Article

Understanding the Informal Morphology of Villages-in-the-City: A Case Study in Hanoi City, Vietnam

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Abstract: This paper explores the production of space in the villages-in-the-city (ViCs) through a morphological perspective. During the urbanization process, rural villages originally located in the peri-area of a metropolis are eventually merged into the urban landscape. Due to lack of proper planning, these villages have faced serious criticism due to informality, self-organized development and sub-standard living conditions, and planning policies tend to focus on demolition rather than on incrementally upgrading ViCs on the same site. In this paper, we focus on the fluidity of spaces in ViCs by drawing on a case study in Hanoi, Vietnam. The key research methods are mapping, observation and visual recording. The findings illustrate how informal urbanism works in ViCs regarding spatial structure, public/private interfaces and incremental upgrading. On a theoretical level, this research helps to enrich the description of the morphological characteristics of ViCs with relation to the effects of rapid urbanization. On a practical level, this study contributes to the ways in which researchers and planners can engage with incremental changes in the integrated village.

Keywords: village-in-the-city; urban village; Hanoi; informal settlements; incremental transformation and morphology

1. Introduction

The integration of rural settlements into the metropolis is not a new phenomenon; nevertheless, due to rapid city expansion, various challenges, such as disorganized spatiality and haphazard environments, are found when examining villages-in-the-city (ViCs) in the Global South [1,2]. When the urbanization is moderate, the transitional zone between rural and urban areas becomes mingled. However, when the process of city expansion is radical, the rural landscape is quickly replaced by highways, roads and functional zones, reflecting the new spatial order. In various cases, the rural village settlements which have undeveloped infrastructure and facilities immediately become part of the metropolis, and are surrounded by urbanized areas [1–4]. Although a ViC is not considered a slum, it faces various criticisms as it is spontaneously developing outside the regulatory order and has sub-standard living conditions [5,6]. In numerous cases, ViCs are seen as negative features within cities, and planning policies commonly tend to focus on demolition, even though these integrated villages could be incrementally upgraded on the same site [7–10].

The aim of this study is not to share optimistic views about ViCs, but rather to explore how the morphological structures of villages work within an urban environment. Planning policies can strengthen the inter-relationship between ViCs and other urban areas and provide a sufficient and safe infrastructure. Such upgrading strategies rely on an understanding of existing morphology, incremental changes and adaptation [11]. Therefore, it is important to explore how spatiality in a ViC functions. Drawing on a case study in Hanoi, Vietnam, this paper explores the morphological structure of ViCs. The outcome of this study raises interesting questions about informal urbanism in ViCs and calls for fresh perspectives on planning approaches.

The remainder of the paper is organized as follows. Section 2 reviews the changing morphology and typology of rural settlements due to city expansion. Section 3 highlights the materials and research methods. Section 4 gives an analysis of the study area. The final section offers discussion, conclusions and relevant further enquiries.

2. Morphology and Typology of Rural Settlements and the Effects of Urbanization

Urban morphology is the study of urban form and engages with the evolution process of human settlements [12]. Morphological study provides an explanation of the arrangement and diversity of an urban form by examining the interrelation between human settlements and socio-cultural, economic and environmental factors [13–16]. The methods principally analyze maps and plans of settlements at three scales: town plan, plot and typology of building [17]. The outcomes of these morphological studies highlight the importance of the built environment and provide opportunities for the planning process, creating an identity of place, and conservation [15,16,18].

Better understanding of urban form is crucial to determine better design interventions [11,16]. Through description, physical analysis and urban mapping to explore the characteristics of ViCs, researchers can predict and shape urban change. Zacharias et al. [19] show that the internal pathway system is used not only for movement, but also helps to boost local commercial activities. Particularly, their findings reveal that, due to the economic and transport linkage between ViCs and other parts of the city, shops are frequently found on the ground floors along the key alleys and conjunctions which experience large movement flows. Seo and Lee [20] reveal that the streets and public spaces endure owing to their public ownership, while buildings and plots can be quickly transformed by their users. Therefore, during rapid urbanization, various public characteristics of traditional villages, such as oxcart routes, alleys or historical temples, could be found in modern cities [20,21]. Figlus [22] indicates that the distance between cities and surrounding infrastructure is a dominant factor contributing to the incorporation process of the rural villages. Villages which are situated near the city are radically transformed; by contrast, rural settlements in the edge of city experience only minor changes. According to Lin et al. [23], formal and informal alliances between clan authorities and new key stakeholders are considerably affected during the morphological transformation of ViCs. Thus, the production of space in ViCs emerges according to social rules which are rarely written and documented, but are shared by people who participate in building activities. A lack of knowledge about the growth of ViCs makes it difficult for governments and agencies to implement planning and regulations to integrate it with other urban areas and the city infrastructure.

