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A socio-spatial methodology for evaluating urban land governance: the case of informal settlements

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Urban land has social and spatial dimensions. Governance of urban land should consider these dimensions. Existing methods of evaluating land governance tend to focus on the social dimensions: the spatial dimensions are considered less. A socio-spatial approach developed here is argued to fill this gap. This research supposes that informal settlements can be used to understand urban land governance. A conceptual framework that links urban land governance, socio-spatial dimensions and informal settlements is developed and tested through a case study. The results show that the socio-spatial methodology improved understanding of equity, efficiency and transparency as compared with the existing approaches which are solely based on poor-quality and unreliable data. This methodology can be used beyond informal settlements such as understanding infrastructural delivery and quality, mapping potential conflict areas and urban land uses where governance plays a great role. Overall, the socio-spatial methodology enabled an all-encompassing evaluation of urban land governance.

Keywords: informal settlements; socio-spatial approach; spatial analysis; urban land governance

1. Introduction

Activities on land can be considered from two dimensions: the social and the spatial. The social dimension refers to the actions of peoples when interacting with land. It includes the creation and implementation of formal land policies, laws and administrative systems regarding land tenure, land use, land value and land development. It also includes the informal rules of governing peoples’ interactions with land. The spatial dimension refers to the spatial space where the social processes are operating and decisions out of it are realised in a physical sense. The dynamic relationships between social and spatial processes are considered the key drivers of the economic, cultural and environmental conditions of the built environment (World Bank 2012). The nature of the relationship in different geographic contexts can be understood through the concept of governance and more specifically land governance. In this research, the comprehensive and widely accepted definition of land governance from the FIG/World Bank joint conference is used. Thus, land governance refers to ‘the policies, processes, actors1 and institutions by which land, property and natural resources are managed through decisions on access to land, land rights, land use, and land development’

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In the context of urban land, it is basically about determining and implementing urban land policies and establishing a strong relationship between urban people and urban land.

The urban environment is the result of intricate interaction between spatial, policy, and governance structures (Gottdiener & Hutchison 2011; Dawson et al. 2014). Thus, urban land governance needs to be evaluated to identify the strengths and weaknesses of policy formulation, implementation and its outcomes. One way is to measure governance through assessment of input, process and output indicators (Burns et al. 2010). Inputs include tangible land policies, laws and regulations. Processes encompass the tasks and activities completed amongst the diverse actors during formulation and implementation of urban land policies and laws. Outputs are the results of the social dimension of inputs and processes and are manifested in a spatial dimension. Informal settlements are a good example here for contexts with weak urban land governance. As further explained later, informal settlements are utilised within this research.

A continuing challenge for research aimed at enabling urban land governance evaluation is the integrated inclusion of input, process and output indicators. Burns et al.’s (2010) Land Governance Assessment Framework is perhaps the most developed tool in the domain. Gani and Duncan’s (2007) Good Governance Measurement Indexes are another well cited example. However, both mainly focus on social dimensions of input, processes and outputs: the spatial dimensions receive less attention. Focusing only on the social side of inputs, processes and outputs can be problematic. Markusen (2003) describes how these indicators are often underpinned by umbrella and abstract concepts such as transparency, efficiency, participation, amongst others. Consequently, the empirical evidence of these concepts can potentially lack clarity and reliability, and may be open to subjectivity and bias. For example, a system considered transparent for one subgroup in a community may not necessarily be transparent for another subgroup in the same community. Moreover, existing socio-spatial approaches are confined at the theoretical level and often do not include robust empirical enquiry (Jessop et al. 2008). Therefore, it is argued that new methodologies are required; ones that include consideration of the existing gaps and that apply an integrated socio-spatial approach.

The spatial approach offers promising spatial data gathering and analysis tools that are useful to address important issues of social effects on the spatial system (McLain et al. 2013) such as people to land interactions in the urban context. This approach fills the gaps in data-poor environments especially where data reliability is a concern, such as governance. Dennis et al. (2005) explain how spatial information derived from high-resolution remotely sensed aerial or satellite imagery can be used to empirically measure social effects (i.e. the output of policies). More specifically, various works illustrate the utility of remotely sensed imagery for analysis of urban environmental impact assessment (Rahman et al. 2011), cadastral data updating (Ali et al. 2012), informal settlement analysis (Hofmann et al. 2008; Dubovyk et al. 2011; Owen & Wong 2013), and urban land use mapping (Hu & Wang 2013). However, none of these studies is explicitly linked with urban land governance.

To this end, the aim of this paper is to develop and test a socio-spatial approach for evaluating urban land governance. First, more depth is provided on debates and methodologies relating to socio-spatial approaches for urban land governance, informal settlements and urban land governance relations, and the contribution of remotely sensed data to urban land governance assessment. From this background, a new socio-spatial methodology for evaluation of urban land governance is proposed and described. A specific case for application is then outlined. Ethiopia is the selected case study country. For various
reasons, its urban areas are rapidly expanding: the need for socio-spatial assessment tools is most evident in these contexts. Additionally, in Ethiopia, urban and rural lands are governed by independent policy, legal and organisational frameworks. This simplifies the analysis, enabling urban land governance to be considered in isolation. Care is taken to outline the nature of the social and spatial data utilised. The results of the analysis are consequently presented and discussed. The paper concludes with a summary of findings relating them to the methodology, case study results and their implications for urban land governance.

