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Self-organisation in urban spatial planning: evidence from the Greater Accra Metropolitan Area, Ghana

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There is growing interest among spatial planners to see spontaneous civic initiatives supporting urban development. The occurrence of self-organisation in two informal settlements in Greater Accra Metropolitan Area, Ghana is considered. The system theories of self-organisation (dissipative structures, synegertics and autopoietic) and actor-network theory were used to analyse the two cases. The findings indicate that actors in these informal settlements are triggered by certain contextual factors to undertake initiatives for their own survival and sustenance. At the regional level, these settlements jointly form patterns relating to self-organisation. We conclude that since self-organisation is context specific, planning rules should be reconstructed to guide actions of the various actors in the urban system.

Keywords: self-organisation; informal settlements; spatial planning; Greater Accra Metropolitan Area; community networks; civil society

1.   Introduction

In today's highly connected and information-driven world, unexpected economic, environmental and political events reproduce urban complexities and drive urban areas towards a future which is impossible to predict (Rauws 2015; Rittel and Webber 1973). Spatial Planners are therefore challenged with complex planning problems. One of such challenges is the self-organising nature of cities and their evolution in time.

Self-organisation is a feature of complex systems. It is a spontaneous emergence of coherent structure out of local interactions, independent from external coordination (Portugali 2000; Heylighen 2008). This implies, under dynamic interaction and interrelation between its internal elements, complex systems could manage themselves in a process of self-organisation, out of which new emerging structure could appear. Such autonomous patterns can have both positives and negative effects.

Self-organisation in planning is also associated with learning processes and innovation through dynamic interaction between stakeholders (Zuidema and De Roo 2004). This implies that within a self-organising system, actors (individuals) at one level may become the foundation for other actors at a higher level to learn from and based on the new knowledge obtained, these actors may constantly adjust their initiatives.

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De Roo ([2016](#)) stated that, 'Self-organisation emphasises a situation "without organisation a-priori", "without organisation", "without purposeful behaviour" or "without intent"'. However, if not collectively, every actor in processes of self-organisation always has ambitions, desires or intent and seeks to change his environment after his heart desires (see Harvey [2008](#)). Self-organisation therefore stands for a spontaneous result which looks organised. De Roo ([2016](#)) further chats that, in an 'open, well connected and multi layered world', self-organisation is part of an alternative, non-linear world with an adaptive behaviour as a response to external influences. Changes in subsystems through these internal, external and bottom processes obviously affect the system as a whole. This offers a conceptual understanding of the city, consisting of different layers with each layer interacting with a higher layer.

Boonstra and Boelens ([2011](#)) and Boonstra ([2015](#)) present the concept of self-organisation beyond the approach of complex systems. They explain self-organisation as 'initiatives for spatial interventions that originate in civil society itself, via autonomous community-based networks of citizens, outside government control'. Here, spatial interventions are mainly driven by actors in a form of actor-networks, cooperatives or associations. Therefore, this covers the emergence of urban development out of coordinated and collective actions by multiple actors.

Despite the remarkable academic explorations on the concept of self-organisation, the phenomenon has not gotten much attention in mainstream planning, if at all by planners, in developing countries its practical reality is barely understood by spatial planners and does not relate much to the planner's tool of control and regulation.

Aiming to support spatial planners in handling such complexities and non-linearity especially with those that are fundamental, this paper brings on the concept of self-organisation to rethink its potential for urban development in Ghana. Self-organisation opens a new sense of thought in the domain of planning as it offers non-linear perspectives – spontaneity and autonomous change – in the trajectories of urban planning (De Roo, Hillier, and Van Wezemael [2012](#)). It shows an open non-linear world in which uncertainty is seen as vital source of innovation that supports systems to adapt to changing circumstances (Boonstra and Boelens [2011](#); Boonstra [2015](#); Rauws [2015](#); Rauws, De Roo, and Zhang [2016](#)).

The paper therefore discusses the concept of self-organisation from the neighbourhood level and it is organised in sections. [Section 2](#) looks at self-organisation as a concept and the features of it and deals with the social character of self-organisation and semantically explored the nexus between self-organisation and planning. [Section 3](#) discusses the research methodology whilst [Section 4](#) presents two cases from the Accra Metropolitan Area (AMA) in Ghana. These cases illustrate how communities self-organise and internally adjust and respond to certain contextual issues in their environment. [Section 5](#) sums the research with propositions for adjustment to a more non-linear planning process in urban development.

2. The concept of self-organisation

The concept of self-organisation can be understood by observing Henri Benard's experiment on heated water (see Portugali [2000](#)). Self-organisation also manifests in our natural environment, for example, the swarm intelligence; in trail-formation and wall-building by ant colony (Bonabeau, Dorigo, and Théraulaz [1999](#)).

Some social behaviour of humans is sometimes self-organised and generates complex societal behaviours. Human beings naturally work with local information and through local direct or indirect interactions with their environment and produce complex societies. In the city, self-organisation manifest in the repetitive behaviour of agents as each of them

independently adjust to reach a better fit within the system. This often leads to a collective results and a spontaneous emergence of pattern formation. A classic example is the emergence of elephant paths (De Roo 2016), and spontaneous settlements in most developing countries (Barros and Sobreira 2002).

Bénard's experiment reveals certain characters of self-organisation. Self-organisation generates a new structure and maintains it (Teisman, Buuren, and Gerrits 2009). Therefore, self-organisation exhibits a creative and adaptive feature that can trigger changes in a self-organising unit (Teisman, Buuren, and Gerrits 2009). In this regard, self-organisation is considered to be a bottom up approach and the initiating factor, the triggering process might very well be contextual (De Roo 2016). Finally, a self-organising system constitutes a variety of numerous elements with a causal relationship between them. 'These elements are interconnected through a complex network of feedback and feedforward loops. This feature makes the complex system robust and flexible at the same time' (De Roo 2010, 30).

Inferring from the above, it can be concluded that self-organising systems are not guided by external forces, but by the internal forces and interactions within the larger system (city, community) and what the system has to do in order to survive. This is further attested to by De Roo (2010, 30) who stated, 'the complex system does not just develop randomly but is path-dependent, that is, development takes place under certain conditions that can be defined and that provide insight into the system and its development'.

Several concepts on complex systems emphasise that systems are spontaneous in nature – they are self-organising. However, there are different views in the various branches of complexity theory on the extent of spontaneity of this self-organisation. These include dissipative structure, synergetic and autopoiesis. These are elaborated in the next section below.