In recent years, several studies have illustrated that the spatiality within ViCs should not be reduced to consideration as totally uncontrolled areas. Gao et al. [24] show that building height in Guangzhou is neither principally influenced by the centrality of buildings, nor by land values; however, it is affected by agreements between the local government and the village committee. Types of streets and alleys also have considerable influence on aspects of building design, such as accessibility, functional mix and urban interface. Van Oostrum [25] highlights that the dynamic intersection between formal and informal morphologies could be found in ViCs in peri-urban areas, owing to the reduced direct control and enforcement of municipal rules. He also points out that there are recurring patterns in the configuration and transformation of ViCs regarding access, density and functional mix, in Chinese and Indian cities [26]. In addition, various forms of public/private interfaces and public space encroachment of have emerged in response to formal codes, cultural norms and unspoken performative rules [27,28]. Thus, a better understanding of how informal urbanism works in ViCs has the potential to facilitate the development of alternative methods of management and improvement.

Several gaps were identified when reviewing the interconnection between ViCs and urban morphology. Firstly, although ViCs were studied through various disciplines, morphologies of ViCs are generally irrelevant. ViCs are frequently been studied by sociologists, historians, planners and architects; thus, majority of studies about ViCs mainly focus on

changing economics, living styles and socio-cultural factors, historical architecture and macro planning [29,30]. While those studies may engage with issues of informal urbanism and incremental development in ViCs, there was very little research performed using a morphological perspective. Secondly, although the village was the most common type of human settlements for a thousand years, the morphological structures of villages within city boundaries in the Global South is underrepresented in the literature. Since the majority of morphological studies of human settlements have taken place in the Western countries [31], the lessons learned from such studies cannot be applied to ViCs in the Global South, because of the different economic, social and political conditions. Lastly, while the image of the ideal city and neighborhood have been well examined, there have been no such studies of the image of ViCs. Due to being surrounded by the urbanized landscape, ViCs could be considered as an archipelago that reflects a cultural landscape within a modern city [32]. With the on-going process of the emergence of large metropolises in the Global South, planning policies for ViCs have become one of the greatest challenges for sustainable development, since ViCs cannot be totally replaced or demolished [33]. The most realistic planning approach would be to upgrade in situ by adapting the existing morphology [34]. Such an approach relies on a sophisticated understanding of how informal morphology works in ViCs.

In summary, the image of ViCs plays a significant role in the politics of development strategies. Detailed morphological analyses of ViCs and its link with changing socio-cultural, economic and environmental factors are urgently needed for better design intervention, yet there is still a lack of sophisticated understanding of how informal urbanism works in ViCs. This paper builds upon an emerging body of work engaging with the exploration of the morphological structure of ViCs in the Global South context [23–28].

3. Materials and Methods

This paper draws on a case study, examining one of the largest pockets of informal areas, in Dong Da district, in Hanoi city. As the housing environment in Hanoi city has primarily been characterized by popular sectors through self-organized and self-built activities since the late 1980s [35–37], the selection of this case study is based on an information-orientated approach. Nevertheless, the effects of urbanization on rural settlements may vary across different contextual settings and will depend on how locals are able to participate in the built environment. Thus, there is no claim that this study can represent the broad range of integrated village settlements in different contexts. Using historical maps at the city scale, an evolution of the village settlements was traced through mapping techniques. Representative samples of street layouts and buildings in the studied area are featured in this paper. In addition, observation was used to explore the ways in which urban morphology works. During the fieldwork in January 2016 and August 2017, streets, key alleys and construction sites in the study area were visited. Visual recording including short videos, images and notes were saved for illustration.

Several limitations were identified in the data collection and analysis. Firstly, apart from the maps drawn by the surveyors from the late nineteenth century onwards, the historical records of Vietnamese cities provide little detailed information about scales and dimensions [38]. Furthermore, various important documents about the original structure of rural settlements have not been well recorded; thus, it is difficult to track the changes to plots and building typology, which are important components of morphological studies. Therefore, the scope of this paper is therefore restricted to understanding the changing spatial layout of ViCs within the influence of rapid urbanization, and how different morphological forms work in a contemporary urban context. The study focuses on three main factors: (1) the process of land-use and circulation network transformation, (2) public–private interface and (3) incremental adaptation.

4. Case Study Analysis

4.1. History and Transformation of Spatial Structure

Hanoi, the capital city of Vietnam, has a rich environment characterized by rural-urban integration [36,39,40]. Historically, there are two main parts of the ancient city: the royal citadel and the marketplace. Outside those areas is a complex and dense network of villages. Since the early twentieth century, the urban boundary has been expanded and changed several times, and various rural villages were immediately integrated into the city [1,40,41]. Nowadays, various aspects of traditional villages, such as temples, pagodas, village gates, communal houses and (sometimes) traditional village houses can be found across the city. The phrase Lang trong pho is frequently used in local news and media to describe the village characteristics within urban areas [42].