2. Conceptual underpinnings

Urban land governance as a socio-spatial phenomenon

Urbanisation is a composite process of social and spatial dimensions (Vis 2012). The contested interactions between social and spatial phenomena in urban areas are the focus of increased academic enquiry. Drivers for the discourse include: urban areas increasingly being the major determinant of economic, social, political and environmental contexts within countries, the world’s population being increasingly urbanised, the escalating demand for natural resources (e.g. land), and the rise of different problems related to urbanism, including informal settlements and slum formation. These problems are driven by social processes and are manifested physically in a spatial dimension.

High contemporary rates of urbanization and the associated problems threaten the capacity of both local and national governments, especially in developing countries (Cohen 2006). In this regard, the concept of governance is considered central to dealing with the interwoven problems of urbanisation: governance theories suggest the need for inclusive, participatory, equitable and accountable decision-making. These principles are manifested in the input, process and output indicators of land governance (Burns et al. 2010). For example, if different actors, including citizens, are allowed to participate in policy-making and implementation, improved transparency, trust and citizen empowerment are the suggested result. In other words, uncertainties of the policy plans and its implementation can be reduced (Dawes 2010; McCall & Dunn 2012).

The diverse interests need to be discussed and dialogued among the different actors in accordance with the urban land policy and laws, and the spatial plans during decision-making on the use of urban land. This implies that actors determine the fate of policy-making and implementation outcomes (Ajakaiye 2007). However, allowing actors to contribute to the policy making process, and its implementation, can have positive or negative impacts upon governance. Diverse actors generate new ideas and knowledge to solve problems. This fosters shared and transparent decision-making. Overall, diverse actors are argued to improve decision-making, and lead to improved service delivery and urban development by reducing corruption and litigation activities. Meanwhile, the diverse nature of actors, especially in urban land, does mean conflicting roles and interests are involved. In this regard, decision-making may take longer than expected: it is difficult to organise the diverse actors and arrive at consensus. If actors are not satisfied they may actively prevent the implementation of political decisions (Huësker & Moss 2015).

Furthermore, participatory processes are resource-consuming, can undermine government efficiency, and can ultimately be to the detriment of development (Ajakaiye 2007; Pahl-Wostl 2009). Such problems can be handled by compromise and aligning the different interests of the actors to the land policy objectives and government’s political interests.

The previous discussions show that there exists continuous interaction among land policy and laws, actors, and urban lands. One
opportunity for evaluating urban land governance from both social and spatial dimensions is to utilise the approach used by Burns et al. (2010). The approach involves consideration of input, process and output indicators.

- Input indicators – refer to land policies, laws and regulations. They are rules that can be implemented by diverse actors during their interaction to use the spatial systems.
- Process indicators – refer to the interaction within and among the different actors that have roles on urban land.
- Output indicators – refer to the combined results of input and process indicators. Both the positive and conflicting roles of actors are shown on the output indicators and are manifested on a spatial dimension (e.g., informal settlements).

Socio-spatial theories argue that society and space are indivisible, inter-reactive and interdependent (Vis 2012). Ruiz-Tagle (2013) also reveals that social systems exist in a specific spatial boundary and in their co-existence the spatial systems undergo reconstruction and transformation by the social systems. The continuous interplay between policy and laws, actors and urban land can be a potential good example here. Because of the interconnectedness of the social and spatial dimensions, contemporary literature focuses on how to deal with the different issues in the urban areas through a socio-spatial theory. For example, Mattingly and Morrissey (2014) assess housing and transportation affordability using a socio-spatial indicators and recognise a different pattern of affordability as compared with the one-dimensional social or spatial consideration. Letema et al. (2014) explain the pivotal roles of spatial information and actor arrangements for locating sanitation technologies. Furthermore, Tedong et al. (2014) examined the social and spatial implications of guarded neighbourhoods in urban Malaysia and noticed the existence of social exclusion among the different neighbours. In a similar way, urban land governance can also be evaluated through combined consideration of social and spatial dimensions (Figure 1).

The potential link between indicators of land governance, social and spatial dimensions and their governance components along with the potential causes and effects of their poor performance are illustrated in Figure 1.

Figure 1 illustrates the integration between different components in urban land governance:

- Integration within the social dimensions (e.g. policy and legal frameworks with actors).
- Integration within the spatial dimensions (e.g. urban land with informal settlements).
- Integration between social and spatial dimensions (e.g. the causes and effects of poorly functioning policy, laws and actors on urban land).
- Integration between indicators of urban land governance with the social and spatial dimensions.