2.1. *Dissipative structure*

Dissipative structures explain how systems self-organise through their interactions with their environment and the exchange of energy or information that comes with it (Mitleton-Kelly 2003; De Roo 2016). The theory was first used by Prigogine's in thermodynamics (Prigogine and Stengers 1984). He compared an open system, which exchanges energy and matter with its environment, and a closed system which exchanges neither energy nor matter with its environment. Prigogine realised that the system continuously generate 'entropy' – through the exchange of energy with its external environment – which is dissipated out of the system (Heylighen 2001, 254; Cleveland 1994, 3). The exchange of energy and information with the system's environment trigger internal actions to take place. This enables the system to self-organise internally and adapt to its external environment.

Allan and co (see Portugali 2011) in a series of studies reformulated the static central place theory of Christaller based on Prigogine's dissipative structures (Portugali 2011). Allan's model establishes the functional relationship between infrastructure of localities in a region, with its residents, jobs and economic functions. The actors in this model represent the individuals, who migrate in order to get jobs, and employers who employ or layoff workers as result of market conditions. The interactions between local areas and economic functions (i.e. employment opportunities) create a local 'carrying capacity' for the system with feedback loops (Portugali 2011, 58).

Relating Allan's model to dissipative structure, the result is the emergence of central places since the areas with greater and higher order employment opportunities will attract more people. This could in turn lead to crowding population at central places thereby forcing others to seek shelter informally as in the cases of the selected informal settlements. And within these settlements, the exchange of information with their external environment triggers certain internal activities which enable the system to adapt to the outside world.

Concluding from the above, the main features of self-organising systems in the concept of dissipative structures are: its interaction with the environment, with feedback and feedforward mechanisms, and it is far from equilibrium state which makes the system dynamic; small changes in the components of the system can result in large changes.

2.2. Synergetics

Whilst dissipative structures stress external interactions, Haken's synergetics explains interactions within the system (Portugali 2011; De Roo 2016). It highlights cooperation and the interrelations between individuals and how they form synergy among the different sections of the society and its overall structure and behaviour through interaction.

Haken's experiment on the laser exhibits a feature of self-organisation. Haken pumped electric current through a gas discharge lamp with atoms moving irregularly without any pattern. As the electric current is increased, the atoms correlate their movement and start to oscillate in self-organised way, and finally discharge a coherent light wave, known as laser light.

> Initially, the atoms emit their light waves independently of each other. Each of these might get support from the other excited atoms. In this way a kind of a competition among the light waves for the energy resources of the excited atoms begins. The winning light wave describes and prescribes the order in the laser and it's thus called the order parameter. It enslaves the others to act in the same way and it's called the slaving principle. (Portugali 2011, 62)

In the context of the city the individual who migrates in search for accommodation or jobs has to adapt to the city's dynamics. He therefore becomes enslaved by the city's 'order parameter'. But by adapting to the city's environment, the individual either supports or rejects the order parameter of the city.

This is known as circular causality (Portugali 2011). However, the enslavement process is not 'command and control' 'but the "enslaved" also gives feedback in form of support or rejection to the order parameter'. An important feature of Hakens theory is the control parameter – which is the power input in the case of the laser. The control parameter can be seen as an external condition which potentially makes the system oscillate and self-organise itself.

Relating Haken's concept of synergetic to the city, the 'parts' of the system can be seen as the individuals, households, formal and informal groups influenced by certain control parameter such rules and regulations of the government, which generates an 'order parameter' that enslaves the behaviour of the agents (Portugali 2006).

2.3. *Autopoiesis*

The concept of autopoiesis, says that systems can regenerate and recreate themselves. The main idea of autopoiesis is that the interaction between different components of a system may generate or regenerate other elements needed in the system, without any external influence.

However, this does not mean that autopoietic system is a closed system. It implies 'systems have a certain degree of self-containment and closure to their environment. They adapt to their environment but do so with properties and characteristics that are created and sustained in the system itself' (Teisman, Buuren, and Gerrits 2009, 27). In other words, external events may trigger internal processes but they cannot determine those processes.

Relating autopoietic self-organisation to human settlements, it implies the inward orientations of these settlements, is about self-regeneration and self-maintenance of the institutions which have been established in the process of self-organisation.

Niklas Luhmann (1982) used the theory of Autopoiesis to explain social systems. He observed that, through communication systems reproduce themselves (Seidl 2004, 14). The emphasis here is on the quality of communication as humans interact. He explained that communication and interaction between social systems could be seen as a learning process which might reproduce society.

2.3.1. *Self-organisation as emergent actor networks*

The characteristics of self-organisation, that is, Dissipative structure, autopoiesis and synergetics explained in the preceding write-up, are features of a complex system. Although complex system theory can offer insights on how to understand the complexity of current socio-spatial systems, it does not proffer strategies for confronting spontaneous initiatives beyond state control (see Boonstra 2015; Boonstra and Boelens 2011). Therefore, in this article, we will adopt a more nuanced stance on self-organisation by associating with Boonstra and Boelens (2011), who argued that self-organisation should go beyond the limits of structured systems and perceive urban development as an unending process of becoming. To this end, actor-network theory, which 'describes the emergence of 'society' as the outcome of heterogeneous relations between actors and artefacts' (Boonstra and Boelens 2011, 113) is introduced.

In the planning arena, actor-network theory enables the planner to understand social processes and their manifestation in space. Actor network is about individual actors who have intents, ambitions and interest and require the collective effort of others to achieve these ambitions. Planners are seen as part of these actors in the urban area and are capable of developing meaningful heterogeneous spatial connections with other actors (see Boonstra 2015; Boonstra and Boelens 2011). This understanding of self-organisation enables a shift from an interpretation of self-organisation as purposive versus spontaneous to understanding of self-organisation as the manifestation of the interactions between individual actors that with time develop networks around socio-spatial issues. This understanding of self-organisations also breaks the dichotomy of the professional planner and civic initiatives, and the lower and higher levels of a system. This thus provides a springboard for understanding civic initiatives in the urban area and how such initiatives gain robustness over time, thus, enabling the planner to adopt a suitable strategy in response to their becoming (see Boonstra 2015).