Before the early nineteenth century, the Vietnamese village was considered to be a basic and self-sufficient unit, and the physical structure of a village was designed to protect villagers from external aggression [40,43]. Ngo [43] and Nguyen [44] highlight that there are no formal rules for villages structures; however, the forms of villages are defined by the surrounding rivers, lakes and agricultural land. Ngo and Nguyen also reveal that one village can have several clusters located around communal houses, temples, pagodas and village wells. In addition, there are village gates and multiple layers of bamboo trees surrounding village settlements, while village houses are one-storey constructions made of timber, bamboo or brick.

The historical village structures were mapped against the expansion layers to explore the ways in which village settlements are positioned within the city. Figure 1 shows a broad distribution of historical village's structures across the urban districts of Hanoi city. Many of those settlements used to be located along the lake and river. Nevertheless, due to city expansion, the village settlements are now surrounded by an urbanized landscape. Before 1997, only a small number of villages were integrated into the city. By contrast, since 1997, various village's settlements can be found within the second layer of expansion.

The selected study area represents the typical morphology of long-time urbanized villages in Hanoi city. The study area is situated in the Dong Da district, which used to be the location of several villages (Figure 1). Those villages were integrated into the urban area when the Dong Da district was officially established in 1954. Today, this area is a dense residential area with a complex network of alleys (Figure 2). Since the villages have become part of the city's structure, they were upgraded to improve living conditions through a participatory process. The local wards have the responsibility of providing additional services and facilities. Nevertheless, as local government finances are limited, it has been difficult to upgrade the whole area. The most common upgrading projects were to develop necessary infrastructure and to widen roads and alleys within and around the villages. As a result, the mode of state and people partnership has frequently been used to upgrade small alleys [35]. This mode focuses on necessary amenities such as water and sewage systems, and electricity. Thus, the mud and brick alleys have been replaced by concrete alleys, and the majority of households in the study area have access to basic services.

Different maps were re-drawn together to show the transformation of land-use in the study area and surrounding landscape (Figure 3). The maps highlight four main types of land use, including village settlements (self-built residential areas), rivers and lakes, circulation and planned urban areas. In 1936, a large number of lakes and village settlements which had informal structures could be found, along with a network of lanes. One notable feature is that a railway passed the area. By the early 1960s, there were little changes in the study area except for an increase in the residential area along the Kham Thien Street. Meanwhile, the surrounding landscape had experienced considerable change due to the construction of the Kim Lien quarter in the south and the Thong Nhat Park in the east. By the late 1970s, several other living quarters were constructed nearby, in the south of the study area [36]. The 1992 map illustrates that various lakes and jammed paddy fields within the study area were replaced by public facilities such as schools, health centers, administrative offices and residential areas. The map in 2015 shows that Xa Dan

Street was created in the south, and the number of alleys significantly increased. Also, Ba Mau lake was kept as an open space, while other lakes were totally been filled in to enable urban construction.
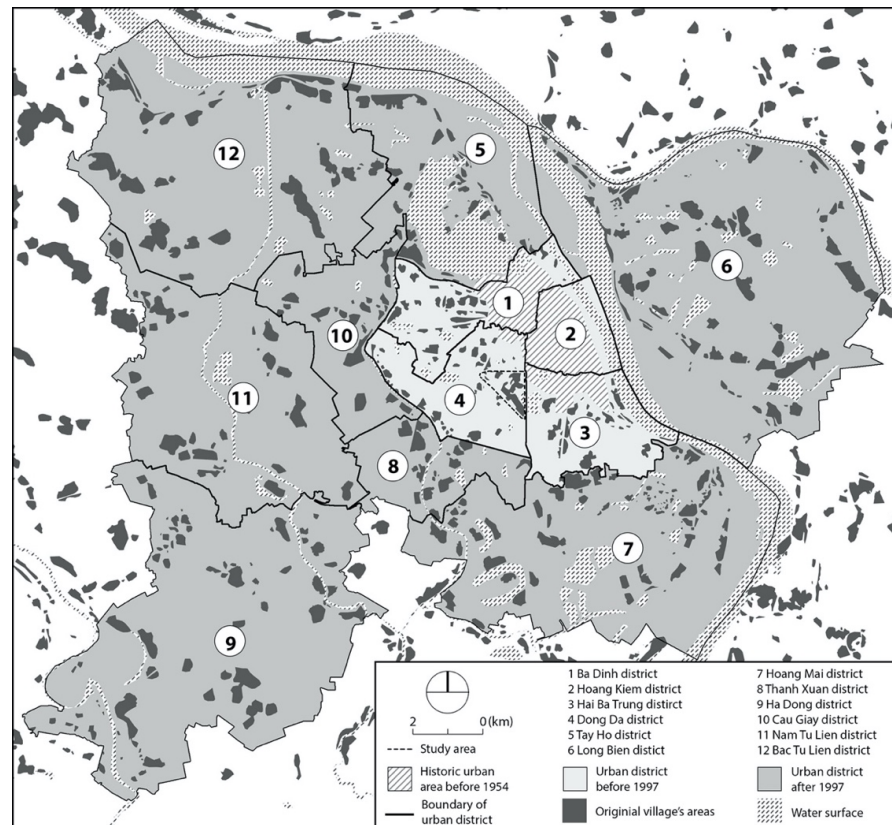