Understanding these integrations could help to pinpoint the elements that are integrated poorly or efficiently. In other words, it gives feedback on the effects of policies and actors on the use of urban land. This implies that the socio-spatial dimension helps to understand the full spectrum of urban land governance. Therefore, a framework for evaluating urban land governance could build on this conceptual model.

Informal settlements and urban land governance

According to UNSTAT (2005) informal settlement are ‘areas where groups of housing units have been constructed on land that the occupants have no legal claim to, or occupy illegally. They are unplanned settlements and areas where housing is not in compliance with
current planning’. The literature (e.g., Shabane et al. 2011 and Abbott (2002)) describes informal settlements as those settlements that do not adhere to local building codes, have either low levels of infrastructure or no infrastructure (e.g. water, power, sanitation, health centres and roads), have informal or no security of tenure, and are characterised by irregular patterns. Whilst many indicators are relevant to evaluate urban land governance, the existence and extent of informal settlements is one that receives high attention. Van der Molen (2014) highlights that governance is the main issue in both improving and worsening informal settlements. According to Haferburg (2002), the proliferation of informal settlements is a sign of the existence of inequality, especially exclusion of minority and low-income people from accessing urban lands. Besides, different factors are articulated as contributing to the expansion of informal settlements, including population growth and rural to urban migration (Dubovyk et al. 2011; Shabane et al. 2011), lack of a pro-poor housing policy (UNECE 2009), poor information systems (Shabane et al. 2011), poor urban planning and land management practice (Roy 2005), inappropriate land tenure systems (Porter 2011; Jones 2012), lack of enforcement of policies and rules due to weak and ineffective governments (Pahl-Wostl 2009; UNECE 2009; Shabane et al. 2011) and political uncertainties and transitions (Niebergall & Loew 2008). These and other interrelated factors mainly originate from poorly functioning social dimensions, including the input and process indicators that lead to the physical manifestation of informal houses at a spatial location (Figure 1). From the different factors listed, it is evident that informal settlements are the outputs of weak land governance (cf. FAO and UN-HABITAT 2009 and Burns et al. 2010). Consequently, they are an indicator of primary concern for evaluating urban land governance.

The above-mentioned factors of informal settlement can be further differentiated into direct and underlying causes. Similar distinctions are used in Dennis et al. (2005) to understand the causes of forest fires in...
Indonesia. In this research context, direct causes refer to specific events (e.g., disputes and economic strain) that motivate people to take immediate and practical actions at a local level (e.g., informal landholding), whereas underlying causes are fundamental to legal, policy and actors. They are distant reasons for people to take actions. In this regard, they underpin the direct causes (cf. Contreras-Hermosilla 2000 and Dennis et al. 2005). Therefore, synthesising the causes of social dimensions and their effects on a spatial dimension is useful to understand informal settlements and thereby urban land governance.

Remote sensing and urban studies

Location plays a central role in policy and political and cultural understanding (Lebel et al. 2007). Meanwhile, new technologies enable the capture and compilation of new indicators for understanding urban land governance. Geospatial information, which is the result of such technologies, is useful to capture implicit or explicit location knowledge (de By & Georgiadou 2014) of surface artefacts. Tools such as Geographic Information Systems (GIS) including spatial analysis and remotely sensed aerial or satellite imagery are prime examples of sources of spatial information. Spatial analysis is motivated by demands that are generated by social phenomena (Anselin 1999). It is increasingly recognised as useful in understanding the effects of social systems at a location (Goodchild et al. 2000). Remote-sensing data sources such as high-resolution images (e.g., QuickBird and GeoEye) provide detailed data about specific surface features. For example, in urban areas these images clearly depict individual buildings in slums, roads, and patterns of features (cf. Sliuzas et al. 2010).

Remote-sensing sensors record data about the built environment by means of reflectance values derived from electromagnetic radiation. However, remote sensing only records human and natural artefacts (e.g., buildings, roads, and land use). These features are obviously derivatives of government policies, organisational capacities and land tenure characteristics. Meanwhile, none of these is directly reflected in the electromagnetic radiation that gets recorded in the sensor system. Attribution problems in this case are tackled by analysing social data collected on the performances of policies, organisations and other related factors. Such data can lead to understanding of different direct and underlying causes (see previous discussions) and thereby their combined effects on the policy outputs. Similar works by Geoghegan et al. (1998) and Cowen and Jensen (1998) show that indicators such as equity can be studied from remotely sensed data through the analysis of plot size, the nature of roads and the pattern and density of buildings. Such integrated applications of remote sensing make it recognised as a policy assessment tool (Gatrell & Jensen 2008). The other advantage of remote sensing especially in decision-making is due to the fact that it creates potential visual effects in the visualisation of outputs of public policies.

Specific to the notion of informal settlements, remotely sensed data also have high utility. In such contexts, textual or attribute information is often not readily available (Fekade 2000). This is because informal settlements by nature are highly dynamic (Hofmann et al. 2008; Niebergall & Loew 2008) and are usually excluded from government census records (Niebergall & Loew 2008; Owen & Wong 2013) and cadastral records (Fekade 2000; Hofmann et al. 2008; Potsiou 2014). Remote sensing can fill this gap.