2.3.2 Self-organisation and spatial planning

The study of self-organisation in social science has the same basic principle with the other sciences, except in the character of the elements of the system. The actors in social self-organisation anticipate, plan and respond to their environmental conditions. This makes actors in complex social systems reflexive and enhances their adaptive capacity. Actors also process information within themselves which influences their actions. In field of planning, this implies actors can rationally select, based on a certain limit of freedom, a certain response or action to a certain situation. As a result, learning and dynamic actors constantly influence the direction of the system (Teisman, Buuren, and Gerrits 2009).

This social character of self-organisation makes it important to planning. As such, several planning theorists have tried to enhance the use of self-organisation in planning, by proposing relatively new approaches in planning, emphasising differently in terms of the content, process and procedural. However, inferring from the conception of cities as self-organising systems, the question is how should contemporary urban and spatial planning institutions adapt to, guide or regulate these urban dynamics in order to cope with the self-organisation processes in the city?

In his publication, Portugali (2006) stated that considering the nature of the city as an open, complex and self-organising system, local plans would be effective in shaping the city. This idea was established using the cityscape Tel Aviv (1950s) as an example where the action of one resident to enlarge his/her apartment by closing the balcony influenced the actions of the other residents in same direction. He thus, concluded that, bottom-up planning should be encouraged to provide room for local initiatives and innovations, and encourage public involvement in planning above and beyond what is given them through the present political process.

Again, in a recent publication, Alfasi and Portugali (2011) contended that self-organisation could be encouraged in planning, when no standard plan is stipulated in planning, except a set of regulatory planning principles that coordinates and manages relations and interactions between physical elements of urban area. They termed this approach 'just-in-time' planning, as contrary to 'just-in-case' planning (Alfasi and Portugali 2004).

Just-in-case planning is based on traditional mode of planning where the city is seen as machine that has to be planned in detail. This type of planning dominates current planning practices in the provision of societal needs such as housing. 'Just-in-case planning stands for a rigid, vertical-hierarchical structure, requiring workers to specialise, thus leading, possibly, to antagonism between workers and management'. (Alfasi and Portugali 2004, 31).

Just-in-time planning on the other hand, suggested that 'instead of using legal long-term land use plans, planning authorities should use rules referring to qualitative relations between different activities and functions in the environment' (Alfasi and Portugali 2004, 32). In this situation, the city is always under construction to respond to current societal needs and opportunities.

Boonstra and Boelens (2011) proposed that self-organised planning approach be 'outside-in' instead of the dominant 'inside-out' approach where planning actions are mainly driven by government and its institutions. It implies that planners adopt an 'open, unbiased and un (pre) structured view' to deal with upcoming socio-spatial initiatives 'on the outside'. In support, Frissen (2007) argued that institutional arrangement that allow 'non-predefined relations' should be promoted. Thus, both the planner and the planned should from the outset be mutually engaged in the planning process.

2.3.3 Self-organisation, spatial planning and cities of the global south

Cities continue to represent the fastest growing sector of the sub-Saharan African population (Parnell and Walawege 2011). According to Roy (2005), much of the significant transformations of the 21st century are taking place in cities of the global south; yet considerable theories of cities' development relate to the developed world.

Urbanisation in sub-Saharan Africa is fundamentally different in context from that in the Global North; in terms of rate of urban transformation and the landscape of political and economic structures where institutional capacities for planning is limited and self-organisation dominates. However, the nature of urban planning commonly practiced tends to be based on northern ethos, but with little success (Andersen, Jenkins, and Nielsen 2015a, 2015b; Njoh 2013). According to Njoh (2013), by supplanting indigenous African practices in the built environment, modernist (traditional) urban planning has effectively complicated sustainable development efforts in Cameroun.

The reason being that in many sub-Saharan African countries, land is mainly owned by chiefs and families. Therefore, planning proposals are prepared with the anticipation of executing them on largely communal land, which is private in nature (Yeboah and Shaw 2013). Local conditions and discretions rather than the state therefore dictate the pace and overall configuration of physical development. As argued by Yeboah and Shaw (2013), the transformation of towns and cities in Ghana is barely ever influenced by statutory or formal planning policy, because of the behaviour of some private landholders. Within this context, Njoh (2013) concludes that planning initiatives must be contextualised to account for local conditions. Planning to account for local conditions requires the active involvement and participation of all the urban citizenry in the planning process, irrespective of income level or class. This is because every individual within the city has got intent or desire, and capitalist logic (see Harvey 2008). This capitalist logic of actors within the urban setting cannot be regulated by the state through formal planning and institutions.

Urban informality-slums is common with cities of the Global South (Roy 2005), and one would expect that planners in these countries, view these slum neighbourhoods as a socio-spatial milieu which constitute face-to-face interaction, identity and a common understanding of joint challenges and objectives. In understanding the dynamics of these neighbourhoods, spatial planners could adopt a flexible and non-predefined approach to dealing with upcoming socio-spatial initiatives.

However, the poor in cities of African countries are marginalised and overlooked in terms of spatial planning and land-use rights (see Parnell and Pieterse 2010). This creates the condition under which self-organisation and civil initiatives thrive. Spontaneous developments–informal settlements emerge as the urban poor try to create a best fit with the environment. A Study by Korah (2015), found that unauthorised extension of buildings and the emergence of informal settlements in Kumasi, Ghana's second largest city, was due to restrictions on building materials and unrealistic planning standards such as aiming for large minimum plot sizes. Already the environmental, social and economic challenges associated with urbanisation in developing countries, particularly Africa have received considerable research attention (e.g. Cobbinah, Erdiaw-Kwasie, and Amoateng 2015a; Cohen 2006; Oduro, Ocloo, and Peprah 2014; Roy 2005). Regrettably, however, self-organisation in cities of developing countries and its potential for supporting mainstream planning is barely understood by spatial planners and does not relate much to the planner's tool of control and regulation. Spatial planning in Africa thus far remains

normative and technocratic and is unable to deal with the complex interconnection between rural–urban migration, poverty, rapid urbanisation and the need for housing and employment in cities (see Mabogunje 1992).

Understanding civic initiatives and self-organisation in the urban setting could therefore be an excellent opportunity for spatial planners, especially in developing countries to bridge the gap between planning decisions and implementation (e.g. Boonstra 2015; Roy 2005). However, as acknowledged by Parnell and Pieterse (2010), issues and implications of a complete right-based agenda for the city are poorly understood and the poor in particular are secluded in spatial planning. This distributive injustice, in the nature of failure to address the needs of the urban poor in terms of access to land, infrastructure, housing and employment creates the condition under which self-organisation, slums and informal settlements occur. The live-worlds in urban Africa and the every-day live activities then follow a common trajectory of informality (see Roy 2005).

