Better Understanding Self-Organizing Cities: A Typology of Order and Rules in Informal Settlements

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Abstract. *Notions of order and rules play a key role in organizing the arrangement of built and unbuilt spaces. Order is achieved at various scales, such as the global, the metropolitan, the district and the neighborhood scale, by using formal and informal rules, regulations, plans and policies. Rules are the conduit by which the spatial order of urban areas is implemented and achieved. Combined with order, they are key tenets of modern planning, influencing the layout, patterns, and processes that shape urban areas. Set within the context of a wider understanding of order, rules, adaptation and how the city self-organizes and transforms, this paper examines a typology of order and rules determining the spatial order in informal settlements. The paper views the city as a dynamic system of formal rules, regulations, plans, codes and emergent informal rules, protocols and conventions that modulate and facilitate adaptation, incrementalism and step-by-step housing change in informal settlements. Using a case study of kampung Lebak Sililwangi in Bandung, Indonesia, the research deconstructed the local spatial order that exists and identifies two main rule types, namely defined and understood rules. These rules represent a set of socially acceptable activities, tasks and principles that residents use, modify and adapt to produce and refresh existing built and unbuilt spaces to meet varying needs. Rules may change from understood to defined rules and vice versa, and in this setting, systems of self-organization and arrangement of order continue to evolve and adapt. The paper is aimed at providing a deeper understanding of the nature of order and types of rules, including their relationship to the public interest and the production of negative externalities.*

Keywords. *self-organization, order, rules, form, structure, informal settlements.*

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Abstrak. *Pengertian tatanan dan aturan memainkan peran kunci dalam mengatur penataan ruang terbangun dan tak terbangun. Tatanan dicapai di berbagai skala seperti global, metropolitan, distrik dan lingkungan dengan menggunakan aturan, regulasi, rencana dan kebijakan formal dan informal. Aturan adalah alat dan saluran untuk mencapai dan membangun suatu tatanan ruang wilayah perkotaan. Kombinasi antara tatanan dan aturan adalah prinsip utama dari perencanaan modern yang mempengaruhi tata letak, pola, dan proses yang membentuk daerah perkotaan. Dalam konteks pemahaman tatanan yang lebih luas terkait dengan aturan, adaptasi dan bagaimana kota mengatur dan mentransformasikan diri, makalah ini membahas tipologi tatanan dan aturan yang menentukan tatanan spasial di permukiman informal. Makalah ini memandang kota sebagai sistem dinamis dari aturan formal, regulasi, rencana, kode dan aturan informal yang muncul, protokol dan konvensi yang memodulasi dan*

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memfasilitasi adaptasi, inkrementalisme dan perubahan perumahan bertahap di permukiman informal. Dengan menggunakan studi kasus kampung Lebak Sililwangi di Bandung, Indonesia, penelitian ini mendekonstruksi tatanan ruang lokal yang ada dan mengidentifikasi dua jenis aturan utama, yaitu aturan yang didefinisikan dan dipahami. Aturan-aturan ini mewakili serangkaian aktivitas, tugas, dan prinsip yang dapat diterima secara sosial yang digunakan, dimodifikasi, dan diadaptasi oleh penghuni untuk menghasilkan dan menghidupkan ruang yang sudah dibangun dan yang belum dibangun untuk memenuhi berbagai kebutuhan. Aturan dapat berubah dari aturan yang dipahami menjadi aturan yang didefinisikan dan sebaliknya. Dalam konteks ini, sistem pengaturan mandiri dan pengaturan tatanan terus berkembang dan beradaptasi. Makalah ini bertujuan untuk memberikan pemahaman yang lebih dalam tentang sifat tatanan dan jenis aturan termasuk hubungannya dengan kepentingan publik dan produksi eksternalitas negatif.

Kata kunci. *pengaturan mandiri, tatanan, aturan, bentuk, struktur, permukiman informal.*

Context

Informality is an accepted global phenomenon commonly associated with the Global South (Harris, 2017) and most visibly expressed in the continued growth of informal settlements, including slums. Informal settlements play an important role in providing low-income housing when the formal market is unable to do so at a sufficient rate to keep up with demand. Spatially, they can be considered urban fragments, localities or districts, representing the most visible indicators of social, economic and physical inequality associated with the urbanization process (UN-Habitat and ESCAP, 2015). In 2015, 25% of the world's urban population was estimated to be living in informal settlements, including slums, which equates to approximately one billion urban dwellers globally. This population as estimated in 2015 by the United Nations is expected to double by 2030 (UN-Habitat, 2016). Informal settlements are not entirely unplanned, as they are the result of a combination of speculative decisions by occupants and strategic decisions by city planning and development institutions at varying points in time. Many informal settlements and their housing practices are highly organized and innovative, with the process of housing expansion and construction often independent of official rules and regulations (Jones, 2017a; Rosner-Manor et al, 2019; Suhartini and Jones, 2019). Despite the adverse stereotype that typifies informal settlements, their communities perform critical functions in city development by providing low- and increasingly middle-income groups with accessible and affordable housing, as well as providing the formal city with access to labor, goods and services (UN-Habitat, 2008).

A basic premise of urban planning is the need to provide stability, while at the same time allowing for innovation and adaptability. Formal rules bind the city together and maintain rigidity and certainty based on agreed plans. At the same time, sets of informal and non-legal rules coexist and may or may not work together with formal systems. While city-making in the modern planning era has traditionally been emphasized via formal master plans, rules, codes and regulations to guide urban transformation, contemporary urban policy makers and planners increasingly acknowledge planning approaches that recognize the city's complexity and diversity (Silva, 2019). Complexity-based approaches acknowledge the city as an open system, comprising many parts that are highly adaptive to internal and external threats, and flows that cross boundaries. The city is viewed as emergent, temporal and nuanced in its context, yet very much part of a functioning wider entity (Rauws, 2017; Silva, 2018). Strongly aligned to complexity thinking is the notion of assemblage theory, which sees the city as comprising parts, processes and networks that are dynamic and interrelated at scales and across city stakeholders, institutions and varied planning systems (Dovey, 2012).

Within this context, the city transforms through an interplay of both formal and informal practices and processes, creating rules and other tools of regulation, such as plans and policies, to reflect the existing and future development or aspirational goals at a point in time. The latter may span city and local master plans and varying actors and resident groups focusing on maintaining or developing specific urban themes, such as transport or open space across geographical areas of the city, often with different or standardized rules, motivations and outcomes (Türker-Devecigil, 2006). Tension may exist within and between different system parts which can result in rules being challenged and refined, with the concepts of coding, decoding and recoding introduced to explain this process of interaction, evolution and adaptation (Boonstra, 2015; De Landa, 2006). Both formal and informal rules may be static, with little pressure for change, while others may be emergent, depending on their flexibility and pressure for adaptation and renewal. In this setting, the city is in a continual state of transformation across a hierarchy of multiple scales and the formal and informal continuum, being multi-layered, contested, as well as spatial, temporal, and functional.

To meet the demand for housing, most local housing transformations by residents are driven via small-scale physical alterations and adaptations (Kamalipour & Dovey, 2019). The process of housing transformation is typically incremental, generally characterized by a fine-grained and irregular morphology. Change occurs by dividing existing rooms for privacy or accommodation, adding a floor, inserting a balcony, reducing setbacks to expand existing rooms, or inserting external stairs to access upper floors. These changes typically occur within a set of specific protocols, where the same or similar socio-material and physical identity are replicated at a small scale within an overarching built envelope. Changes such as horizontal and vertical 'bottom-up' transformations may result in transgressing the 'quasi-legal' or 'legal' front-plot boundaries, thus changing the building footprint and configuration of the block. These incremental changes collectively impact on wider neighborhood social and economic sustainability as they change the way residents and traders ply their livelihoods in alleyways as well as having an impact on practices of sociability in the public spaces framed by housing (Jones, 2016a, 2019).

In the 1960s and 1970s, John Turner popularized the idea of self-help housing and the key role that 'bottom up' led resident processes play in low income housing provision (Turner, 1968). Since that time, it has been well documented that informal settlements grow through generative processes of incremental adaptation and self-organization that meet residents' needs (Rapoport, 1988; Dovey, 2014; Kamalipour, 2016a, 2016b; Kamalipour & Dovey, 2019). Change via self-help housing is undertaken by individuals and groups of residents who express their adaptations by different non-linear geometric forms, range of materiality and construction methods, and in certain contexts through the development of hybrid governance arrangements (Suhartini & Jones, 2019). In these settings, adaptability and incremental step-by-step accretion emerge as both key processes and actions in meeting housing needs while contributing to the wider neighborhood transformation process (Dovey, 2014). Such adaptation may occur within a framework of groups and individuals who are capable of self-organization and co-evolution across space, time and society (Suhartini & Jones, 2019). This change provides owners or occupiers with the flexibility of time and choice while reducing housing costs.