Meanwhile, using remote sensing for identification of informal settlements is not a straightforward process. First, the criteria for informal settlements, which vary from place to place and with the resolution of the remote-sensing image, need to be defined (see Table 1). These indicators should be measurable, easily quantifiable and observable from the remotely sensed image (Hoornweg et al. 2007).
In summary, this section demonstrated how the socio-spatial approach could be operationalised by equal consideration of input, process and output indicators. The existence and extent of informal settlements were demonstrated as an important indicator in this regard. The data-poor nature of both informal settlement and governance analysis benefits from the state of the art of remote sensing technologies. These lessons provide the foundation for the socio-spatial method for evaluating urban land governance that is now presented.

3. Research methods

Contemporary research (e.g., Yeager and Steiger 2013) suggests the application of mixed methods that comprises of social and spatial analysis techniques to better understand and resolve the social influences on spatial systems. Pahl-Wostl (2009) also pointed out the need for developing more interdisciplinary approaches to enhance the knowledge base and understanding of governance. In this research, a socio-spatial approach for evaluating urban land governance is developed and applied. Based on the arguments in the previous sections, the methodology is composed of three parts: literature review, social data collection and analysis, and spatial data collection and analysis.

### Literature review

Literature reviews on concepts of urban land governance and its socio-spatial dimension were undertaken in order to understand the debates on socio-spatial approaches and its usefulness to urban land governance. Useful criteria for discriminating informal from formal settlements were also reviewed (Table 1). Similar criteria were also used in Owen and Wong (2013).

### Social data collection and analysis

The social data collection was done through a field survey. A total of 115 questionnaires and three group discussions composed of six participants were conducted. Land administration and development department heads at both Dar municipality and the Amhara Region Industry and Urban Development Bureau were interviewed. Residents for questionnaire were selected randomly, whereas society representatives for group discussions were selected in consultation with Kebele3 experts. In both cases, the objectives of the study were made clear to participants. Meanwhile, the questions asked were systematically designed. First, participants were asked to list causes of informal settlements in Bahir Dar. Second, they were asked to use a Likert scale to assign a value to the cause. Third, the participants needed to reason why and how a selected cause

### Table 1. Summary of useful criteria for discriminating informal from formal settlements during image analysis

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description of the criteria in the context of informal settlements</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetation</td>
<td>Lack of or low vegetation cover</td>
<td>(Muriuki et al. 2011; Hofmann et al. 2008)</td>
</tr>
<tr>
<td>Road type and material</td>
<td>Short length, irregular and narrow width</td>
<td>(Niebergall &amp; Loew 2008; Kohli et al. 2012; Owen &amp; Wong 2013)</td>
</tr>
<tr>
<td>House size</td>
<td>Small dwelling size</td>
<td>(Niebergall &amp; Loew 2008)</td>
</tr>
<tr>
<td>Housing density</td>
<td>Lower nearest neighbourhood distance</td>
<td>(Hofmann et al. 2008; Kohli et al. 2012)</td>
</tr>
<tr>
<td>Building orientation/pattern</td>
<td>Precarious house placement (randomly oriented) and simple in shape</td>
<td>(Myint et al. 2006; Stasolla &amp; Gamba 2007)</td>
</tr>
</tbody>
</table>
played a role in the informal settlement development. The intent was to capture important issues of the causes and effects of the poorly functioning urban land and other policies and laws, and urban land and other actors and their interaction during policy-making and implementation (Figure 1). This helped to understand the specific causes of informal settlements in Wuramit Kebele and their effects on the urban land.

Overall, the data collection strategies and questions asked were designed to distinguish the direct and underlying causes of the spatial and temporal expansion of informal settlements, in the Kebele case study during the social data analysis (Figure 2). Questionnaire data were analysed using descriptive statistics whereas interview and group discussion data were compared to derive common facts.

**Spatial data collection and analysis**

Spatial data for this research were collected from satellite sources including a QuickBird image of 2004 with spatial resolution 0.6 m and a GeoEye image of 2012 with spatial resolution 0.5 m. The GeoEye data were purchased from Geoserve Company whereas the QuickBird data were from Bahir Dar University databank. The cadastral map was from the consultant who developed it, whereas the land-use map was from the Amhara Region Institute of Urban Planning.

GPS was used during the field survey to collect ground truth data for informal settlement boundaries, main roads and other reference points. These were used to support the spatial analysis.

The images were analysed using segmentation and object-oriented analysis. A semi-automatic object extraction was preferred (cf. Baud et al. 2010): it avoids some of the limitations of automatic object detection when applied to informal settlements. These include continuous rooflines, improper pixilation of building outlines and incorrect dwelling separation due to diverse materials on a single roof (Owen & Wong 2013). Kohli et al. (2012) and Baud et al. (2010) suggest applying visual image interpretation and field surveys to minimise such problems. The same is applied here.