Figure 1. Layout of historical villages in urban areas of Hanoi city (Adapted from map entitled "*Hanoi*" published in 1935, from digital library Gallica).
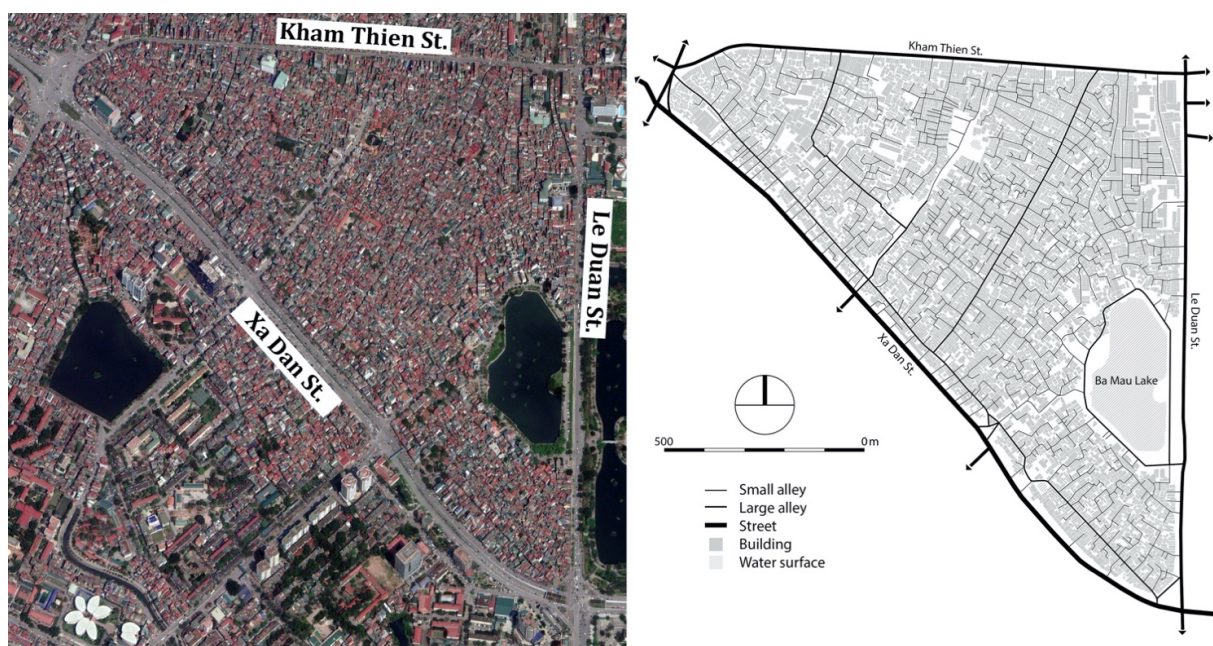

Figure 2. Satellite image (**left**) and contemporary morphological structure of study area (**right**) (based on information published on the website of the Hanoi Environment and Natural Resource Department. Retrieved from http://qhkhsdd.hanoi.gov.vn:2015/ Accessed on 1 January 2018).

Figure 3. Transformation of the land-use types around and in the studying area (In the study area, changes in land use and circulation were mapped using data from a set of maps. The first map dates from 1936 and is entitled "Plan de la ville de Hanoi", from digital library Gallica. The study area in 1960 was extracted from two maps, namely "Bản đồ khu phố Đống Đa" dated 1960 from Ashui.com and "Bản đồ chỉ dẫn Thành phố Hà Nội" dated 1962 from the National Library of Vietnam. The third map is from 1992, and was collected in the Hanoi University of Architecture. Finally, the land-use map dated 2015 was digitally published on the website of the Hanoi Environment and Natural Resource Department.

Generally, the pattern of integration of villages into the city can be summarized as follows. Firstly, the paddy fields are the main priority for conversion to new urban functions, followed by lakes, and finally, residential areas. Within the urbanization process, the large parcels of agricultural land situated around the village settlements are converted into urban land use through large-scale projects. Meanwhile, jammed agricultural parcels situated between the village settlements and urban projects are converted into urban areas through small-scale projects including apartment blocks, self-built housing areas, roads and public facilities. When there are no paddy fields left, the lakes become the next target for conversion. By contrast, the residential areas in formal villages generally remain unchanged. Secondly, the internal circulation network is continuously developed. Small

alleys are an identifiable characteristic of the internal circulation of rural villages. Within the urbanization process, the pathways, alleys and small roads are informally and formally upgraded or rebuilt to provide accessibility.