3.   Research methodology

Self-organisation is not a contemporary phenomenon. However, with regard to urban development and management, especially, in Ghana it has hardly been taken into consideration. Therefore, in order to reveal the emergent of new urban patterns as a result of interactions between actors in a self-organising society, the study collated data from relevant stakeholders.

Review of literature on Global and African perspectives unravelled the manifestation of the concept of self-organisation in urban areas. The findings from this constituted the framework for analysing the Ghanaian case. Primary data was collected through interviews, Focus Group Discussions, observation and photography at the micro level. Different methods of data collection helped to validate responses. The study conducted 18 semi-structured interviews using questionnaires; including 12 community members, 3 executives of the Slum Union of Ghana, 2 Town and Country Planning Officers and the Manager of Peoples Dialogued on Human Settlement an NGO in the Greater AMA. The semi-structured interviews allowed for a thorough assessment of the phenomena being studied (Sarantakos 1998), and also offered enough flexibility to approach different agencies differently whilst still covering the same areas of data collection (Mohd Noor 2008). The interviews provided information on the processes of self-organisation within the selected settlements as presented in Section 4.

As shown in Table 1 above, informal settlements in the Greater AMA have been grouped according to tenure security and stage of formation. Issues of tenure security tend to influence government decisions either to demolish or intervene in the infrastructural development in the settlements.

Being an explorative study to identify the processes of self-organisation in informal settlements, it is important to understand the process of self-organisation within the selected settlements from the perspective of the settlers and institutions, as they are the

Table 1.   Selected cases.

Community	Land tenure security/Level of tenability	Stage of formation by length of years
Chorkor	Secure	Matured
Amui Dzor	Insecure	Matured

key actors. However, in the Ghanaian context, ambiguity is deeply rooted elements on the ground which prompted the use of triangulation – the use of various methods and data sources ensured that data collected is cross-checked to denote their validity.

4   Case analysis

This section evaluates two cases Amui Dzor and Chorkor. Amui Dzor, is a case, which reveals how contextual factors triggered informal settlers to develop an approach in solving their problems. The case of Chorkor reveals how social cohesion is an opportunity to mobilise local knowledge for community development.

4.1   *Amui Dzor social housing project*

Amui Dzor is a slum community located at the Ashaiman Municipality, which is close to Tema, the industrial hub of the country. Tema is planned as the industrial city of Ghana. During its development many of the workers who came to work at various construction sites and the harbour lived at Ashaiman. Ashaiman therefore served as the dormitory town. Waste wood from the harbour construction sites were used to construct temporary dwelling units by the immigrants. Over the years these wooden structures never got changed and became permanent housing units. This makes the Ashaiman municipality one of the few in the country with about 70% of its settlements being informal (King and Amponsah 2012). The settlement emerged in a self-organising process, beginning from an 'attractive boundary' (which in this case is the city of Tema). Interacting with their environment, the individuals (agents) who migrate to Tema in search of jobs and attractive urban sites are fed with information about their environment which changes their behaviour and drives them to settle at Amui Dzor. The social housing project of Amui Dzor reveals the essence of partnership between informal dwellers and urban development stakeholders in addressing basic social problems.

4.1.1   *Pre-development of initiative*

The initiative began in 2004, when some women who wanted to lessen their economic plight mobilised themselves into savings group. The first initiative was to establish a savings group that would enable them save money and manage their finances. At this stage, members appointed a coordinator, who was in charge of keeping the savings of the group. As an open system, the community exchanged and absorbed information from its external environment. The women groups absorbed ideas and experience through informal interaction and visits to Old Fadama – an informal settlement in AMA – which had a better experience as far as micro savings is concern.

They save daily, mobilising not only financial resources but also collective capacity as members meet weekly to manage their funds and deliberate on pressing issues in the community and formulate strategies for addressing them. By June 2005, the group registered 2000 members and formed a saving cooperative. In 2006, the community increased their savings and opened a savings account with Ghana Commercial Bank where they save weekly. This served as collateral for them to access loans.

4.1.2 *Development and stabilisation of initiative*

This phase started with the formation of Amui Dzor housing cooperative which sets out plans and strategies to invest their savings in a social housing project. This phase is characterised by dialoguing, advocacy and partnership. The openness of the community system became a paramount feature in this phase. Several activities were undertaken at this phase. First was the construction of wooden apartment which served as a pilot project (see Figure 1). The cooperative rented out the apartment to interested members and received a lot more profit which was ploughed back into their savings. This pilot project was not an easy task since it faced restrictions from the municipal assembly which prohibited the construction of new structures in the settlement. But with the commitment of members, some of them moved to stay with friends and donated their pieces of land for construction. This initiative, which proved to be effective, gained the attention of Ghana Federation for Urban Poor (GHAFUP) in 2006. Some of the cooperative members were taken to India on an exchange to study the social housing projects and community-led initiatives on improving housing conditions in informal settlements.

The collective action between the community and GHAFUP's facilitated the formation of a partnership with the UN Habitat Slum Upgrading Facility. At this stage, the cooperative developed the desire to construct social housing. They negotiated with the traditional council of Ashaiman to secure a piece of land and partnered with Tekton Consultants to design the structure. Members also negotiated with the municipal assembly for building permit. The assembly readily issued the permit and offered consultancy services since the project was in line with its slum upgrading strategies.

After gaining the support of the planning institutions, UN Habitat helped to secure a long-term mortgage from Ghana Commercial Bank – with which the cooperative has been transacting business – at an interest rate of 12%. Together with the cooperative initial savings, construction commenced. One annotative strategy that emerged at this stage was the relocation of those residents displaced by the construction to a transitional housing apartment (see Figure 1). The municipal assembly accorded this strategy since it served as a practical example of relocating slum dwellers during upgrading processes.

A three-story structure consisting of 15 commercial stores, 1 and 2-bedroom apartment, and a 12-seater public toilet was constructed. This is managed by the cooperative in

Figure 1.   Left: the pilot project (wooden structure); right: transitional housing. Source: Field survey, 2014.

accordance with their constitution and rental agreements, which subsidises the cost of housing for its members. Non-residents who use the public toilet are charged and the housing cooperative collects this money and uses it to help maintain the facility and also pay back its loans.

