related to the first principle, this strategy would involve designing development plans that take account of and

build upon successful development paths – ‘steady-state’ in CAS terms. At the same time, incremental development could create opportunities to include emerging contextual trends and self-organized initiatives. With respect to the Blauwestad development, an explicit incremental strategy could have led to an approach with a greater emphasis on learning and adjustment. As such, the failure of one sub-plan would not have impeded the reconsideration of the initial choices made for the next sub-plan.

Applying an incremental development strategy would, according to Marshall (2009), also support the synchronization of social and spatial organization. Relying on the idea that urban development by and large emerges out of the self-organized interactions between local actors, adjusting the scale of developments to the size of these communities could help by making use of their capacities for self-organization (see also Gehl, 2010; Talen, 2013). In the context of the Blauwestad development, this approach would have opened up opportunities for local cooperation and decision-making by future inhabitants, adjusting the design to meet local needs. The field of serious gaming also suggests a few promising methods which could make the combination of formal plans and informal self-organization activities feasible (e.g. Poplin, 2012; Tan & Portugali, 2012).

Third, the development plan could require *carrying structures* to make small-scale projects possible. Such carrying structures provide urban development with robust frameworks (Alexander et al., 1987; Salingaros, 1998) and can support and connect autonomously emerging initiatives which will form the basis of further development (see also Hartman et al., 2011). In CAS terms this approach enables a balance between robustness and flexibility to be struck. The notion of ‘carrying structures’ originates from ecology. Such structures or infrastructures enable the population level of a certain species to be supported under the existing conditions in an ecosystem, for example the quantity of food, the habitat, etc. (Xu, 2008). In a similar way we can refer to carrying structures in urban settings, such as road and public transport networks, blue-green networks or data networks. These can function as frameworks (cf. Palmboom, 2010) which self-organized initiatives can easily link into, increasing the opportunities for such initiatives to emerge and therefore contribute to a vital urban system. However, where such structures are expensive and there are significant risks to the development proceeding, it is advisable to look for ways to split investment into several stages. The carrying structure can be divided into independent parts or it can be upgraded while the development of a district is progressing. For example, access roads could be upgraded only after a minimum level of traffic is achieved.

Investments could thus proceed in stages, while service levels keep pace with developments.

For smaller projects, *loose rules* based on core objectives can be defined, rather than detailed regulations. This approach provides a response to the challenge identified by Marshall (2009) of sticking to old forms and formats for the sake of it and should result in sufficient flexibility for actors to reshape their environment to suit their needs (Lynch 1981). We propose a set of basic, general and often qualitative rules defined within a development plan to guide development, for example 'mixed use' or 'energy neutral'. This contrasts with detailed, quantitative and narrowly defined rules on how objectives should be met, as, from a CAS perspective, such rules could undermine or inadequately recognize the opportunities created by self-organized initiatives (see e.g. Frank & Stevens, 2007). Many initiatives which include ideas that could contribute to an area's potential might thus not be realized within existing sets of planning rules, since they are derived in terms of 'being' and insufficiently account for 'becoming'. In contrast, loose rules do not try to cover all possible urban forms, nor do they advocate any particular way of living (for a similar discussion see Alfasi & Portugali, 2007). Loose rules guide future development paths and embrace diversity in further evolution rather than regarding it as a risk to be minimized.

The Blauwestad development's finances and the predetermined group of future inhabitants meant that strict design standards were set out in the development plan. Such inflexible rules could have inhibited the productive coevolution of Blauwestad with changing circumstances. In contrast, loose rules with the potential to adjust to and make use of the opportunities which arise should the overarching vision and general aim of the development be widened could have been useful. These could include 'low density living in open space' and 'water-oriented development'. Coupled with options for multifunctional land use, architectural variation and differing plot sizes, these may have significantly increased the adaptive capacity of the urban development area.