In the study area, different types of morphology were mapped and drawn in detail to show variations of informality in ViCs. As there is no clear visual boundary between different typologies, representative areas are used to highlight morphological characteristics. Figure 4 highlights three typical types of morphology. The first is an extension area with a regulated layout along the railway (Figure 4, area 1). The second is a historical village's structure (Figure 4, area 2) and the last is an extension area with an unregulated layout along the ancient dyke (Figure 4, area 3).

Although the study area at the macro scale seems chaotic, several parts of it were developed with regulated layout. Figure 5 (area 1) shows the area along the railway and Le Duan Street. The road network has a clear grid layout, with parallel alleys that extended to the main streets. The area is a mix of residential areas and state enterprise offices, which are located nearby. There is no direct access between this area and the formal village structure. The housing typology is of tube shape, which is long and narrow. The building density is very high, with a gross coverage of about 70 percent. The housing size and number of storeys varies according to the location of buildings and local regulations. Buildings which are situated along the railways commonly have two to three storeys; by contrast, constructions in alleys generally have three to five storeys.

Figure 4. Circulation system and built-up area in the study area in 1936 (small map) and in 2015 (area 1, 2, and 3 in Figure 4 correspond to those shown in Figure 5).
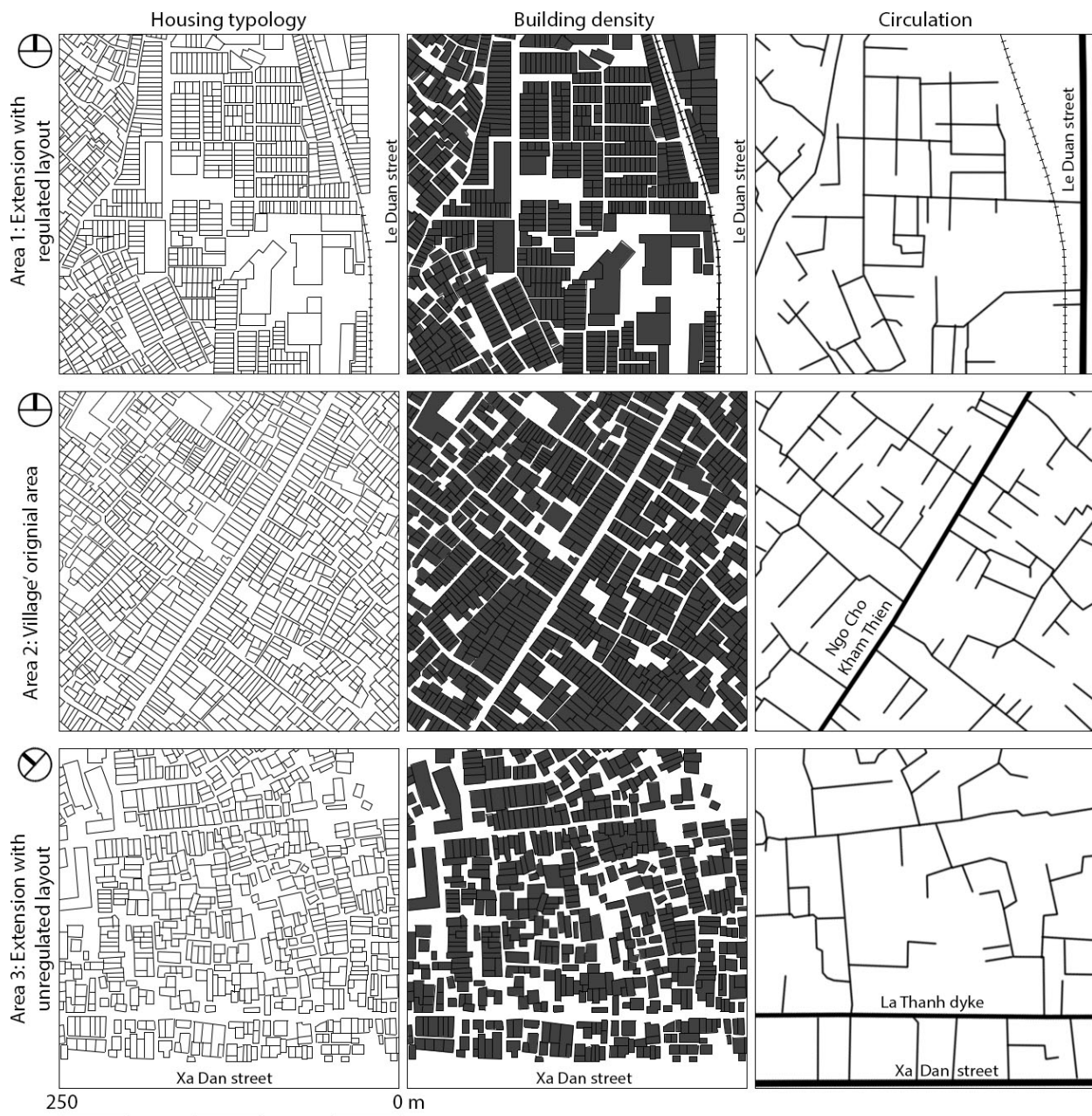
Figure 5. Morphology and housing typology in the studying area Đống Đa district.