At a national level, the scale of such changes are significant but often under-recognized in official estimates in Indonesia, for example, estimating that 80% of housing development is undertaken through informal self-help systems (United Nations General Assembly, 2013). In 2007, it was estimated at a global level that the informal sector already provided approximately 70% of all housing in cities, thus making it the leading supplier of housing (UN-Habitat, 2007). This is a

significant contribution to the stocks of affordable housing, underpinning the need to understand the local orders and rules that produce and facilitate such housing.

Notions of Self-Organization and Order

Central to understanding processes of adaptation and rules by which informal settlements transform, such as by self-help housing, are notions of order and self-organization. Processes and practices of self-organization have increasingly been a topic of urban planning and design research (Kamalipour, 2016a; Suhartini and Jones, 2019). The self-organization approach to understanding cities is based on the principle that the spatial order of the city is a collective result of multiple interactions between myriad plans and policies influencing plan content and outcomes. As succinctly stated by Alfasi and Portugali (2007:167), "No plan is capable of fully controlling a city, including those created by state and municipal planning agencies and those prepared by large firms and organization". Under the self-organization model, plans are conceived and developed within the system rather than applied from outside. Order with its sense of certainty results from the self-organization of system parts finding their own equilibrium through the setting of principles and rules. In more sophisticated systems, rules can evolve and become publicly enforceable laws and legislation. Self-organization is a key process by which cities dynamically recalibrate their socio-spatial patterns, form and structure as both contexts and new determinants evolve (Alfasi and Portugali, 2007; Batty, 2007)

Paramount to self-organization is the concept of 'complex adaptive systems', which, like complexity and assemblage theory, are founded on understanding systems that are unpredictable, open, dynamic and non-linear. It is a term that has been applied to help in deepening our understanding of urbanism patterns generally and informal settlements specifically (Dovey, 2012). Non-linearity is key feature of a city's complexity, with small to large plans have differing impacts and influences. For example, it does not follow that a large-scale plan or policy will have greater impact than one prepared and applied at a local scale (Alfasi and Portugali, 2007). Moroni (2015) argues that mechanisms such as plans and policies are in effect forms of control and guidance aiming to influence the dynamics and evolution of self-organizing cities. Outcomes and impacts may be problematic and in many scenarios impossible to predict across time and space. The term 'framework rules' has been coined to describe an overarching planning framework rules and does not denote a particular future socio-spatial structure or pattern but one that provides flexible spaces for 'unplanned' activities so as to allow cities and communities to adjust to and evolve with unforeseen circumstances (Rauws, 2017). In this setting, there are many planning approaches, actors and institutions spanning formal to informal systems that self-organize, influence and articulate urban form, structure and spatial order at different scales, with varying risks and opportunities. However, in an informal settlement context, self-organization remains relatively understudied (Silva, 2018; Silva and Farrell, 2016).

The second concept fundamental to understanding rules is the notion of 'order'. This term has been an important defining element in comparing formal planned towns and cities from those considered informal and unplanned (Jones, 2017a). The rise of modern planning in the late 1800s and the early twentieth century saw the notion of order become a key determining factor in planning and design. The layout of old towns and cities with little or no planned services and infrastructure struggled with the rapid growth of cities driven by industrialization and urbanization in the nineteenth century. This generated a plethora of new issues to be addressed, including inadequate sanitation, narrow streets, dire housing conditions, pollution, inadequate drainage and growing levels of disease. Collectively, these required new planning orders to be implemented under the emergence of the town and country planning movement (Hall, 1988).

A key characteristic of imposing a 'formal discipline' are the rules and regulations that achieve the desired formal order (Kostof, 1991). In planned modern cities, formalization results in standardized rules that impose hierarchical control, geometric uniformity, aesthetic 'beauty', and repetition of consistent physical styles and patterns. An explicit spatial and physical order aims to achieve certainty, including advocating development in accordance with legally approved plans and policies. A sense of permanency and desire for stability is enforced through public infrastructure, services and social harmony (Arefi, 2011). Whether in new suburban greenfield estates, middle-ring or inner-city housing areas, the explicit order is reinforced by repetitive, uniform housing styles, land-use zoning and subdivisions comprising similar plot sizes. There is a conscious desire in such layouts for geometric and visual coherency as derived from a preconceived vision of what planning and design should comprise and achieve in the modern planning era. The latter approach to implementing a desired order as promulgated by governments and residents has become the domain of contemporary urban planning, management and governance in the new millennium.

However, in an informal settlement context, disorder and illegality and absence of physical and social order have become a central tenet underlying the formalization of informality (Dovey, 2012; Jones, 2017a). Adverse traits of disorder often emerge through processes called self-organization, organic, bottom-up, and self-made urban order, with many notions nuanced at the local level (Jones, 2017b). Informal settlements, including slums, lack coherency, contributing to what policy makers and academics have labeled 'dysfunctional' urban patterns (Lombard, 2014). Symptoms of disorder in informal settlements have been identified as including varying housing styles and building materials, lack of setbacks, intrusions into public space, and a lack of reticulated water, sanitation and waste disposal systems (Jones, 2019). Traits such as varying housing styles, irregular setbacks, multi-functionality, and a wide choice of new and second-hand materials are used to perpetuate simplistic myths insinuating disorder and chaos, rather than acknowledging the diversity of a rich 'local' architecture and design innovation, as well as the complex order existing in many informal settlements. As such, these settlements and their communities are problems 'to be fixed' by introducing a 'new' order by upgrading schemes to replace the physical, visual and social chaos. There is an explicit objective in many plans of modern global cities to correct disorder in informal settlements and slums by bringing their condition into line with the current suite of 'best-practice' upgrading practices and approaches advocated by modern planning (UN-Habitat, 2016). These span approaches ranging from a simple makeover to in-situ upgrading, eviction, resettlement and redevelopment, for example involving high-rise tower blocks (Jones, 2017a).

In the context of clarifying types of urban order, Marshall (2009) identified two types, namely systematic and characteristic order. Systematic order is that which is readily identifiable, coherent and discernable, such as in consistent block layouts with repetitive housing setbacks, fencing heights, standards of material use, set housing styles and heights as seen in planned modern suburban and city contexts. On the other hand, characteristic order is a type of nuanced order generated by contextual social norms and values that produce their own unique form of spatial and physical layout, such as that seen in informal settlements. Pivotal to understanding the concept of order is the role of scale, scaling and hierarchy. Salingaros (2000) argues that every urban element is formed by the grouping of sub-elements according to geometric rules that form a hierarchy at different scales. At the smallest scale, order is created by paired contrasting elements such as windows, walls, and doorways, which exist in a balanced equilibrium. Complementary elements are those of similar size, which couple in a strong fit to become modules of the next higher order of scale, with smaller scales defined before aggregating at larger scales.

In his classic paper *The City is Not a Tree,* Alexander (1965) made insightful observations on the functional complexity of towns and cities by arguing that modernist planning and design has evolved based on simplified notions of complexity and order. Alexander (1965) argued that planning and design have failed to achieve a deeper understanding of what gives true functionality and form to towns and buildings as it does not understand the complexity of the underlying orders. In the new millennium, Alexander (2002) takes a deeper intellectual approach to analyzing order and its relationship to complex and adaptive systems, arguing that order constitutes an understanding of the process by which objects and activities occur based on their relative positions as shaped by forces guiding their location and evolution. Alexander (2002) asserts that while understanding the multiplicity and connections of the component parts is necessary in the urban milieu, concepts of disorder emerge from our inability to comprehend the organizing processes and paths of change that form one configuration compared to another (Waguespack, 2010). In other words, the built environment, whether defined as formal, informal or a continuum, is produced by orders of varying manifestation, coherency and governance.
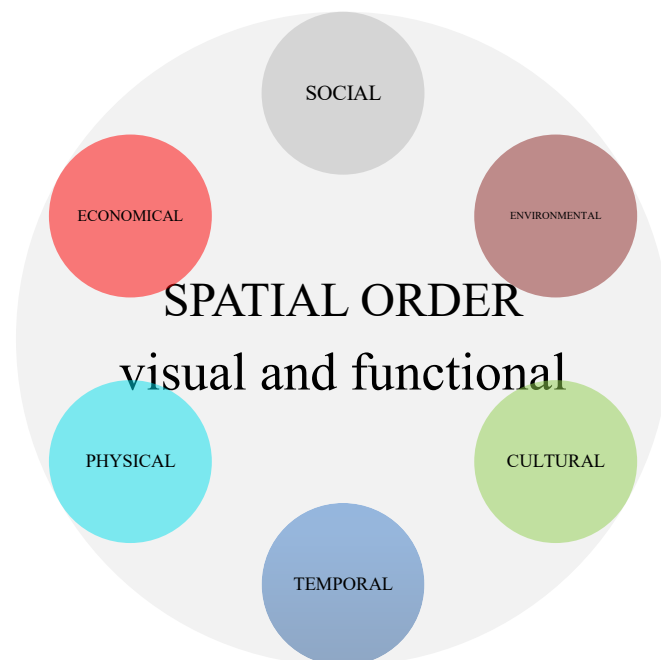
Figure 1. The multi-dimensional determinants of spatial order in informal settlements.
Source: Jones, 2019; Moatasim 2019; Mikolajczyk and Raszka 2019