The cooperative adopted several strategies to help maintain the facility and pay back its loan. In order to ensure good sanitary conditions within the housing facility, the cooperative signed a contract with the municipal waste department to drain the septic tank of the facility within every 5 months and also collect domestic waste daily. It established a 10-year revolving fund which is an essential element for the repayment of the loan secured. Monthly rental payments from the housing units and commercial stores together with revenue generated from the public toilet and the sale of water are ploughed back into this fund, which continues to revolve fund into new businesses of members and also service the loan. It is expected that, the first 3 years would be used to service the loan and the remaining 7 years use to raise capital for the construction of a new housing project in the community.

The case of Amui Dzor highlights the effectiveness of self-organising process to affordable social housing in informal settlements. The community collectively saves money, which served as collateral to secure credit as well as marshalling the collective capacity and commitment required to sustainable manage projects. Partnership between the community and other stakeholders is important for addressing the social dysfunction that has for long excluded the urban poor – particular dwellers of informal settlements – from decent and affordable housing. This initiative has gained much support from the planning institutions since it fits with the development plans of the assembly. The government of Ghana has adopted the design as a model for in-situ slum upgrading projects and several institutions visit the community to learn.

4.2   Chorkor sanitary facility

Chorkor is an overpopulated slum settlement overlooking the sea southwest of Accra (see Figure 2). It lacks most basic infrastructure and the houses, dating from the pre-colonial and colonial eras, are made of brick and mud. The geographical location of Chorkor and the booming fishing and fish smoking industry has attracted a lot of people from across the country to settle there. The overpopulation coupled with bad sanitary conditions has made it one of the worse slums in Ghana. The increasing population of residents puts pressure on the available facilities resulting in poor management and indiscriminate defecation especially in open spaces (nature reserves), and has been a major cause of diseases like cholera, typhoid and malaria in the community.

4.2.1   Pre-development of initiative

In 2005, a community member built a *Traditional pit-latrine* in his house. This was without the intent of collective action by the community to achieve a collective result. In the course of time, other community members individually adopted the idea without consultation of one another and about six households had constructed pit latrines within 6 months of the initiative emergence. Rains washed away these pit latrines and the idea to collectively construct a *Ventilated Improved Pit (VIP) latrine* emerged. Several community meetings followed this idea. With the moral and financial commitment from community members, an amount was raised to construct the facility.
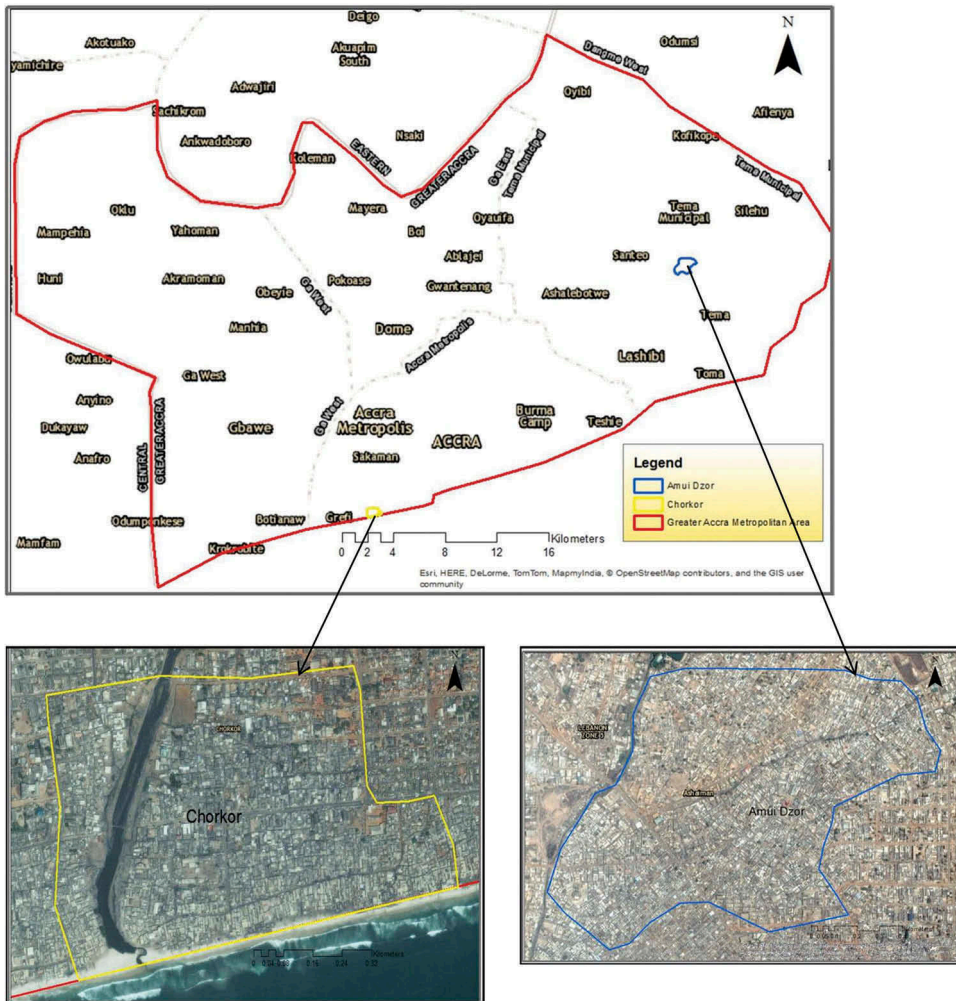
Figure 2.   Geographic location of case study areas.

4.2.2 Development and stabilisation of initiative

A community leader then suggested the idea to build a communal toilet and bath for the whole community with the intention of stopping open defecation. Several community meetings followed this idea. In pursuit of their plan, and with the commitment of community members, the community contributed a certain amount of money in order to support the construction of the toilet facility. Each household was required to contribute 50 Ghana cedis (about 12.5 Euro), and with the communal support of community members the project construction started. It was a 12-seater public toilet with hand washing facilities, 8 public bathrooms, a mechanised borehole which supplied water to the facility and a skip container for waste collection.

However, during the construction of the facility, AMA intervened and stopped the construction. The proposed location for the construction was along the shoreline of the coast and with anticipated Sea Level Rise, the government restricted construction to a

range of 150 m from the coastline. The objective of AMA was to prevent encroachment onto the coastline and to ensure the sanitary facility meet the planning standards of being located 50 m from residential facilities. However, since the available land space was inadequate to meet the required planning standards, the community negotiated with AMA for building permit to construct the facility within their residential area in order to make it more accessible. AMA provided technical support and later added a skip container to the sanitary facility for the storage of waste.