The four principles set out above could help planning communities to design more flexible development plans that strengthen the adaptive capacity of an urban area. In some instances, major initial investment might nonetheless be considered inevitable, for example in trying to force an end to a period of decay. Such investment (e.g. the creation of a large artificial lake) might be realized if actor coalitions agree that they are the only way forward. However, from a CAS perspective, actors need to accept the uncertainty of the spatial development paths into which this investment could fit and the unexpected effects, even

surprises, to which such investment could give rise. Investment might not meet projected profit targets or be adjusted without further investment. In such instances, it should be recognized that the degree of flexibility embodied in a development plan is not predetermined by natural laws but is the result of choices made by key actors (see Zuidema, 2011 for more about the relationship between socially mediated choices and decision-making in planning). Of course, at the same time, the uncertainties and risks associated with flexible development plans should also be unpacked and considered in decision-making processes.

Politicians play a critical role in many decision-making processes and this could compromise the degree of flexibility built into a development plan. As Sager and Ravlum (2005) showed, politicians have difficulty limiting political authorization processes to a strategic level, that is, remaining focused on the general outline of plans rather than their detailed implementation. Questions raised by the electorate often lead politicians to feel the need to engage in discussions about the details of implementation to secure the support of their voters. Therefore, implementing 'loose rules' for example would at least require efforts by planners to convince politicians to stick to strategic-level decision-making. Furthermore, if developments are guided by loose rules, there might be a need to understand what uncertainties could arise for investors and who might be responsible for deciding whether the proposed initiatives fit the aims of the development plan. The starting point here should be maximum transparency, which could be developed in advance and ensures that the requirements that the initiatives must meet are considered and procedures for and the degree of adjustments of these requirements while the development proceeds are clear as well. This should thus prevent subsequent development of initiatives being frustrated by requirements of the development plan, at least to some extent.

4.3 Critical reflections

Taking a CAS approach has resulted in a set of principles that can allow planners to create flexible development plans without reducing their visionary power, strengthening the adaptive capacity of urban development areas. However, there is a risk of becoming overly eager to embrace flexibility, certainly after having reviewed projects of the type discussed here. A CAS approach, however appealing and elegant in a theoretical sense, raises a number of fundamental questions concerning the implementation of the derived design principles in practice. Complexity thinkers implicitly bring the use of planning into question in

the very logic of their argument (Portugali, 2012, p. 55). Therefore, we pose three critical questions about the tensions that might emerge when increasing flexibility of development plans is sought.

First we ask, *How flexible can a plan be without ceasing to be a plan?* In a flight from the rigidity of traditional plans, a CAS approach would opt for maximum flexibility. However, a 'flexible plan', in its ultimate rendition, is an oxymoron. When all future actions are possible, open to consideration at any point in time to come, by definition, a plan is absent. We therefore cannot set out on a course of action and at the same time declare that the course is entirely open for reconsideration. Not only is this semantically impossible, it also disregards the structuring, stabilizing and synergizing role of development plans; their robustness in the face of external pressure and internal stress. Therefore, both the flexibility and robustness of a plan should be strengthened. A danger which could arise here if flexibility is sought at the expense of robustness, is that the return of uncertainty and mistrust causes a loss of performative power. Whether flexibility and robustness are locked into a zero-sum game where an increase in one attribute leads to a reduction in the other is an open question for research. If such trade-offs actually exist then a way to resolve, or at the very least manage, the relationship between these attributes will need to be sought.

Second, we ask, *Is it possible to foresee all alternative development trajectories?* A consequence of adopting a CAS approach in development plans requires planners to aim for flexible plans which accommodate a range of future situations without costly redesign and rebuilding. Although a valuable intention, requesting that alternative uses be considered when designing spaces implies that we can foresee and define alternative uses *a priori*. At the same time, CAS and the complexity approach in general dismiss the possibility that planners can predict the future. A contradiction thus arises. Meanwhile, we cannot design spaces to accommodate all futures because such designs will necessarily accommodate some uses and thereby render the space unsuitable for others. Therefore, on what basis could we decide the range of uses and concomitant flexibility in the design of development plans?