The above concepts still apply today in challenging and enhancing our understanding of order, complexity and emergent rules in shaping the design and planning of the city. This is especially relevant in the context of informal settlements where attachment to context, local and place are all important in understanding the diversity and logic of 'messy' built form. As observed in a European context, formal planning rules and regulations have ignored the dynamics of informal settlements in certain time periods but where they are recognized, they can co-exist and co-evolve in producing mutually benefiting outcomes (Silva, 2018). The lack of explicit visible physical and aesthetic order in informal settlements leads urban planners, policy makers and the public to formulate superficial assumptions about the inhabitants of such settlements and their socio-economic, spatial, physical and environmental conditions. Not surprisingly, incremental adaptation, generative processes and more importantly rules by which spatial order is created in

informal settlements are relatively understudied and are a challenge for city planners and policymakers (Jones, 2019: Kamalipour, 2016; Suhartini and Jones, 2019, Hakim, 2007).

Within unplanned and organic cities, previous studies (for example, Arefi, 2011; Kostov, 1991; Jones, Maryati and Suhartini, 2019) have argued that systems for organizing spatial order do exist, with notions of disorder and 'out of place' being superficial and lacking depth of analysis. According to Boeing (2019), spatial order in informal settlements can be clustered into two main types: visual/geometric order and social/functional order (Boeing, 2019). Mikolajczyk and Raszka (2019) suggest that spatial order can be viewed constructively by considering the multi-determinants embedded in the urban fabric, including environmental, physical, economic, social and cultural factors. This includes the role of adaptation as a form of 'spatial management' (Mikolajczyk and Raszka, 2019:3288). In addition, Moatasim (2019) highlights the importance of temporality of space, place, forms and structure so as to provide a better understanding of the key features of spatial order in informal settlements. This paper views elements of spatial order, both visual and social, as interconnected factors both shaping and producing order (see Figure 1).

In this context, the aim of this study was to develop a typology of rules by which to deepen our understanding of the way in which rules evolve and operate through self-organization and generative processes as well as understanding the nature of the prevailing order in informal settlements. The emphasis is on rule types so as to unpack the nature of the spatial order, including the production and realignment of built and unbuilt space. In this paper, a rule is defined as a set of principles, activities, steps or phases that contribute to the development, shaping, organization and or achievement of the prevailing spatial order. They are the conduit by which an overarching order is achieved as set within complex and adaptive systems (Jones, 2019). The method used builds on the typology frameworks as developed by Dovey and Wood (2015), Kamalipour (2016a) and more recently Suhartini and Jones (2019) by using a morpho-typological approach to deconstruct and understand the relationship between spatial order and rules (Moudon, 1994).

The typology analysis as used in this paper is set within the broader field of urban morphology and desire for deeper knowledge regarding the transformation of the form and spatial structure of the city (Carmona, 2010; Moudon, 1997). The notion of type is central to identifying patterns of physical elements and rules of arrangement that replicate themselves in built structures and the organization of land use, movement and connectivity (Scheer, 2017). By studying the spatial order, we gain insight into the socio-cultural dimensions of the types, forms, and 'hidden order' in the *kampung*, a trait observed by Arefi (2011) when studying order in informal settlements in Pinar, Istanbul. In the context of the case study of Lebak Siliwangi, the application of a typology analysis has been argued as an essential tool for better understanding the coherency and rhythm of physical complexity and spatial patterns embodied in built form and structure (Jones, 2019; Jones, Maryati, & Suhartini, 2018).

Case Study – Kampung Lebak Siliwangi, Bandung

Setting

Indonesia is one of the fastest urbanizing countries in the world, comprising a range of large to small sized towns and cities (Suhartini and Jones, 2019). After Jakarta and Surabaya, Bandung is the third largest city in Indonesia and the capital of West Java. The city in 2014 had an estimated metropolitan population of approximately 10.5 million persons and has been subjected to pressures from rapid urbanization. This includes flourishing informal settlements, with the city containing some 38,450 hectares of 'slums' comprising mainly of *kampungs*. The latter have

traditionally accommodated urban disadvantaged and poorer households and play a key role in providing affordable housing (Jones, 2017a). In the center of Bandung is the Tamansari valley and adjoining localities. Divided by the Cikapundung River, this once fertile agricultural area situated between the Dutch planned areas to the east and west was settled by West-Javanese migrants following civil riots and political struggles over Islam in the 1960s. The gradual influx of migrants saw the dominantly agricultural use of Tamansari intensify with the growing *kampungs* and population, with many original refugees and their descendants now being long-term legal and de facto landowners (Jones, 2016b).

Located in the north of Bandung on the perimeter of Tamansari and the eastern slopes of the Cikapundung River abutting the Bandung Zoo is *kampung* Lebak Siliwangi (see Figure 2). In 2015, *kampung* Lebak Siliwangi had a population of 4,240 persons comprising some 1,080 families consisting of 2,098 males and 2,142 females. While livelihoods are diverse, including many home businesses and mini-stores, the *kampung* is increasingly home to university students, especially those from the neighboring Institut Teknologi Bandung (ITB) university. Also, the *kampung* accomodates an array of street hawkers who ply the major north-south Gang Stones alley, which parallels the eastern edge adjoining the Cikapundung River. This heterogeneity of activity and population mix reinforces the nature of affordable housing that Lebak Siliwangi offers to 'newcomers' such as students and young professionals apart from as longer-term low-income residents.

**Figure 2.** Location of Lebak Siliwangi and typical built form.
Source: Distarcip Kota Bandung and Authors.

Since the influx of migrants in the 1960s, the morphology of Lebak Siliwangi has been one of the new emerging patterns of residences and alleyways, with the quality and effectiveness of services and infrastructure following later. The labyrinth of alleyways that surround the dwellings and collectively frame the irregular block patterns are the original pathways that connected the network of rice paddies that connected Lebak Siliwangi in the mid-1900s. Over time, these residual spaces have been spatially 'squeezed' by residents and landlords as they sought extra horizontal space for housing expansion. Built and unbuilt space in Lebak Siliwangi has become highly sought after, with housing construction being a mix of vertical and horizontal expansion as residents and landowners respond to demand for space within the context of familial pressures, rental demand plus available social and financial resources.