The settlement layers extracted from the satellite images were also used for overlay analysis with the land use and cadastral maps.

The overall methodology can be viewed as a socio-spatial approach (Figure 2).

### 4. Description of the case study

The developed methodology was applied in Bahir Dar city, the capital of Amhara National Regional State in the Northwest of Ethiopia (Figure 3). The city is divided into nine administrative Kebeles. Like other cities and towns in the country, informal settlements in Bahir Dar are a common phenomenon. Informal settlements are locally called ‘yechereka bet’. The literal translation is ‘moon house’: they are built at night.

In Bahir Dar, new informal settlements are found in peri-urban Kebeles, whereas, the old ones are usually found in the central and sub-central parts of the city. To understand the social and spatial dimensions of informal settlements, a peri-urban Wuramit Kebele was chosen. The selection was made in consultation with municipality officials and people representatives from all the Kebeles.

Wuramit Kebele is located in the northwest of Bahir Dar. From 2004 to 2012 rapid expansion of informal settlements was experienced especially in pocket areas that are covered by eucalyptus and khat plantations. This strategic situation makes them far less visible to municipal and Kebele officials: they can develop and expand for extended periods.

The Wuramit Kebele administration office does not have official socio-economic data about the Kebele. The data in Table 2 are estimated from the discussion conducted with the Kebele officials and the people living in the Kebele.

Table 2 shows the low income status of the residents in Wuramit informal settlements.
The type and quality of the houses signify this. Most of the houses are single-room, congested and poorly sanitised. The informal settlements in Wuramit Kebele lack access to basic infrastructures and services including road, water and electricity. They get water and power at unfair prices from the formal settlements. This has exposed them to additional living costs.

5. Results

In this section, the social and spatial data analysis results for Wuramit Kebele informal settlements are presented.

**Social data results**

The social data collected during the field survey were identified as direct and underlying causes of informal settlements in Wuramit Kebele. Additionally, data from the group discussions and interviews were used to complement the discussion. The results of the social data analysis are presented in Table 3.

The percentage of responses shows that both the direct and underlying causes exhibit very high to high contributions to the spatial expansion of informal settlements over time in the Kebele (Table 3).
Spatial data results

The spatial analysis involves image segmentation and image classification. The results of these steps are now presented here.

Image segmentation

The first step in object-based feature extraction is image segmentation. The purpose is to create image objects through partitioning the entire image into constituting objects (segments) based on the spectral signature and geometric characteristics of features. A multi-resolution segmentation minimises the average heterogeneity and maximises their respective homogeneity (Trimble 2012). It is also used here. This step requires adjusting the scale factor, shape and compactness parameters. Different values for these parameters for QuickBird and GeoEye were used (Table 4).
because the two images have different scene and geometric properties.

**Image classification**

The second step in object-oriented analysis is image classification. The segments identified by the segmentation process are now assigned to classes. The dominant classes identified during the field study are vegetation, roads, buildings and open spaces (Table 5). The criteria presented in Table 1 were applied here to discriminate one class from another. For example, vegetation was distinguished from other classes using the Normalized Difference Vegetation Index (NDVI). Roads were discriminated using width and asymmetry parameters. However, a number of elongated house roofs and open spaces were misclassified as roads. In such cases, manual techniques, which were supported by visual image interpretation and knowledge of the area, were applied to classify the misclassified ones in their appropriate class. The building class, which was further classified as formal and informal building during level 2, was discriminated using shape index and brightness. Finally, the unclassified objects were assigned to an open space candidate class.

Buildings in informal settlements have different characteristics from those in formal settlements. It was recognised during the fieldwork that the average maximum distance between road and formal building is 50 metres. The distance of roads from buildings is as used in Owen and Wong (2013). Thus, to discriminate informal settlements the 50 m threshold value was used in a level 2 classification to discriminate informal buildings from formal buildings (Table 6).

However, a few old informal settlements which are close to roads were misclassified as formal settlements. In such cases, a manual technique was applied to classify them in their appropriate class. Figure 4 shows the image analysis results for QuickBird 2004 and GeoEye 2012.

Figures 5A and B show a GIS overlay analysis of informal settlements in 2012 with the land use and cadastral map respectively.