Figure 5 (area 2) shows an example of an original village structure which is situated along the historic alley named ngo cho Kham Thien. The courtyard houses, which are popular designs in traditional rural villages were replaced long and narrow tube-shaped houses. The building density is very high, and the height of buildings varies between one and five storeys. The circulation is based on a network of narrow alleys.

The last example has an informal layout built over an area which used to be farmland around the ancient La Thanh dyke (Figure 5, area 3). The building constructions in this area have emerged only after the 1960s. After the city expanded its territory, the dyke lost its main function of flood protection, as urban projects had filled the lake and water bodies nearby. Then, due to a lack of clear regulation and detailed planning to control urban growth during the 1980s and 1990s [35–37], buildings were informally constructed on both sides of the dyke. Similar informality was reported in different village settlements across the city [1,2,29]. The circulation system of this area is based on a network of the historic lanes and the dyke.

4.2. Public and Private Interfaces

There are various types of shops located in different parts of the study area, resulting in numerous forms of public–private interface. The majority of the shops are situated along the main alleys, intersections and streets, where the flow of people is greater than in other parts of the settlement. Buildings in the main alleys and streets accommodate a vertical mix of living and commercial activities. This pattern of functional mix includes shops at ground level with residential areas on the upper floors. The shops also vary in terms of their locations and types (Figure 6). The public–private interface of commercial activities can be classified into three types. Type 1 comprises shops with a showcase is situated within a private boundary (Figure 6, left). This type is commonly located along the main streets. The shops are well designed and decorated to attract customers from local and surrounding areas. Type 2 consists of shops which are situated in both private boundaries and public spaces such as pavements and alleys (Figure 6, middle). The shops' owners informally use parts of public areas for counters and food preparation tables. The appropriation of public areas are not only helps to increase the volume of commercial spaces (such as sitting and cooking areas), but also provides wider views for customers. These shops often sell basic products and essential services to locals, and include small restaurants, tea shops, cafés, hair salons and clothing shops. Type 3 comprises shops which are entirely situated in small alleys (Figure 6, right). Commonly, the shops' owners live in small alleys, which can make it difficult to open business, so in order to attract customers, they use loose parts of the alleys to run their business. These shops are frequently found at the conjunction between alley and street so they can gain attention from the flow of people in the streets. The shops only open at particular hours in the daytime, and they sell only one type of product or services such as rice, noodles or haircuts. Also, in order to avoid conflict with local residents and traffic, these shops are always situated around impermeable facades such as walls, closed doors or public constructions. The benefits of such shops are that they help to provide a source of income for residents, and they enhance social interactions; as a result, the various alleys in ViCs are the most livable places in the city.

Figure 6. Shops along main street (**left**); shops with the counters situated on the pavement (**middle**); food stall in the small alley against impermeable facades (**right**).

The diverse public–private interfaces can also be seen in different types of moveable shops. Due to strict control of informal trading activities in the main street [35], roaming vendors frequently use spaces around the traditional street markets and large alleys in ViCs as venues for their trading activities. The street vendors are generally villagers living in peri-urban areas. Owing to their proximity to the city center, they bring products from their gardens to sell in the city during the daytime. Figure 7 shows different types of movable shops in the study area. The most common type is food shops, which are situated next to impermeable facades or public spaces (Figure 7, upper left). Also, in many cases, vendors

negotiate with residents to use spaces in front of their houses for trading activities (Figure 7, lower left). Meanwhile, various types of vehicles can be used to transfer products around ViCs (Figure 7, upper right and lower right). These shops often provide fresh food and cooking ingredients which cannot be found in nearby supermarkets or convenience stores.

Figure 7. Vegetable products in baskets (**upper left**); fish and shrimp in baskets (**lower left**); vendor using a bicycle to enhance mobility to sell seasonal vegetables (**upper right**); vehicle modified by a roaming vendor to carry domestic products (**lower right**).