The Nature of Structure and Form

The current structure of Lebak Siliwangi has evolved from a collation of factors. These include: (i) significant physical features such as the meandering Cikapundung River and long-standing trees, which influence the shape of the major north-south Gang Stones alley, (ii) the topography, including the gradient falling from east to west to adjoin the Cikapundung River, (iii) past major government infrastructure decisions driven by settlement growth, such as irrigation channels, the eastern perimeter road and two pedestrian river crossings, (iv) major land-use change involving the infilling of rice paddies for housing and associated small-scale residential/commercial mixed land-use and more recently boarding/rental housing, and (v) the evolution of 'urban' morphological units, such as irregular-sized plots, blocks, mosques (with their east-west orientation) and alleyways as the area have intensified primarily through self-organization (see Figure 3).
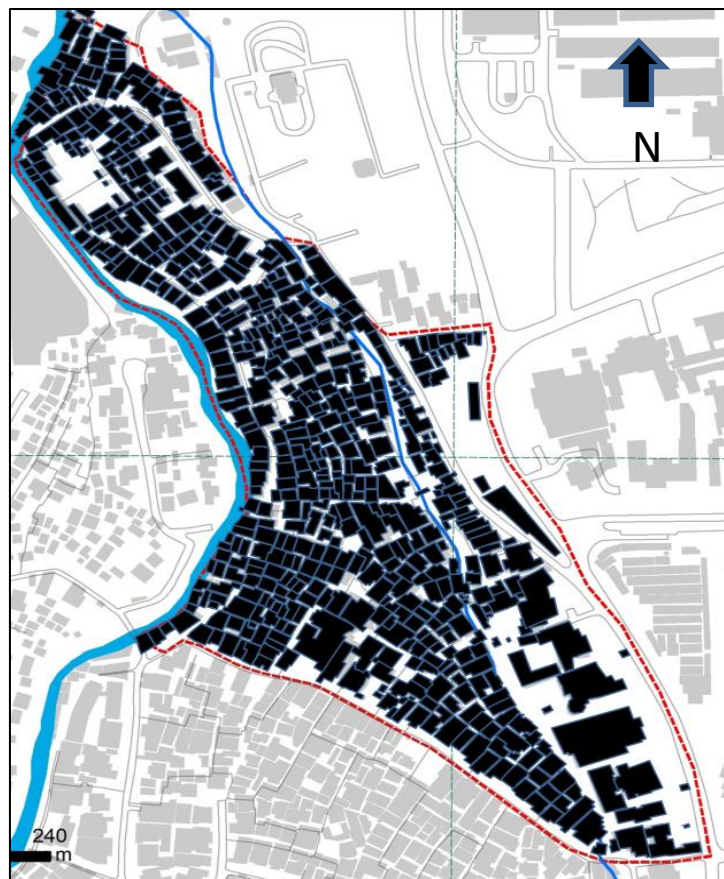
Figure 3. Form and structure including block and alleyway patterns in Lebak Siliwangi have evolved from the layout of the original rice fields. Source: Authors.

In the new millenium, the major influence on the current structure and form have been the cumulative impacts of multiple individual household decisions supported by group governance, such as the eight government neighborhood units based around the *rukun warga* (RWs) and *rukun tetangga* (RTs). There are no higher-order planning rules and regulations imposed by the government. Innovation by residents in space creation and utilization means house and alleyway expansion is strongly intertwined with local rules and norms. Formal government institutions

exist in RTs and RWs, but have little influence in Lebak Siliwangi as they are primarily concerned with managing community centers, open space, registering of occupants, ensuring uninterrupted access to mosques, managing temporal use of motor bikes (no usage between 10 pm and 5 am), and garbage collection.

Similar to other cities in developing countries, Bandung has put in place various governance systems to achieve spatial management outcomes (Jones 2017; 2019). The aims and objectives of formal planning systems in Bandung are reflected in the Bandung City Spatial Plans 2011-2031 as prepared by the Bandung City Government. Such plans provide guidelines regarding land use and infrastructure aspirations at citywide and detailed local scales, including identifying zoning regulations for particular land uses and activities. According to the plans, Lebak Siliwangi is considered a green corridor, accommodating residential and eco-tourism uses, the latter being a major departure from the open-space functions (including water catchment and conservation) enacted in the 1933 Karsten plan as prepared in the Dutch colonial period. Notwithstanding the increasing population and housing densification, the Bandung City Government leverages its ownership of land abutting the Cikapundung River as the main consideration to enhance the green functions of Lebak Siliwangi. In the current plans of the Bandung City Government, all self-organized forms and structures as built by residents are excluded from the spatial plan. The consequence of this exclusion is that current settlement patterns and activities are not recorded and recognized in formal data-collection activities or contained in development plans. The threat of eviction by the government in order to attain the objectives of the spatial plans as enacted by regional laws remains an ongoing threat to the residents' systems of order and rules.

The absence of implementation of the spatial plans of the Bandung City Government and the aims contained therein contributes not only to the disconnect between formal governance systems and informal arrangements but also to the lack of understanding regarding the dynamics and practiced governance mechanisms that evolve and shape informal settlements (Suhartini and Jones, 2019). There have been attempts to connect formal structures at higher levels by the establishment of RTs and RWs, which work as low-order institutions for mediation and local service provision in informal settlements in Indonesia. However, despite the admirable aims of increasing efficiency and safety, their limited span of responsibility, ad-hoc duties and part-time working hours means they are unable to contribute to achieving the objectives of formal orders and rhetoric contained in spatial plans. Hence, this absence of formal rules and regulations, including a lack of enforcement, opens opportunities for residents to self-organize and flourish with innovation in regulating their own development needs.

The Nature of Spatial Order in Lebak Siliwangi

The framework below (Figure 4) explains the analysis structure utilized to understand the dynamics of order and rules in Lebak Siliwangi. Key themes are grouped using the main characteristics of visual/geometric order and social/functional order. The visual/geometric order as observed consists of the ever changing public-private interface, the shape of alleyways and housing configurations, while the social/functional order comprises public space and community facilities, community governance, and livelihoods.

Using these criteria, types of physical evidence reflecting the determinants of spatial order in Lebak Siliwangi can be clustered as shown in Table 1 in which V stands for the presence of physical evidence of a particular determinant observed; O indicates both physical and non-physical evidence regarding the presence of particular determinants; and X represents no physical evidence regarding the determinant observed.
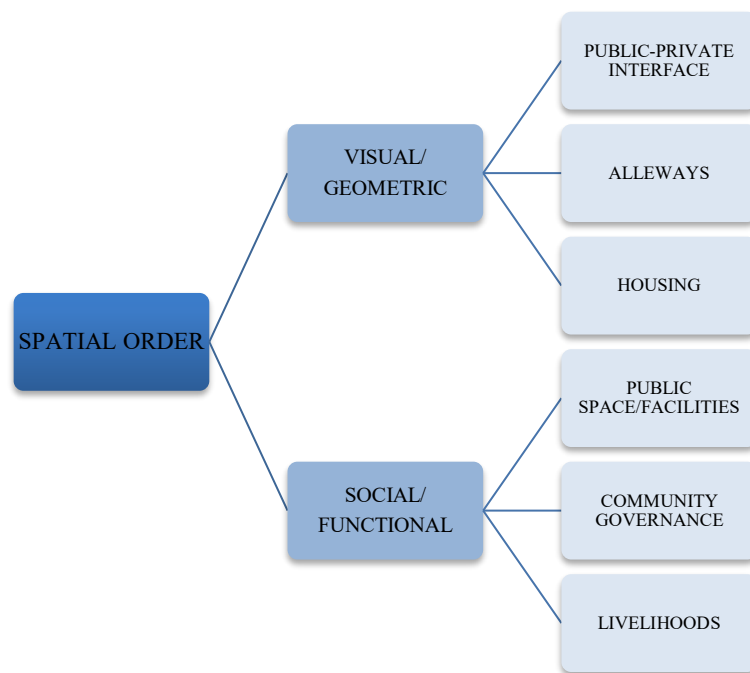
Figure 4. Conceptual framework applied to understand spatial order in Lebak Siliwangi.
Source: Adapted from Boeing (2019)

Table 1. Physical evidence of spatial order in Lebak Siliwangi.

Spatial Order Physical Evidence	Visual/Geometric Order			Social/Functional Order		
	Public-Private Interface	Alleyways	Housing	Public Space/ Facilities	Community Governance	Livelihoods
Physical (forms and structure)	V	V	V	V	O	O
Environmental (aesthetics)	V	V	V	V	X	O
Social (communal values and norms)	X	X	X	V	V	O
Economic (adding values)	O	V	V	O	X	O
Cultural (traditional values and norms)	O	X	O	O	X	O
Temporal (timing)	O	X	V	O	O	O

Source: the authors

The information in Table 1 regarding the array of physical evidence of spatial order determinants was utilized to identify the rules shaping the nature of the overarching order. As can be seen from Table 1, several determinants overlap with other determinants and between the two broad types of orders. These observations are initial evidence of the complexity of the systems in informal settlements as produced and shaped by rules. What is observed is that informal development arrangements focus on individual and communal outputs, including physical, environmental and temporal changes, while development outcomes undertaken in collaboration with RTs and RWs are reflected in the social, economic, and cultural development of Lebak Siliwangi. The outputs

of order and rules can be seen as signs and evidence of development form, structure, patterns and flows influenced by the spatial-order determinants in each theme of settlement development. The outcomes of spatial order and rules are represented in the livability and quality-of-life indicators in Lebak Siliwangi, such as degree of cleanliness, safety and security, peaceful and friendly environment, number in employment, economic and business opportunities, and resident participation in communal *kampung* development activities.