### 6. Discussion

This section discusses three main outcomes of the research: the developed methodology, the causes of the spatial expansion of informal settlements and their implications for urban land governance.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated households</td>
<td>2000</td>
</tr>
<tr>
<td>Average family size per household</td>
<td>6</td>
</tr>
<tr>
<td>Job types</td>
<td>99 percent daily labourers</td>
</tr>
</tbody>
</table>

#### Access to infrastructure

<table>
<thead>
<tr>
<th>Water</th>
<th>No access to water; they buy water from nearby formal settlements. The cost for 10 litres of water is 1 Ethiopian Birr (ETB). Its price in city centres is 0.25 ETB.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>No access to power; they buy power from nearby formal settlements. The cost of running on bulb is 30 ETB, whereas the cost in city centres is 10 ETB.</td>
</tr>
<tr>
<td>Health center</td>
<td>No health centre within and around the informal settlements.</td>
</tr>
<tr>
<td>Police station</td>
<td>A police station has recently been built.</td>
</tr>
</tbody>
</table>
In section one, two contemporary gaps were mainly discussed: (1) the data-poor nature of existing social inclined land governance evaluation approaches and (2) the lack of methodologies that integrate the social and spatial dimensions in the evaluation of land governance. Whilst the socio-spatial approach is not novel in a general sense and is applied in other domains (e.g. sociology; cf. Vis 2012), it remains theoretical in other domains, and had certainly yet to be applied to the land governance domain. In this research, a socio-spatial methodology specific to evaluating urban land governance is developed and tested with empirical evidence. The developed methodology enabled an understanding of both the spatial expansion of informal settlements and their socially driven causes, which are identified as direct and underlying causes. The methodology developed here clearly demonstrates the ‘where’, ‘how’ and ‘why’ of the informal settlements developing in Wuramit Kebele.

To be more specific, the ‘where’ question clearly portrays the spatial dimension (see Figure 4) in different epochs. Linking the spatial analysis results with social data from the ground provided answers to questions about ‘how’ and ‘why’ the informal settlements exist. A detailed analysis of the ‘why’ and ‘how’ questions led to identification of causes as direct and underlying causes (Table 3) that are responsible for the effects on the spatial dimension as shown by informal settlement (Figure 4). Another capability of the spatial analysis as demonstrated in this research is its potential to drive understanding of temporal trends in informal settlements (in this case between 2004 and 2012). This was not possible to do solely by using the social analysis results. Similarly, the direct and underlying causes could also not be extracted from spatial analysis alone. The tackling of such gaps calls for a socio-spatial methodology.

However, a case study specific limitation is observed on the spatial analysis. The literature (e.g., Kohli et al. 2012) considers the colour of roofs as a useful indicator for informal settlement discrimination, whereas this indicator was found to be less useful here. This is because there are people in both the informal and formal settlements who have similar low socio-economic status and they use roof

<table>
<thead>
<tr>
<th>Table 3. Direct and underlying causes for expansion of informal settlements in Wuramit Kebele</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Responses (%)</strong></td>
</tr>
<tr>
<td>Very high</td>
</tr>
<tr>
<td>Direct causes</td>
</tr>
<tr>
<td>Election-time political uncertainties</td>
</tr>
<tr>
<td>Economic crises</td>
</tr>
<tr>
<td>Underlying causes</td>
</tr>
<tr>
<td>Inefficiency of local government</td>
</tr>
<tr>
<td>Improper implementation of land and housing policy</td>
</tr>
<tr>
<td>Weak urban land use planning and cadastre system</td>
</tr>
<tr>
<td>Low price of urban land in the informal land market</td>
</tr>
<tr>
<td>Shortage of houses at affordable rental price</td>
</tr>
</tbody>
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<table>
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<tr>
<th>Table 4. Multi-resolution segmentation parameters</th>
</tr>
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<tbody>
<tr>
<td><strong>Segmentation parameters</strong></td>
</tr>
<tr>
<td>Scale</td>
</tr>
<tr>
<td>Shape</td>
</tr>
<tr>
<td>Compactness</td>
</tr>
</tbody>
</table>
materials similar in both type and quality. In such cases, the roofs do not show much difference in the remotely sensed images.

**Causes of informal settlements in Bahir Dar**

Figure 1 shows that the causes of informal settlements originate when the social dimension composed of land policies, laws, diverse actors and their continuous interactions is poorly functioning. Based on the discussions provided in section 2, the direct and underlying causes of informal settlements in Bahir Dar are analysed (Table 3). These causes combined have effects on the urban land (Figure 4). The detail of these results is now discussed here.

**Direct causes**

The results in this research show that election-time political uncertainties and the economic crises were the main direct causes of informal settlements in Bahir Dar. Obviously, both originate from problems associated with the social dimension. The government administration vacuum, resulting from the 2005 national election, and the effects of the 2008 and 2009 global economic crises motivated the urban and peri-urban poor to take immediate action: they acquired land through informal means and constructed illegal houses. The causes and resultant effects of such uncertainties are illustrated in Figure 1. More specifically, the physical effect in the real situation is shown in Figure 4. The responses from respondents regarding the two instances are now discussed.

**Election-time political uncertainties**

The response in Table 3 show that 55.6 percent of the respondents believe the election dispute in 2005 had a high to very high contribution to the expansion of informal settlements in Wuramit Kebele. According to the respondents in the group discussion, the election dispute was the prime cause of the proliferation of informal settlements in this particular Kebele. This is also witnessed by Figure 4A, showing that few farmers were settled in 2004. People were motivated by the administration vacuum created following the unstable moment to get land in an informal way. Respondents, both in the group discussions and in the questionnaires, claimed that the government was reluctant to take immediate action against such illegal activities because it was taken as one means to divert the attention of the people from taking part in the political dispute processes.