The stabilisation stage of the initiative involved the operation and maintenance of the facility. Compared to the Amui Dzor case, there were no exchanged visits and collaboration with non-governmental organisations (NGOs) in this community.

The sanitary facility (Figure 3) was categorised as an AMA franchise toilet since AMA granted approval to the new site. It is therefore operated by the community under contract with AMA. The community pays 35% of gross monthly revenue to AMA and the remaining profits belong to the community. AMA is also responsible for emptying of the septic tanks and disposal of refuse at the sanitary site.

The mechanised borehole supplied fresh water required for the basic functioning of the toilet facility as well as for cleaning, hand washing and also offered complementary services like public showers. Also, the disinfectants and other cleaning materials were important for maintaining the facility and basic hygienic conditions necessary for continual improvement in community health.

The sanitary facility deeply influenced both domestic hygiene and general sanitary conditions in the community. Waste disposal had become part of the daily life of community members and practiced as routine activity. In one of the interviews, a community member said:

> Every morning, I dispose my domestic waste at this place, free myself, bath and fetch water for my household. It is a four in one facility. Our kids no longer defecate openly and our main sickness of diarrhoea has reduced. We are therefore doing our best to maintain this facility well since it is through our toiled that we had it

Thus, it can be deciphered from the above statement that, the community had realised the benefits of the facility and therefore strives to maintain it since it is their own initiative and was implemented through their own efforts.

Figure 3.   Left: Chorkor toilet and bath facilities; right: pipe-water system. Source: Field Survey, 2014.

4.3. Theoretical analyses of cases

The theory of dissipative structure emphasises on external orientation of the system, in which it exchanges energy, matter and information with its environment. Within the selected informal settlements, dissipative self-organisation occurred because the settlements continuously interacts and exchange information with their external environment through the residents.

For instance, in the case of Amui Dzor, a relationship developed, linking the community to local and international NGOs. At this stage, there was a continuous flow of information 'in and out' of the system which influences the internal self-organisation processes of the settlement as similarly demonstrated in Bénard's experiment. Relating this to theory, the information and knowledge received from external environment symbolises the energy consumed (in the form of heat) by Bénard's cells. As these cells continue to receive energy they export entropy out of the system. In this case, the entropy is the out information, experiences and knowledge shared with institutions, the government of Ghana and the visitors who come to learn from the community. Since the community still maintain the 'in' and 'out' exchange of information, it's more sensitive and able to expand and modify its structure in response to its environment.

Synergetics and actor-networks were also manifested through the interaction between residents of the settlements. In Chorkor, the interrelation between community members was a significant feature. Through these interaction coupled with the emergent commitment of community members, some informal institutions emerged – in the form of rules and regulations. Every household has to participate in the weekly communal cleaning of the sanitary site and defaulters were charged 10 Ghana Cedi (less than 3 Euro). At this point, the initiative gained some robustness through the adoption of informal rules and regulations. In this case, these institutions/rules acted as the *order parameter* that enslaves or guided the behaviour of community members. However, it should be noted that, the 'enslavement' in this case is not direct control (strict rules and regulation) but based on the interactive, consensus and mutual agreement between members of the community. The interaction and interrelation between community members are also influenced by the legislations of Accra Metropolitan Assembly. In the theory of synergetics, this external influence is the *control parameter*. These external institutions/legislations served as 'power input' into the community and causes it to adjust and self-organised under its own capacity.

In the cases above, autopoietic self-organisation is manifested in the regeneration of actors, and more significantly the regeneration and maintenance of the initiative. Autopoietic self-organisation was also exhibited in the meetings among community members and the discussions with both government organisations and NGOs. The results of these discussions served as a point of reference for the regeneration and maintenance of the initiative and also provided the community with standards for the monitoring and the evaluation of their initiatives.

5. Discussion and conclusion

From the above discussion, it can be seen that each case study has its unique features depending on certain contextual factors. However, one common feature among all the case studies is the fact that, they all relate to structural changes through which certain

patterns emerged. This section discusses the case studies from two positions: neighbourhood and regional levels.

At the neighbourhood level, all the studied cases exhibited features of continuous interaction and interrelation between the actors and their environment (both internal and external since we have accepted that the society is an open system which exchanges energy with it environmental – theory of dissipative structures). These continuous interactions resulted in a disparity between *function and structure* causing the community to adjust. With time, these changes in structure and function caused several activities that resulted in new patterns within the settlements.

The case of Amui Dzor was triggered by the socio-economic context of the community. It started as an informal savings group (i.e.: its structure) with the intention of pooling financial resources together (i.e.: function). With time, the continuous interaction between the actors influenced a change in the functionality of the system and a housing cooperative emerged though this was not the initial intention or purpose for their collective action.

Different from the first case, the sanitary facility of Chorkor emerged spontaneously in response to the prevailing environmental conditions without intent and was adopted individually by community members. However, in the course of time, structure and function changed and the community collectively agreed to combine their efforts and pursue one collective goal – which initially was the construction of the public toilet but due to internal and external interactions they later had a sanitary facility.

Relating these to the theories of self-organisation discussed above, the theory of dissipative structures draws attention to the fact that these settlements are open systems that interact with their external environment. The knowledge and experiences gained through these interaction played useful roles in the development and stabilisation of their initiatives. Therefore, as these communities continuously transform, spatial planners should reposition themselves as part of the agents of transformation. This will expose them to the varied interests and the heterogeneity in society and enable them adopt a best fit planning approach. Their ambition should not be to control the system based on predetermined regulations but to adopt and develop smart interventions. These interventions should specifically target the characteristics of actors and try to realise desired patterns of interactions and outcomes.

Also, the theory of synergetic and actor network draw our attention to the interaction and interrelation between the residents of the informal settlements and how they collaborate, develop partnership with other stakeholders to collectively achieve certain goals. This indicates that there is face-to-face interaction, identity and common understanding of joint challenges in informal settlements.