Typology of Rules in Lebak Siliwangi

Development patterns in Lebak Siliwangi are a reflection of the application of different types of rules seeking to implement an overarching, albeit opaque spatial order with a certain type of underlying logic. Our analysis indicates that two types of rules can be identified:

1. **Defined rules** are generally clear and explicit in conveying that a certain type of behavior and activity can be undertaken and is acceptable. These rules can be written, publicly exhibited or communicated verbally such as in RT or RW meetings or in the local mosques. They can include visible boundary markers, property numbers, RT and RW entrance signs, notice boards, and schedules that organize and communicate a certain message and or action to be carried out. With defined rules, the opportunity for confusion, misinterpretation and ambiguity is minimized as these rules are assumed to be clearly communicated. Such rules may be included as part of the community governance arrangements.
2. **Understood rules** are implicit and potentially more ambiguous. They may be implied in written or verbal communication but most times they are not conveyed using these modes. In Lebak Siliwangi, understood rules dominate community governance and self-organization and are best reflected in the array of physical actions carried out by residents where they replicate small-scale physical changes carried out by other residents when adapting their dwelling. Understood rules are effectively protocols and accepted standards that are not directly expressed verbally, in writing or via physical symbols such as signage and yet are embedded as normal behavior by residents, including RT and RW leaders. They are the accepted mode of organization most visibly expressed in the multiple precedents of physical change embedded in the *kampung*'s built fabric.

Both rule types emerge through processes of self-organization, with actions embedding local wisdom, cultural norms and values while co-existing and co-evolving over time with modern and traditional rules as the settlement grows. The rule types reflect a set of principles, procedures, practices and protocols to be carried out within a particular activity or sphere of the overarching designated order.

As a general observation, understood rules tend to be hyper-adaptable and fluid. Rules for form and function change, and manipulation of physical *kampung* elements are differentiated according to function. For example, in major alleyways, two main forms of transport predominate, namely walking and motorbikes. The physical width of the major alleyway is never reduced to less than 1.5 to 2 meters to allow for the passing of motorbikes. However, in minor alleyways such as those in the east-west direction and which follow the gradient of the slope, the alignment has been reduced to walking width only. In this context, the 2 types are not mutually exclusive with an understood rule being elevated to a defined rule. For example, in 2017, residents adjoining the major north-south Gang Stone alley became concerned over the extent of horizontal dwelling extensions using and claiming alleyway space, thus restricting the width and functionality of the alleyway. As a result, the affected RW leaders agreed to the painting of white lines at the respective public/private alleyway interfaces so as to indicate to landowners that further 'alleyway

creep' – that is, the forward horizontal expansion of housing on their plot or building line into the alleyway, thus constricting alleyway space, functionality and sociability – was not acceptable (Jones, 2019). In this case, there was a failure of the understood rule to achieve its purpose as reflected in the ongoing reduction of alleyway space in this section of the alleyway. The exploitation of the rule led to an understood rule being elevated to a clear, physically explicit rule (a defined rule).

Where no communication exists and there is a lack of enforcement of a 'standard rule' (such as standards for dwelling changes or 'interface creep', for example), these could be seen as understood rules. The lack of communication and/or enforcement is powerful and often hard to interpret and hence may add to the multiple and often conflicting messages being conveyed regarding the *kampung*'s desired spatial and physical order. In this setting, understood rules are open to multiple interpretations and meaning by residents, one result being that the subsequent spatial and physical changes as applied in the *kampung* are diverse and many.

Based on the above, the following are examples of spatial rules applied in Lebak Siliwangi to achieve the spatial order as shown in Figure 3. The rules developed by residents include those used to guide incremental changes, the diversity of designs and building materials, the use of multiple scales, optimum usage of space, the fluidity of the public-private interface (use and boundaries) and the importance attached to traditional and religious norms and traditions.

Defined Rule: Signage

There is a variety of signs placed throughout the *kampung*. Excluding commercial signs for businesses such as childcare and mini-stores, there are many signs that indicate localities in the *kampung* (such as RTs and RWs) plus other signs that regulate behavior such as the time limit of staying for guests to report to local leaders, 'white lines' on alleyways to minimize 'interface ', signs indicating not to throw litter into the river and times for using public toilets.


Figure 5. A range of signs primarily reflecting defined rules indicating place identity and desired behavior in Lebak Siliwangi. Source: the authors.

*Understood Rule: Incremental Changes to Dwellings*

Dwelling alterations in Lebak Siliwangi occur incrementally. Densification occurs via a reduction in setbacks, increase in the number of stories, undertaking subdivisions, and adding rooms and stairs.
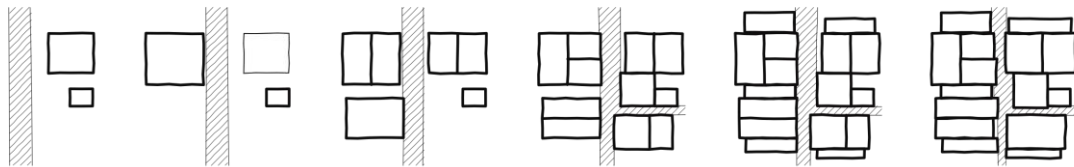
Figure 6. Horizontal densification in Lebak Siliwangi (from left to right).
Source: Jarrod Harth et al.

As a general rule, horizontal changes are followed by vertical changes. Vertical change occurs when the maximum expansion is achieved by the dwelling on reaching the side setbacks and importantly, the front plot boundary. This front plot boundary may be legal as certified under family or individual ownership, such as created by a process of subdivision, or have no legal status (not registered). As the alleyways have no formal legal status, de-facto communal rights of way have evolved to facilitate movement of pedestrians, hawkers and motorbikes over time and through what is effectively privately owned space extending from the adjoining dwelling. In this nebulous setting, families or individuals will gradually encroach their dwellings into the alleyway, thus concurrently creating new building lines and plot boundaries. As such, alterations to and addition of rooms impact on setbacks, with changes to the front setback having the most impact on the public-private interface between the dwelling and the adjoining communal space, namely the alleyway.
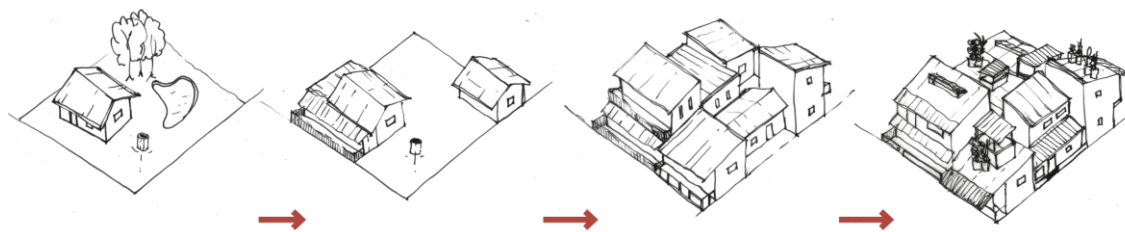
Figure 7. Horizontal expansion followed by vertical densification in Lebak Siliwangi.
Source: Jarrod Harth et al.

Understood Rule: Diversity of Designs and Building Materials

Residents in Lebak Siliwangi display the use of different building materials for walls and infrastructure/utilities, using multiple colors, motifs, and styles on dwelling facades. Varied geometric shapes, sizes and materials are clues to incremental changes in style periods, building typology and adaptation processes. Some dwellings have been left unpainted thus the changes are more obvious, some have uniform painting to minimize alteration impacts, while some have a mix of colors contrasting the phases of adaptation. Some dwellings utilize new materials while other maximize the use of recycled or old materials for building renovations.

Figure 8. Diverse materials and designs occur in small increments and are the acceptable norm in Lebak Siliwangi. Source: Niki Hornsby et al.