**Table 5. Parameters for discriminating candidate classes**

<table>
<thead>
<tr>
<th>Candidate classes</th>
<th>GeoEye 2012</th>
<th>QuickBird 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetation</td>
<td>NDVI &gt; 0.37</td>
<td>NDVI &gt; 0.4</td>
</tr>
<tr>
<td>Road</td>
<td>Width &gt; 7 m</td>
<td>Width &gt; 7 m</td>
</tr>
<tr>
<td>Building</td>
<td>asymmetry &gt; 0.84</td>
<td>Asymmetry &gt; 0.76</td>
</tr>
<tr>
<td></td>
<td>Shape index &lt; = 3.4</td>
<td>Shape index &lt; = 2.5</td>
</tr>
<tr>
<td>Open space</td>
<td>Unclassified to open space</td>
<td>Unclassified to open space</td>
</tr>
</tbody>
</table>

**Table 6. Parameters for discriminating informal settlements from formal settlements**

<table>
<thead>
<tr>
<th>Class</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 2</td>
<td>Building within distance &lt; = 50 m from roads</td>
</tr>
<tr>
<td>Formal building</td>
<td>Building with distance &gt; 50 m from roads</td>
</tr>
<tr>
<td>Informal building</td>
<td></td>
</tr>
</tbody>
</table>
Table 3 shows that 86.5 percent of the respondents agreed that the economic crises of 2008 were a highly to very highly significant direct cause of the development of the informal settlements. In the group discussion, respondents mentioned that about 50–60 percent of the expansion of informal settlements in Wuramit Kebele took place in 2008 and 2009, peak times for the global economic crises. According to the respondents, the prices of food items and commodities grew exponentially between 2008 and 2009 and the low-income people were unable to cover different expenses, including paying house rents.

Overall, the two direct causes of informal settlements in Bahir Dar are in agreement with Abbott (2002): a correlation between informal

![Figure 4. Informal settlements in Wuramit Kebele: (A) QuickBird 2004, (B) GeoEye 2012](image)
settlement expansion and uncertain political and economic situations exists. Next, the underlying causes that underpin the direct causes are discussed.

**Underlying causes**

The low-income people in Bahir Dar were motivated to get land informally and construct illegal houses during the instances discussed earlier. This illustrates dissatisfaction with existing service delivery (in this case lack of affordable houses and access to urban land). Such problems are attributed to numerous and interrelated underlying causes. They are also considered in the socio-spatial framework (Figure 1) and their effect in the real situation is shown in Figure 4. Specific to Bahir Dar, the following major underlying causes are discussed.

**Inefficiency of local government**

Local governments are the main actors in people-to-land interactions. The effect of policies and laws on the spatial system is dependent on how efficient the local governments are in implementing them. Table 3 shows that 73.9 percent of the respondents mentioned that inefficiency of the local government in Bahir Dar had a high to very high underlying role in triggering informal settlements. It was mentioned during the group discussion that the municipality of Bahir Dar came to know about the informal settlements in Wuramit Kebele long after they were established. This indicates that the capacity of the local government to cope with the different strategies used by the local people was low. In this research, inefficiency of local government appeared to be the major underlying cause for the expansion of the informal settlement in Wuramit Kebele.

**Improper implementation of land and housing policy**

Table 3 shows that 62.6 percent of the respondents mentioned that weak implementation of land and housing policy played an important to very important role in the circumstances that led to informal settlements. The case of the condominium housing policy, which was principally meant for low-income people, was mentioned in the group discussion: the initial down-payments to get the condominium house and the monthly payments to repay the bank loan were high. In addition, large numbers of condominium houses were sold for government agencies and some condominium houses were sold through bidding at high prices where the low-income people were unable to compete financially. Such unintended outcomes of condominium policies are also observed in Addis Ababa (Wubneh 2013). The low-income people feel neglected by the government’s housing scheme.

**Weak urban land use planning and cadastral system**

Land use planning and cadastral systems play important roles in urban development. Table 3 shows that 73.1 percent of the respondents agreed that a weak urban land use planning and cadastral system triggers informal settlements. The spatial analysis results in Figure 5A show that both the formal and informal settlements in Wuramit Kebele are taking place on areas designated for other land use classes on the land use plan. Contemporary urban developments are also taking place outside the cadastral boundary of the city (Figure 5B). This shows that both the urbanisation and associated land demands exceeded the capacity of the existing land use plan and cadastral system. According to experts in Bahir Dar municipality and Amhara Region Industry and Urban Development Bureau, lack of national land use and information system policy and related laws are reasons for the existence of weak urban land use planning and land management.