The range of activities taking place in loose parts of alleys also contributes to the dynamic living environment in ViCs. Most of the loose areas are used for vehicle parking (Figure 8, left). Local residents frequently occupy the alley as they are parked in proximity to the houses. At the same time, the storage of domestic items and plants is also visible in the house fronts and along the alleys. It is important to note that due to the complex system of narrow alleys, not many strangers visit ViCs, which increases the sense of safety and prevents looting and theft. As a result, the concentration of loose parts becomes greater in the deeper parts of ViCs.

The interaction between public and private spaces can also be observed through the design of buildings. In many cases, the overhang of a building extends into the public alley. While the need to maintain flows at ground level prevents encroachment on public space from blocking the alley, the cantilevers often touch each other on the upper levels and block the light of the public space (Figure 8, right).

Figure 8. Motorbikes parked in the alley (**left**); plants (**middle**); cantilevers block the light in the alley (**right**).

4.3. Incremental Adaptation

Although the typologies of buildings are varied, their building architecture shares several characteristics. Apart from several collective apartment blocks, which were built during the central economic planning period (1954–1986), the majority of buildings in the study area are self-built housing, which means that households were directly involved in the design and construction processes. The design of buildings often reflects the personal interests of the owners. Thus, each building has its own detailed decoration, styles, color, height, use of materials and number of storeys (Figure 9, upper left). Meanwhile, as the size of self-built housing is relatively small, in order to increase living spaces, households frequently design their houses in a vertical form. The lower levels are for business activities and living spaces, while the flat-top terraces are for gardens, laundry and clothes drying areas.

There are various forms of incremental adaptation in ViCs. One of the other increments of change is where the parts of a building changes from a residence to a shop, warehouse or rental accommodation. Parts of the domestic space, particularly on the ground floor, may be allocated the role of a small shop or workshops. Although the existing floor area remains unchanged, the use of the building thus alters from purely residential use to a mix of living and commercial activities. This is more likely to take place along the main street and in large alleys which have large flows of movement. On the other hand, different parts of buildings in small alleys may be used as rental accommodation and workshops. The renters are low-income groups such as students and migrant workers, and they do not complain much about the living conditions in ViCs.

Changes in housing typology and housing ownership are among the most common changes during the urbanization process. In traditional villages, each family had a courtyard and gardens [43,44]. Inside the courtyard, there would be a basic house for living spaces, and the kitchen and toilets were built separately. Most village houses were single-storey and were made of timber and brick. Since the villages became part of the urban area, the farmers started to redevelop their houses. The villagers, they needed to save money to support their urban lives. Meanwhile, as upgrading projects were implemented around the villages, the land values increased quickly. Thus, villagers started to divide their residential areas and gardens into smaller plots and sell them to the new middle classes in the city. In addition, villagers often distributed their housing plots amongst their children. By doing so, their offspring could build their own houses. Consequently, gardens and yards were divided into smaller housing plots either for sale or distribution to children. This process helps to explain the high density of built-up areas in the village area (Figure 5, area 2).

Adding a new domestic space over an existing construction is another common incremental change in ViCs. There are various ways to extend living spaces, such as adding a temporary structure at the top of a building (Figure 9, upper right) or on the balcony

(Figure 9, lower left). Such addition of rooms is frequently used to extend living spaces because it does not require much investment. Sometimes, a new storey may be built using concrete if the framework allows it (Figure 9, lower middle).

Rebuilding a house or repairing parts of a building are further incremental changes. The aim is to improve the living environment when adaptation can no longer satisfy the owner's needs in terms of living spaces, and new functional requirements may result in the destruction of the original structure and its replacement by a new one. In addition, most households cannot build a large house to begin with due to financial constraints, and therefore a basic house may be constructed using temporary materials. Then, over time, the house can be rebuilt or upgraded using permanent materials such as reinforced concrete (Figure 9, lower right). This process of change is continuous until the building quality meets the satisfaction of the house owners.

Figure 9. Diverse architectural styles of buildings (**upper left**); a temporary structure added over the top of a building to increase living space (**upper right**); a contemporary structure added over the balcony (**lower left**); the addition of a new storey (**lower middle**); a new house built over the site of an old building (**lower right**).

5. Discussion and Conclusions

This study explored the production of space in village settlements within a city to determine why different informal structures appear in a metropolis, as well as how the public–private interaction and incremental adaptation in these environments work. The initial aim was to provide a better understanding of morphologies and incremental adaptations in ViCs, which have remained inadequately studied. This paper has used a case study in Hanoi city; therefore, it makes no claim that this study represents the way in which urban morphologies work in ViCs in the different contexts. As the morphological structure of ViCs and its process of change depends on social, political and economic

factors [2,19,23,40], further studies are needed to compare the form and transformation of ViCs elsewhere. Also, as certain important data were unavailable, this study is not a replacement for detailed morphological research. Nevertheless, several fundamental characteristics of the study area were analyzed in this paper as follows.