Premises with high economical value such as mini-stores and boarding houses tend to have 'stand-out designs', with the latter adopting modern architecture in building designs and applying bright-contrast colors and space for motorbike parking. Older private residential premises may or may not have setbacks, with various fencing, screening and window designs applied to constrain or permit visual intrusion. According to Islam, minimizing visual privacy and overlooking from the street into the dwelling is a valued practice. As a result, design and materials at this fine-grain and human-scale level are diverse, with forms and their configurations unpredictable.
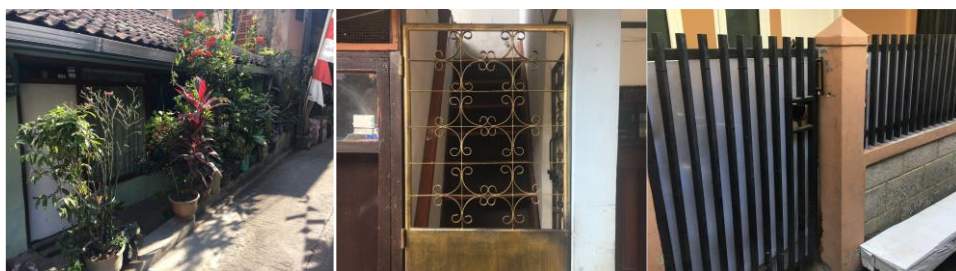
Figure 9. Various types of fences and screening are used to regulate levels of visual porosity and security in Lebak Siliwangi. Source: Lachlan Hutton et al.

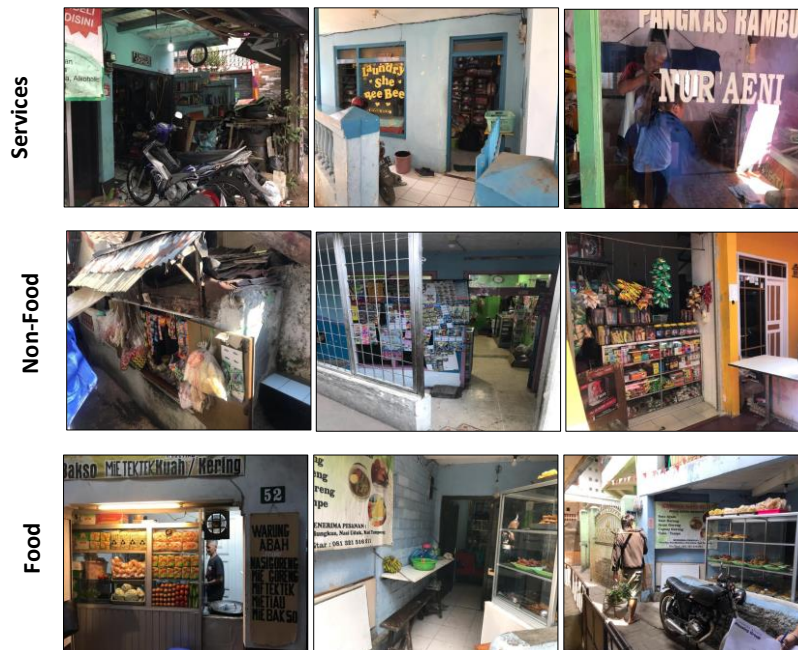*Understood Rule: Multi-Functionality and Mixed Use*

The breadth of informal built form reflects the creativity and coverage of goods and services that residents produce and provide within Lebak Siliwangi. It is an understood rule that built form facilitates multiple functions to enable the selling of goods, services while enabling sociality in (i) dwellings and (ii) the interface. Despite a lack of available space, it is understood that human-scale additions and extensions on private premises and on the adjoining communal space can deliver multiple functions via both temporary and/or permanent forms. This practice is accepted despite impinging on the environmental condition such as access to light, reduced space for connectivity (pedestrians and hawkers) as well as privacy. When impacts reach critical mass, such

as the use of motorbikes for personal and economic use late in the evening, the understood rule elevates to a defined rule with signage well-placed throughout the *kampung* to limit use and associated noise impacts. More importantly, despite the size of the plots and their distance from vehicular access to the main road, the settlement generates a wide range of services not only for local residents but also for city-wide customers. Mixed-use dwellings on the western fringe area of Lebak Siliwangi face collector and main roads and provide services at neighborhood and importantly city scale, such as computer sales, motorcycle repairs and printing/copying services. As such, it is accepted that form does not fully constrain function.

Figure 10. City-wide ground-level functions (with dwelling use above) are located on the western edge of Lebak Siliwangi, where greater visibility to passing traffic and ITB university students and staff facilitate a consistent source of trade. Source: Leonard Vogel et al.

Figure 11. The interface facilitates a diversity of multi-functionality and mixed use via permanent and temporary form elements, significantly contributing to the rich coherency of ground-level urbanism in Lebak Siliwangi. Source: Leonard Vogel et al.

*Understood Rule: Dwelling and Unbuilt Form Changes are Small Scale*

Within Lebak Siliwangi, human scale is applied in nearly all incremental additions, mainly in the height, width, and size of building components and space configuration. For example, alleyways can be grouped into three types according to the width and access of motorbikes. Housing, with floors approximately 2 meters in height, are designed to achieve minimum heights for resident movement within the premises and within Lebal Siliwangi. Rooftop water tanks are also small. Privacy levels are created by multiple designs on fencing/screenings, windows and ventilation louvers, particularly on dwellings located on the public-private interface, where permeability and access to light are important. Intrusion into alleyway space is incremental, such as through claiming space for tiles, ramps, steps and room extensions. In all cases, elements added or created are generally small in size, one to two meters maximum.

Figure 12. Human-scale incremental design is a key feature of urbanism patterns in Lebak Siliwangi. Source: the authors

Since residents are confronted with minimal space and limited access in Lebak Siliwangi to fulfill their basic needs for housing, jobs, and services as well as socio-economic opportunities, space is optimized and well-utilized. This practice rule is reflected in multifunctional rooms (such as combined sleeping, kitchen and mini-store rooms), setbacks and alleyway furniture as well as the temporality of space uses and activities within the varying RTs. Built spaces such as living rooms, doors, windows and setbacks are utilized as shop displays, stalls, storage, and parking lots, while the alley also acts as a communal meeting point interspersed with fixed and movable seating.

Alleyways are used differently at particular times of day for various economic and social activities. Most activities are carried out in the morning, while the afternoon is mainly used by the residents for social interactions. Children who have finished their daily school activities use the alleyways and small open space pocket areas in each RT as their playground. Some economic and social services are run during the evening hours, primarily for selling food and doing the laundry while prayer times are carried out at the same time in the five mosques. At different times, the public-private-interface is 'adjusted' to accommodate activities by opening fences, 'moving' parking lots and portable stalls. These are all acceptable uses and activities with their respective measures of physical adaptation and also accepted as normal conventions by residents.
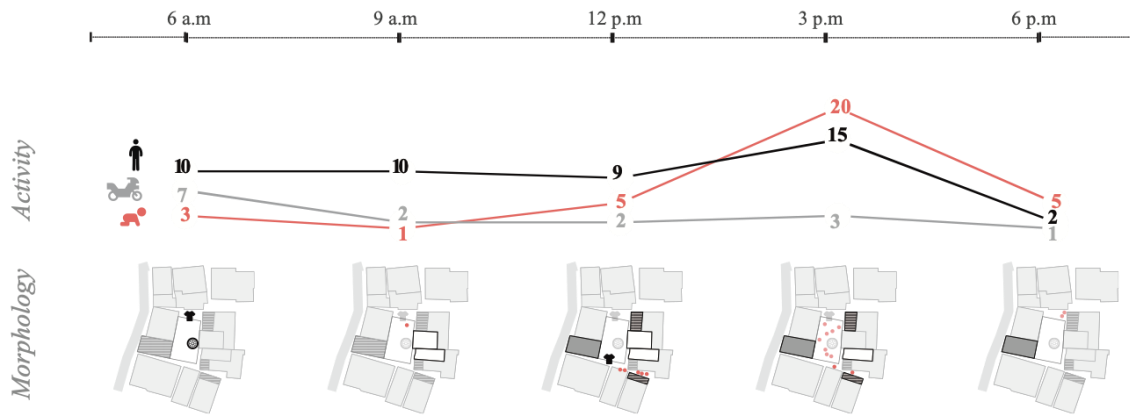
Figure 13. Temporality of space in Lebak Siliwangi at varying times of day by activity and morphology in Gang Stones alley, Lebak Siliwangi. Source: Leonie Bryson et al.