**Low price of urban land in the informal land market**

Shortage of land supply and the high price of land in the formal land market triggers
Figure 5. GIS overlay analysis of informal settlements in Wuramit Kebele with (A) land use plan map and (B) cadastral map
informal land transactions (Jones 2012). Table 3 shows that 69.6 percent of the respondents agreed that low prices for urban land in the informal land market contribute to the development of informal settlements in Wuramit Kebele. According to the group discussion, the land price in Bahir Dar keeps on rising over time. This makes land unaffordable, in a financial sense, to the urban poor. On the other hand, the low price, less complex and less bureaucratic processes in the informal land market, as compared to the formal processes, mean it becomes an option for the urban poor. According to Adam (2014), the non-state institutions also play a role in the informal land market in Bahir Dar.

Shortage of houses at an affordable rental price

The continuously increasing population in Bahir Dar creates a shortage of houses and consequently a rise in rental prices. Table 3 shows that 70.5 percent of the respondents agreed that the shortage of houses and the high rental price of the existing houses led to informal settlements in Wuramit Kebele. In the group discussion, it was mentioned that due to the price inflation of goods during the periods of the economic crises, the urban poor could not afford to pay rent for a house. This pushes the urban poor into becoming involved in informal land occupation.

Overall, the socio-spatial analysis clearly scrutinises the two types of causes that are mainly attributed to the social dimensions and their effects on the spatial dimension. Such an integrated assessment of causes and effects of social dimensions on the spatial dimensions is useful to understand the workability of government urban land policies and laws, and the capacity of diverse actors in particular and the situation of urban land governance in general.

Implication for urban land governance

Analysis of informal settlements through a socio-spatial approach has different implications for urban land governance. The spatial analysis results in Figures 4 and 5 show that the service delivery situation (e.g., formal land delivery) in Wuramit Kebele is poor. In addition, these results also show trends of inequity from 2004 to 2012. Here, one should note that a great majority of the people who live in the informal settlements are poor day labourers (Table 2). Without the spatial results one could argue that there is no change to the informal settlement over time. This is because there are no well-organised current data, let alone time-series data, for the informal settlements. Furthermore, Figures 5A and B indicate the poor implementation of the land use plan and Cadastre systems and Figure 4B also demonstrates that the current formal urban expansions are taking place outside the cadastral boundary and on land that is designated for other purposes. Overall, the combined results from the social and spatial analysis clearly show how efficient the government is in dealing with the unprecedented urban growth in Bahir Dar.

Referring back to the spatial results in Figures 4 and 5, they are derived from independent data sources. According to Geoghegan et al. (1998), human interference is low in raw satellite images: satellite sensors provide data as they arise in situ. Analysis of such independent data fills the gaps in existing social data collection, which is often encumbered with a lack of transparency, unreliability and bias. In this way, the spatial results improve informed decision-making, especially in data-poor contexts. From the spatial results one can also infer the social causes and assist in tracing the accountable parties.

Overall, the coupling of social and spatial dimensions, via a socio-spatial approach, helps in forming an understanding of governance principles such as quality of service delivery (e.g., shortage of affordable rental houses), inequity (e.g., lack of access to urban land and infrastructure for low-income people) and inefficiency of local governments. The nature of the satellite data provides results that are
transparent and assist decision-making based on transparent data.

7. Conclusions
This paper creates a conceptual, methodological and empirical link between indicators of urban land governance, social and spatial dimensions, and informal settlements. This assists the evaluation of urban land governance: outputs can be traced back to the contributing inputs and processes. In this regard, informal settlements appeared to be a useful example: causes are easily understood from social analysis and the effects on the spatial dimension are easily mapped using modern geospatial tools. In this context, this research has brought the social and spatial dimensions together, which previously were distanced from one another in evaluations of urban land governance.

Governance is about making decision-making and service delivery transparent, efficient and equitable. In the context of urban land, this relates directly to land and housing access. A lack of access leads to informal settlements. The socio-spatial methodology developed in this research demonstrates the intertwined cause and effect roles of the social and spatial dimensions in the proliferation of informal settlements, and thereby produces an improved understanding of equity, government efficiency and transparency, as compared to existing approaches which are solely based on limited social datasets. Land governance is not limited to issues of informal settlements: it embraces all the activities in the urban people-to-urban land relationship. Thus, the methodology developed can also be used beyond the context of informal settlements. For example, creating spatial and temporal understanding of infrastructural delivery, mapping potential conflict areas and examining urban land use are all potential application areas.

Specific to the case study, this research showed that recent formal and informal developments in Wuramit Kebele do not correspond with the de jure land use and cadastral map. Overall, this research indicates that the government should work towards improving the direct and underlying causes of informal settlements and urban land governance in general.

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Notes
1. Actors refer to representatives of organisations and interest groups in urban land.
2. Though these areas have direct or indirect linkage with urban land governance.
3. Kebele is the lowest government administrative unit in Ethiopia.
4. Current expansions are also taking place outside the pocket areas in Wuramit Kebele.
5. The black broken rectangle shows formal buildings.

References


Haferburg, C. (2002) The informal settlement Phola Park in the context of Cape Town’s plans for...