A partial answer could lie in understanding the path-dependency of spatial development trajectories, a concept of the CAS approach that has not been introduced thus far. In short, path-dependency suggests that only a limited number of possible development paths are open at a specific moment. This is due to historical developments and present conditions (Assche, 2006). It implies that planners can learn about such phenomenon and explore the particular nature and

degree of flexibility that could be built into a development plan's design. This is likely to require planners to monitor trends carefully as they arise and understand the past qualities of an area, i.e. its history.

Third, we ask, *At what geographical scale should planners aim to enhance adaptive capacity and, by extension, where should this be avoided?* Adaptive capacity and predefined structures are rarely absent in the spatial. Even in highly regulated planning systems, the opportunity to self-organize can be found, for example at the scale of people's daily walking patterns. Collectively, people create new walking routes and reconfigure the urban fabric (cf. Helbing, 2001). At the same time, rules that structure developments emerge in chaotic spatial processes. For example, formal and informal rules govern the spatial in illegal settlements (Turner, 1976). Approached this way, might the design of development plans be viewed as a result of self-organization? We argue that there will always be openings for diversity and alternative spatial development paths, within a certain web of regulations that both facilitate and constrain further development. Every planning system and every plan are temporary agreements which embody such limits. Therefore, regulatory structures, such as development plans, are to some extent *a product of* self-organization, and certainly are *a precondition for* self-organization, rather than the opposite of self-organization. Structures are a precondition of development because although they can be criticized for setting limits, by doing so they also define spaces that allow freedom of action. In other words, structures constrain and facilitate development – structures and the actions of agencies are 'counter-moulds' (Giddens, 1984). Thus, we can observe that spatial change is self-organized and self-structuring at the same time – at different moments and at different levels of scale. We cannot and do not necessarily need to choose the spatial and temporal scales at which planners should remove barriers to self-organization or identify the scales at which this should be avoided.

5 Conclusions

In this paper we have drawn on the complex adaptive systems (CAS) view of spatial development to explore the issues associated with 'rigid' development plans and how these can be resolved. This was illustrated by an analysis of the Blauwestad development. From this we have learned that planners should not only work toward a design that is able to mobilize actors around a shared vision and motivate them to work together, but one that also includes mechanisms to allow an area to respond to significant changes in its context. Inspired by the CAS approach, we explored how a degree of flexibility can be incorporated into the

design of development plans to help strengthen the adaptive capacity of urban development areas. As such, these areas have a better chance of success when responses to changes in context are required.

Three main lessons can be derived from this paper. First, designing a development plan requires a distinction between the visionary elements and the implementation measures incorporated in the plan. If visionary elements are not sufficiently linked to implementation measures that would promote flexibility to respond to changes in context – while appreciating the future posited by the plan – rigidity becomes a serious risk. Second, four CAS-based principles can be distinguished and used to derive such implementation measures: small sub-plans, incremental development, carrying structures and loose rules. The combination of these principles would result in development plans which provide a direction for development and have a persuasive and motivating effect, while enlarging the opportunities to adapt to volatile contexts. Third, when upfront investment which reduces the flexibility of a plan is nonetheless considered inevitable, it can still be made when actors agree this is the only way forward. However, the actors involved also need to be transparent about the limited future paths this investment could accommodate, the risks associated with this and the unexpected effects it may have. Put differently, the degree of flexibility in development planning is a choice and therefore the associated risks should also be presented as a choice.

As illustrated by the principles above, a CAS approach to development plans should respect the value of making plans, but could contribute to implementation mechanisms which allow reconsideration in the future. These could allow the plan in question to coevolve successfully within a volatile context, strengthening the adaptive capacity of the urban development area. Acknowledging that planning occurs in a world in constant change, the crucial task for the planner becomes supporting both flexibility and robustness within the confines of space and time-related conditions. This paper has explored how development plans could become a helpful tool in this process.

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