Understood Rule: Fluid Use and Movable Social/Economic Boundaries in the Public-Private Interface

The notion of the public-private interface with its non-linear alignment in Lebak Siliwangi is fluid, being more flexible than the discrete use zones imposed by rules under modern planning arrangements. While the public-private interface in Lebak Siliwangi can be viewed as blurred, given the lack of clarity over physical land boundaries as well as ownership issues, this is of little concern to the residents who use the dynamic alleyway space for an array of visible and permeable boundary, dwelling and functional markers. These are expressed via door and window designs as well as in temporary and permanent/fixed barriers, including horizontal room extensions built by residents and landowners. The physical territorial boundaries of social and economic spaces as embedded in the interface are well-understood by residents, being identified by the use of different activities at particular times of the day/night and in certain physical configurations. It is such activity that gives the alleyway its irregular alignment.
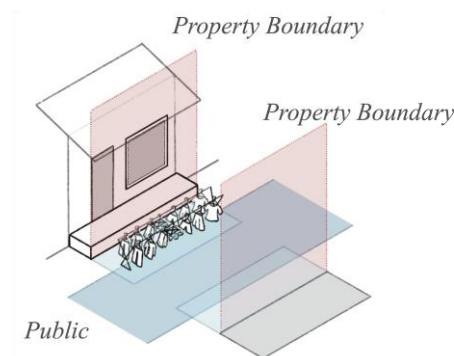
Figure 14. Fluid dwelling and alleyway boundaries denote the changing character of the interface and alleyway alignment in Lebak Siliwangi. Source: Leonie Bryson et al.

As a result, the interface can be wider or narrower depending on the placement of motorbikes, carts, materials, tables, chairs, plantings, stalls, shoes and slippers, all informing 'expansion' or

'reduction' of social and economic boundaries and spaces. While the alleyway is often under family land ownership as it is the residual void of the original plot, it is deemed public space by taking on a strong communal role. Long-standing practices such as de-facto rights of way are considered normal and are accepted by the community to certain limits.

Figure 15. Interface boundaries change through temporary or permanent alterations in Lebak Siliwangi. Source: Lachlan Hutton et al.

The degree of permeability of dwellings and the interface are influenced by the level of access needed by activities within the premises, the location compared to surrounding uses, and how active the surrounding alleyways are throughout the day and night. Rooms with a higher degree of privacy have more solid walls and closed access, with low permeability to the surroundings and vice versa.
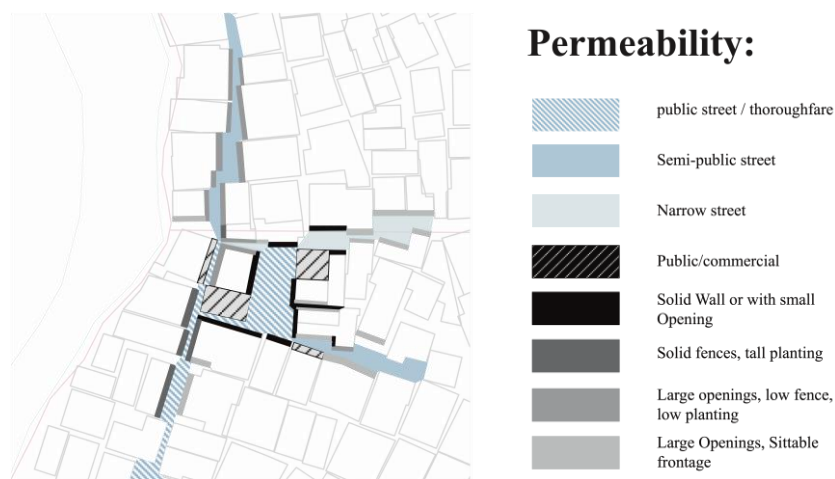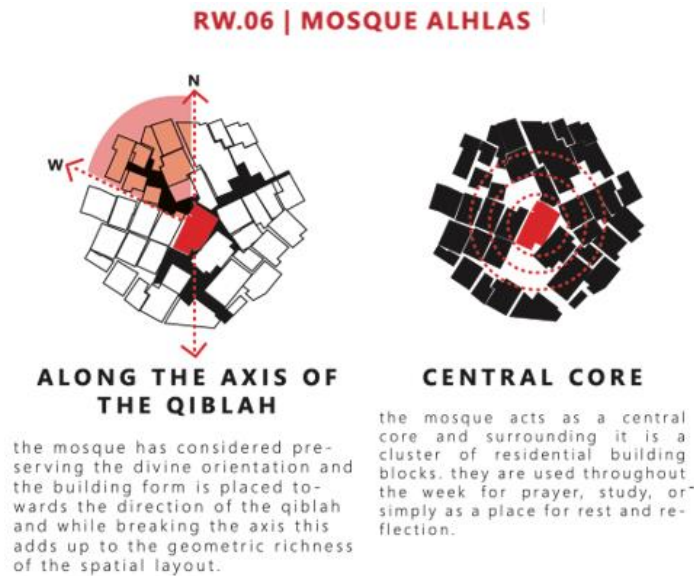

Figure 16. Varying levels of permeability in Lebak Siliwangi. Source: Leonie Bryson et al.

Defined Rule: Valuing Local and Religious Norms and Traditions

The mosques are the central physical focus in Lebak Siliwangi, acting as a datum for surrounding premises who adjust their designs and functions to support the need of respecting space for Islamic prayer, plus the religious values of privacy, such as providing separated space for male and female worshipers. Mosques such as the one located in the northern end of Gang Stones alley orientate their boundaries in an east-west direction towards Ka'bah in Makkah, Saudi Arabia, reflecting the importance of this universal Islamic datum. The result is that the mosque is offset in Gang

Stones alley, thus extenuating and adding to the irregular and non-linear alleyway alignment as created by multiple individual dwelling extensions at the dwelling/alleyway interface.

RW.06 | MOSQUE ALHLAS

ALONG THE AXIS OF THE QIBLAH

the mosque has considered pre-serving the divine orientation and the building form is placed to-wards the direction of the qiblah and while breaking the axis this adds up to the geometric richness of the spatial layout.

CENTRAL CORE

the mosque acts as a central core and surrounding it is a cluster of residential building blocks. they are used throughout the week for prayer, study, or simply as a place for rest and re-flection.

Figure 17. Mosque as the central datum in RW 06 in Lebak Siliwangi.
Source: Niki Hornsby et al.

Traditional Indonesian values based on communal and voluntary cooperation in public arrangements are well-preserved and recognized by residents of Lebak Siliwangi. For RTs and RWs, leadership remains voluntary despite formal mechanisms of election introduced to appoint new leaders. Thus, formally defined rules evolve to become understood rules, with implied norms now being used to elect leaders who have already gained respect through their leadership in the community, including mosque activities. Mutual respect among residents is common and has become a basic requirement if one is to live within the settlement and be involved in communal interaction with neighbors, including sanctioning arrangements for self-organization. For example, public space such as the small open space areas are self-built and crowd-funded by the residents. Some arrangements for communal activities such as Independence Day celebrations as held annually on 17 August are written and placed on notice boards, walls and gates, while others are verbally conveyed using mosque loud-speakers and individual oral communication. These self-organized arrangements based on voluntary involvement and crowd-funding reduces the need for formal government arrangements in terms of administration and budget. Thus, both defined and understood rules are in use to achieve an overarching defined order.

Discussion and Conclusion

While the Bandung City Government may have a formal plan designating Lebak Siliwangi as a revitalized eco-tourism and regulated modern residential district, there are no top-down rules imposed on residents. The RT and RW governance structure effectively deals with matters of social, community and religious affairs, and with the exception of major *kampung* upgrading proposals occurring in nearby localities in Tamansari by the Bandung City Government, residents are left to self-organize and self-regulate their built environment. There is no official regulatory and enforcement regime as residents are responsible for the organization of their own dwellings and communal activities. When undertaking development, residents are also responsible for

considering the impact on adjoining residences and public spaces. In this setting, the ongoing recalibration of the structure, the form and the key elements that comprise this urban milieu – that is, the dwellings and the infrastructure and services that tie the settlement together via built and unbuilt space – evolve from the needs of residents and respect for local socio-cultural and religious peculiarities. The latter includes the strong role of religious rules and in this context, the notion of local order is similar if not a more suitable term than Marshall's notion of characteristic order (Marshall, 2009). It cannot be stressed strongly enough that context and place are all-important in understanding the peculiarities of local order and rule types and their outcomes (Suhartini and Jones, 2019).

Table 2. Summary of determinants of visual/geometric spatial order, their physical expression and type of rule used.