The implication is that there could very well be a mutual interdependence between purposeful interventions that is formal planning and the emergence of spontaneous order due to self-organisation processes. Perhaps spatial planners then become 'trend watchers, 'transition managers' and active actors in the urban transformation process through an understanding of upcoming socio-spatial initiatives in various neighbourhoods. In understanding these initiatives, the decision would be to either negotiate about intervening, allowing it as it is, and even supporting such initiatives or perhaps triggering such processes to a desired intent (see Boonstra 2015; De Roo 2016). The initiative in the case of Chorkor best supports this, where AMA intervened and stopped the construction of the sanitary facility because its location did not meet the planning standard. However, through negotiation between AMA and the community, AMA later provided building permit and technical support for the construction of the facility.

Policymakers, spatial planners and local actors, both formal and informal have to find a synergy and focus on the non-linear processes that might emerge; positive effects should be harnessed and negative effects such as emergence of new informal settlements reduced.

Autopoietic self-organisation finally emphasised how self-regeneration and self-maintenance of the settlements contribute to the stabilisation of the initiatives. This became possible because the initiatives and the institutions that emerged were not imposed on them but were regenerated through a learning process. This also implies that strategies by planners to manage the becoming of civic initiatives should not be predefined but based on an understanding of these initiatives.

These settlements when viewed from the micro level depict some processes of self-governance or self-regulation in interaction with their environment and planning authorities. This reiterates Heylighen (2002) argument that 'controlling agents' – in this case rules and norms – cannot be separated from a system. It is assumed that an internal order can be achieved to cope with the environment in an effective way. The actors are organised but not in an institutional design, which is the responsibility of authorities, in this case it is the responsibility of the neighbourhood. Here too, there are issues of self-regulation which makes it not only robust internally but also robust in its position to interact with institutions. These institutional structures are essential for intersubjective exchange and enable individuals to express themselves as actors in an institutional environment (De Roo 2003). The institutions regulate social actions and enhance the adaptive capacity of the system.

At the higher or regional level, these neighbourhoods are seen as independent actors in the urban core which do not interact with each other. These cases when viewed at this level represent mechanisms of spontaneous, unplanned and unexpected changes in the image of the city (AMA). The cases show self-organising mechanisms with the challenges of financial crisis and housing problems serving as triggers; which unintentionally resulted in spontaneous pattern formation at the regional level.

For the two cases, the challenges of financial crisis and housing problems triggered the construction of the social housing and the sanitary facility at Amui Dzor and Chorkor, respectively. Collectively, these cases represent an adjusting process of actors setting up their strategies to comply with existing contextual factors, following an existing non-linear route, which to some extent is unpredictable. This creates a robust pattern at the regional level.

These cases, when treated as collective activities, imply the spatial planner is confronted with a highly interconnected society which evolves through non-linear chains. This gives us a conceptual view of reality existing out of the many layers of the urban environment. Each layer exchanges energy and information with a higher level, which is digested within the system and causes it to adjust or rearrange creating a continuous linkage of subsystems (neighbourhoods) and systems (City or region)

The case analyses revealed that, self-organisation, especially in developing countries is a potential for development. Understanding the mechanisms of self-organisation may enable spatial planners to influence processes of self-organisation within the daily environment in tandem with planning regulations for the good of society. Therefore, in dealing with self-organisation processes in informal settlements especially those in line with Medium Term Development Plans, local authority may support the process by stimulating it with programmes and incentives.

A lesson from the two case studies is that, self-organisation is case and situation specific. Local development authorities can therefore optimise the processes of self-organisation by creating external conditions, which may stimulate or trigger the process at the community level. This presupposes that spatial planners should focus more on

conditions as a means of regulating development instead of content and process. This implies that plans should be retrofitted to neighbourhoods in accordance with the internal features of these neighbourhoods, rather than using the general planning standards as guiding principles in all cases.

Self-organising social agents however do not behave freely as they are being constrained and enabled by prevailing conditions in various ways. And these conditions could be under change as well (De Roo 2016). Thus, Metropolitan, Municipal and District Assemblies (MMDAs) should monitor the process in order to be able to act accordingly to agents' behaviours in the process. Monitoring should be done by the local authorities through formal/informal community meetings and discussions depending on the conditions of the settlement.

Self-organisation is consequence of social complexity and requires closed monitoring through formal and informal meetings and discussions. Depending on the local conditions, spatial planners particularly Town and Country Planning Departments, local folks and entrepreneurs and all actors in the urban system have to collaborate and find a synergy between plan, its content and the spatial qualities of each community. Each unit must appreciate the interdependency between planning regulations and self-organising behaviours. This would provide a robust condition for integrating spatial planning and spontaneous processes in communities due to self-organisation.

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References

Alfasi, N., and J. Portugali. 2004. "Planning Just-In-Time Versus Planning Just-In-Case." *Cities* 21 (1): 29–39. doi:10.1016/j.cities.2003.10.007.

Andersen, J. E., P. Jenkins, and M. Nielsen. 2015a. "Who Plans the African City? A Case Study of Maputo: Part 1 – The Structural Context." *IDPR* 37 (3). doi:10.3828/idpr.2015.20.

Andersen, J. E., P. Jenkins, and M. Nielsen. 2015b. "Who Plans the African City? A Case Study of Maputo: Part 2 – Agency in Action." *IDPR* 37 (4). doi:10.3828/idpr.2015.25.

Barros, J., and F. Sobreira. 2002. City of Slums: Self-Organization Across Scales. Paper presented at the International Conference on Complex Systems (ICCS2002), Nashua, NH, June 9–14. Accessed 23 January 2014. http://www.casa.ucl.ac.uk/workingpapers/paper55.pdf

Bonabeau, E., M. Dorigo, and G. Théraulaz. 1999. *Swarm Intelligence: From Natural to Artificial Systems*. Santa Fe Institute Studies on the Sciences of Complexity. New York, NY: Oxford University Press.

Boonstra, B. 2015. *Planning Strategies in an Age of Active Citizenship; A Post-structuralist Agenda for Self-organization in Spatial Planning*. Groningen: InPlanning.

Boonstra, B., and L. Boelens. 2011. "Self-Organization in Urban Development: Towards a New Perspective on Spatial Planning." *Urban Research & Practice* 4 (2): 99–122. doi:10.1080/17535069.2011.579767.

Cleveland, J. 1994. "Complexity Theory: Basics Concepts and Applications to Systems Thinking." Innovation Network for Communities. Accessed 23 January 2014. http://www:slideshare.net

Cobbinah, P. B., M. O. Erdiaw-Kwasie, and P. Amoateng. 2015a. "Africa's Urbanisation: Implications for Sustainable Development." *Cities* 47: 62–72. doi:10.1016/j.cities.2015.03.013.