Visual Geometric Order Determinants	Themes – Physical Expression			Type of Rule: Defined or /Understood
	Public-private interface	Alleyways	Housing	
Physical (forms and structure)	Setback, set forward, aligned, set over	Major alleyways, minor alleyways, dead ends, lively ends, bumpers, portals	Horizontal densification, vertical densification, building design, number of stories, subdivisions	Understood rule: incremental changes, diversity of design and materials, human scale
Environmental (aesthetic and natural boundaries)	Greenery, screenings, paintings	Riverbanks, slopes, drains as limits	Gardens, screenings, direction, plot shape, paintings	Understood rule: optimum usage of space; diversity of designs and materials
Social (communal values)	Notice board, wall signage, directions	White lines, bumpers, portals, signage/directions	Multiple room designs	Understood rule: fluidity of private-public boundaries, diversity of designs and building materials, human and neighborhood scales
Economical (adding values)	Multiple uses of setbacks and windows	Islands for hawkers, wall ads and signage	Multiple usages of rooms, housing quality	Understood rule: fluidity of public-private boundaries, diversity of designs and building materials, human scale
Cultural (traditional values)	Screenings, materials	Wider alleyways around mosques, multiple uses of alleyways	Screenings, materials, directions	Defined and understood rule: valuing local and religious norms and traditions, neighborhood scale
Temporal (timing)	Movable plantings and fences/partitions, multiple uses of setbacks, non-permanent setback extensions	None, alleyways are fixed	Individual room extensions, multiple usage of rooms	Understood rule: Optimum usage of space

Source: the authors

The systems of self-organization and the arrangement of order by rules that manifest themselves in Lebak Siliwangi continue to evolve and adapt. The emergence of order occurs by generative rules, which leads to adaptive higher-level actions and behavior. There is a certain way of carrying out dwelling changes and manipulation of public/communal spaces that residents understand is normal practice. Commencing from the bottom up, generative processes with feedback loops create unique 'free form' designs, forms and structures that some call 'vernacular architecture'

(Hakim, 2007). In this setting, spatial planning is not an act of making a formal explicit plan, but builds on broad community consensus on important principles derived from core values and norms embodied in defined and understood rules. These rules are the means to attain a social, economic and physical order that is both implicit and explicit. Among other matters, this order allows the needs of the urban disadvantaged/rising middle class to secure affordable housing while being able to pursue their livelihood and acceptable levels of sociality moulded strongly by Islamic beliefs.

Table 3. Summary of determinants of social spatial order, their physical expression and type of rule used.

Social Order Determinants	Themes – Physical Expression			Type of Rule: Defined Or /Understood
	Public space/facilities	**Community governance**	**Livelihoods**	
Physical (forms and structure)	Fixed locations (intersections, wider alleyways, lively ends, setbacks), fixed uses (sanitation, health, religious, sports, meeting points), modest designs, parking space, storage	Notice boards, wall signage, directions, night watch posts, seating around alleyways intersections, community halls, mosques, residents' living rooms and setbacks, major alleyways	Diverse designs and locations (alleyway sides/intersections are preferable), wall signage and ads, bright paintings, open setbacks, moveable stalls/carts	Understood rule: optimum usage of space, fluidity of public-private boundaries, human and neighborhood-scale arrangements
Environmental (aesthetic and natural boundaries)	Visible/non-visible boundaries, paintings, greenery	Signage	Bright paintings	Defined and understood rules: valuing local and religious norms and traditions
Social (communal values)	Communal uses, free of charge	Mutual respect among residents, shared responsibilities on governing the settlements, voluntary work	No need to obtain permits from leaders to work/open business in the settlements, leaders oversee tenants and visitors	Defined and understood rules: valuing local and religious norms and traditions
Economical (adding values)	None	None since community governance is voluntary	No formal tax levied, affordable prices, no/low renting costs	Understood rule: valuing local and religious norms and traditions
Cultural (traditional values)	Shared space	Elders are preferred leaders, shared space	Halal products, separation between male and female dormitories, local menus	Understood rule: valuing local and religious norms and traditions
Temporal (timing)	Flexible uses and timing (most are open for 24 hours)	Flexible uses and timing, some arrangements follow praying time	Multiple activities over time, some activities occur at certain time of the day/night such as markets, street hawkers, food stalls	Understood rule: respect for religious principles

In contrast with formal spatial rules and regulations, rules in Lebak Siliwangi do not stand alone as individual guidelines and regulations for specific matters. Rather they co-exist and overlap across multiple different themes and determinants of spatial order, namely physical, social, cultural, economic, environmental and temporal factors, thus reflecting the complexity of self-organized and bottom-up driven processes and outcomes (see Tables 2 and 3). In this context, the

upward trajectory of physical development in Lebak Siliwangi reflects the continuation and co-evolution of spatial, social and economic systems that respond simultaneously to achieving the betterment of the residents' quality of life.

Rules that govern household changes are essentially understood rules and are reflected in small-scale yet often obscure changes that gradually emerge, such as walls, floors, new roofing, balconies, windows, clothes drying areas and doors. These rules facilitate the collation of human-scale built form components at the scale of individual houses, plots and alleyways, which collectively form the *kampung* as a whole. The rules produce fixed and non-fixed elements such as doorways or movable food trolleys while organizing space and guiding the self-regulated behavior of the residents. This process of multiple visual encounters of residents while concurrently deciphering the spatial order and embedded rules contained therein communicates behavior as to the way spatial order and built environment is to be constructed and used (Rapoport, 1988). Thus, the dwelling environment and wider spatial order results from the rules of daily practices and activities that inform urbanism, which, in turn, informs and recalibrates spatial practices of adaptation, transformation and emergence.

In this context, understood rules are fluid in that they facilitate maximizing expressions of small-scale adaptability as reflected in the diversity of self-help solutions such as setbacks, set forwards, vertical extensions, building materials, and vernacular and modernist designs of house components. The prominence of understood rules in shaping the adaptation and transformation processes combined with no standardization of planning and building rules means there is flexibility and robustness of rules leading to greater ambiguity. This means rule boundaries continue to be redefined and in some cases where the physical changes are exploited too far with adverse impacts, such as through 'alleyway creep', the understood rule is elevated to a defined rule. Residents build their own communities via self-organized rules – arguably what could be called a local vernacular 'unwritten code of practice' – as driven from the bottom up. These conventions, protocols, norms and 'ways of doing things' mean planning becomes a complex process of ordering and reordering diverse physical and spatial patterns with social, economic and environmental implications. In this setting, this is the framework within which order and rules evolve and shape Lebak Siliwangi and are fundamental to understanding the self-organizing city.

Self-organized housing is undertaken through a fluid framework of rules that are primarily understood rules, thus allowing for the creation of a decentralized unregulated decision-making system. It is a self-governance framework organized and endorsed by this local community that is stable yet malleable. However, a 'rules-by-the-people' approach where user control over housing adaptations is generated at the individual house level and overrides public interest concerns comes with a cost. Unregulated design and incremental construction by residents and landowners wearing 'multiple hats' as designers, architects, planners, builders and developers leads to overcrowding, loss of light, decline in infrastructure and service quality, ongoing 'interface creep' into public/communal alleyway spaces and general environmental degradation. While some co-evolution can be observed such as the development of open-space areas in each RT with the cooperation of the community, ongoing unregulated self-organization of multiple interactions by fluid rules generates negative externalities.

In conclusion, the development of rules is part of the social and governance infrastructure owned and recalibrated by residents, which underpins the transformation of the *kampung*'s built environment. While these rules and their messy nature may be seen as having little value and appreciation outside of the *kampung* by city planners and policy makers, the rules and their fluidity are highly valued by residents being linked to the emergence and sustenance of

livelihoods, sociality and the Indonesian concept of community spirit and working together (*gotong royong*). In this context, the development and co-evolution of formal and informal rules and the manner in which they support each other (such as the RTs and RWs) is an important part of the process of self-organization, adaptation and evolution of order in the *kampung*. Residents learn to navigate forces and webs of relationships with stakeholders and institutions involved in making and shaping the city, including local governments such as Bandung City Government. The lack of enforcement by the latter can be seen as endorsing and supporting the current status quo of arrangements for self-organization.

From the viewpoint of self-organizing cities, a key narrative of this paper is the insight gained into the way order and rules evolve through self-organization leading to emergence of the the *kampung*'s spatial order with all its component parts. The challenge for urban policymakers, planners and cognate professions is to shift towards conceptualizing the city as a system of systems with multiple stakeholders, their orders and parts working or not working together at different scales using different and the same rules, governance systems, plans and policies. In other words, an assemblage of 'formal and informal' orders, rules, parts and connections representing many aspirations and many plans at varying scales as part of a complex system. Viewing the city from this perspective reinforces the need for urban planners and policy makers to understand and apply in practice the concepts of self-organization, transformation, and complex adaptive assemblage so as to facilitate a planning system that offers certainty while allowing innovation and flexibility (Jones, 2019; Silva, 2018: Suhartini and Jones, 2019).

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