Cohen, B. 2006. "Urbanization in Developing Countries: Current Trends, Future Projections, and Key Challenges for Sustainability." *Technology in Society* 28 (1–2): 63–80. doi:10.1016/j.techsoc.2005.10.005.

De Roo, G. 2003. *Environmental Planning in The Netherlands: Too Good to be True – From Command-and-Control Planning to Shared Governance*. Aldershot, UK: Ashgate Publishers Ltd.

De Roo, G. 2010. "Planning and Complexity: An Introduction." In *A Planner's Encounter with Complexity*, edited by G. De Roo and E. A. Silva. Farnham: Ashgate.

De Roo, G. 2016. "Self-Organization and Spatial Planning: Foundations, challenges, constraints and consequences." In *Spatial Planning in a Complex Unpredictable World of Change*, edited by G. De Roo and L. Boelens. Groningen: InPlanning.

De Roo, G., J. Hillier, and J. Van Wezemael. 2012. "Complexity and Spatial Planning: Introducing Systems, Assemblages and Simulations." In *Complexity and Planning – Systems, Assemblages and Simulations*, edited by G. De Roo, J. Hillier, and J. Van Wezemael, 1–33. Farnham: Ashgate Publishing.

Frissen, P. 2007. *De staat van verschil – een kritiek van de gelijkheid*. Amsterdam: Van Gennep B.V.

Harvey, D. 2008. "The Right to the City." *New Left Review* 53 (Sept.–Oct.): 23–40.

Heylighen, F. 2001. "The Science of Self-Organization and Adaptivity." *The Encyclopedia of Life Support Systems* 5 (3): 253–280.

Heylighen, F. 2002. "The Science of Self-Organization and Adaptivity." *Online*. Accessed 7 January 2014. http://www.eolss.net

Heylighen, F. 2008. "Complexity and Self-organization." In *Encyclopedia of Library and Information Sciences*, edited by M. J. Bates and M. N. Maack. London: Taylor and Francis.

King, R. S., and O. Amponsah. 2012. "The Role of City Authorities in Contributing to the Development of Urban Slums in Ghana." *Journal of Construction Project Management and Innovation* 2 (1): 285–313. Centre of Construction Management and Leadership Development 2012, SA ePublications, South Africa..

Korah, P. I. 2015. "Reinventing the Role of Plans in Guiding Urban Transformation; A Crititical Assessment of the Capacity of Kumasi's Spatial Plans to Guide Foreseen and Unforeseen Urban Dynamics." Master thesis, University of Groningen, Groningen, Netherlands. http://irs.ub.rug.nl/dbi/55d5806a24e5b

Luhmann, N. 1982. "The World Society as a Social System." *International Journal of General Systems* 8 (3): 131–138. doi:10.1080/03081078208547442.

Mabogunje, A. L. 1992. "New Initiatives in Urban Planning and Management in Nigeria." *Habitat International* 16 (2): 73–88. doi:10.1016/0197-3975(92)90038-Z.

Mitleton-Kelly, E., ed. 2003. *Complex Evolutionary Perspectives on Organizations. The Application of Complexity Theory on Organizations*. London: Pergamon.

Mohd Noor, K. B. 2008. "Case Study: A Strategic Research Methodology." *American Journal of Applied Sciences* 5: 1602–1604. doi:10.3844/ajassp.2008.1602.1604.

Njoh, A. J. 2013. "Modernist Urban Planning as a Tool of Acculturation: Implications for Sustainable Human Settlement Development in Cameroon." *City, Culture and Society* 4 (2): 111–120. doi:10.1016/j.ccs.2013.01.004.

Oduro, C. Y., K. Ocloo, and C. Peprah. 2014. "Analyzing Growth Patterns of Greater Kumasi Metropolitan Area, Using GIS and Multiple Regression Techniques." *Journal of Sustainable Development* 7 (5): 13–31. doi:10.5539/jsd.v7n5p13.

Parnell, S., and E. Pieterse. 2010. "The 'Right to the City': Institutional Imperatives of a Developmental State." *International Journal of Urban and Regional Research* 34 (1): 146–162. doi:10.1111/j.1468-2427.2010.00954.x.

Parnell, S., and R. Walawege. 2011. "Sub-Saharan African Urbanisation and Global Environmental Change." *Global Environmental Change* 21: S12–S20. doi:10.1016/j.gloenvcha.2011.09.014.

Portugali, J. 2000. *Self-Organization and the City*. Heidelberg: Springer.

Portugali, J. 2006. *Complex Artificial Environments: Simulation, Cognition and VR in the Study and Planning of Cities*. Berlin Heidelberg: Springer.

Portugali, J. 2011. *Complexity, Cognition and the City. Understanding Complex Systems*. Berlin: Springer- Verlag.

Prigogine, I., and I. Stengers. 1984. *Order out of Chaos: Man's New Dialogue with Nature*. New York: Bentam.

Rauws, W. S. 2015. *Why Planning Needs Complexity: Towards an Adaptive Approach for Guiding Urban and Peri-urban Transformations*. Netherlands: InPlanning.

Rauws, W. S., G. De Roo, and S. Zhang. 2016. "Self-Organisation and Spatial Planning: An Editorial Introduction." *TPR* 87 (3). doi:10.3828/tpr.2016.18.

Rittel, H., and M. Webber. 1973. "Dilemmas in a General Theory of Planning." *Policy Sciences* 4: 155–169. doi:10.1007/BF01405730.

Roy, A. 2005. "Urban Informality: Toward an Epistemology of Planning." *Journal of the American Planning Association* 71 (2): 147–158. doi:10.1080/01944360508976689.

Sarantakos, S. 1998. *Social Research*. London: McMillan.

Seidl, D. 2004. "Luhmann's Theory of Autopoietic Social Systems." Munich Business Research paper. Munich: Ludwig-Maximilians-Universitat Munchen.

Teisman, G., V. A. Buuren, and L. Gerrits. 2009. *Managing Complex Governance Systems*. London: Routledge.

Yeboah, E., and D. P. Shaw. 2013. "Customary Land Tenure Practices in Ghana: Examining the Relationship with Land-Use Planning Delivery." *International Development Planning Review* 35 (1): 21–39. doi:10.3828/idpr.2013.3.

Zuidema, C., and G. De Roo. 2004. *Integrating Complexity Theory into Planning: Truth or Dare*. Groningen: Urban and Regional Studies Institute (URSI), University of Groningen.