Firstly, although the morphologies in ViCs might appear to be unregulated and chaotic in structure, there is an underlying logic to the growth of various forms of informality in ViCs. As suggested before, the process of morphological transformation is closely related to land-use types and land use right [20]. Vietnamese village settlements were built around water sources while the farmland surrounded villages. Rural roads and alleys developed according to the natural landscape as a means of connecting houses with local destinations such as paddy fields, temples, pagodas and communal buildings [43–45]. In the study area, the land types were depicted on cadastral maps which show four main types of land, including agricultural fields, residential areas, lakes and rivers and a circulation system. Under the influence of city expansion, the rural landscape around the villages and the physical layout of the villages themselves started to change. Rural characteristics including lakes, ponds and a predominance of arable lands and landscape features were gradually replaced by new residential areas, urban facilities and infrastructure. The urbanization process starts with the development of new urban areas on agricultural land on the edge of village settlements, mainly because the procurement process is easier. Modern roads are created to integrate the village settlements with the urban landscape. Since agricultural land is consumed quickly, lakes become the next target. On the other hand, local households are the most resistant to new development; thus, the existing residential areas and circulation networks remains for a longer time, and eventually become surrounded by urban projects. Meanwhile, the jammed agricultural plots and unplanned spaces along the main streets, railways and dyke are transformed into self-built housing areas.

Secondly, the study shows that there are various forms of public–private interfaces in ViCs. It has previously been shown how the morphological form of ViCs can accommodate a mix of living and working environments [19,24,26–28]. Such a combination of working and living spaces in one building is frequently found in the study area. Buildings with mixed functions are generally located along the main streets and large alleys, and close to intersections with more pedestrian and traffic movements. Large shops are mainly found along the street at or the edge of the village due to the large flows of public movement. The key alleys are frequently used as local street markets, where vendors commonly use buildings along the alleys and pavements for their business activities. Meanwhile, small moveable kiosks, workshops and stores are found in less crowed alleys. Also, different loose parts and spaces in the alleys are used for private activities and motorbike parking. The different patterns of public–private interactions in ViCs illustrated how self-organized settlements can evolve to adapt to the needs of the daily life in an urban context.

Thirdly, a number of incremental changes can be observed in ViCs. As the majority of housing in ViCs is self-built, the housing architecture was personalized in terms of form, arrangement and use of domestic spaces. When the family needs change, the house forms change accordingly. Such incremental changes include the rearrangement of plots and housing property, functional alterations, repairing or rebuilding of houses and the addition of temporary structures or storeys. These changes do not happen because of modernization, but in response to changing socio-economic conditions. Such transformations reflect the ideal of Turner [46,47] that when households participate in the design and construction process, they can justify their needs and priority. In order to adapt to urban living conditions, local households can sacrifice short-term discomfort, such as lack of accessibility to daylight and ventilation, in exchange for longer-term benefits such as larger living spaces and opportunities for commercial activities to generate income.

Exploring the morphology of ViCs has provided a better understanding of the relationship between cities and rural settlements at different scales. As presented in this study, ViCs shared various similarities with other informal settlements [47–52]. Nevertheless, the distinct identity of ViCs come from their original rural background. In other words,

they have dual rural and urban characteristics. Unlike some European cities that were defined by the Acropolis, or Italian piazzas with their special spatial divisions that were associated with civic life and religion, ViCs developed from farmland and rural ways of life. Despite the significant changes brought about by the urbanization process, ViCs have inherited many characteristics from the traditional settlements that were integrated with the natural landscape by geomancy principles, spatial division of private and public spaces and circulation systems. However, these characteristics also shared with the value of locus, as discussed by Rossi [53]. Furthermore, the analysis of the transformation process suggests that, unlike architect-designed neighborhoods where a street network and infilled architecture are identified in a planning system that is very often related to a grid systems imposed on the organically evolved landscape, ViCs carry some characteristics that reflect the topography of the land. There are many stakeholders and policies of formalization which might be involved in the development of ViCs. Such transformations may not produce a slum-like environment, but the densification can lead to a tragedy of the commons, in which accessibility to light, ventilation and public spaces is limited.

The proposal of upgrading strategies is outside the scope of this paper; however, it is reasonable to suggest three recommendations. Firstly, ViCs and their incremental transformation should be clearly classified and identified along with the process of city development. The architecture of s ViC is a part of its social history; therefore, it is always associated with events, memory and ideals [53]. The structure and form of ViCs can be reinterpreted to suit modern needs, and the planning policies should recognize the specific roles that ViCs have played in the urbanization process. Secondly, the improvement of ViCs should not only focus on upgrading infrastructure, but also needs to address how to allow incremental development. The transformation of building forms and the diverse interfaces of public–private spaces respond to local needs; thus, there is a need for different sets of regulations to enhance the quality of living space. Thirdly, as the image of a ViCs plays a critical role in determining planning strategies, more detailed analyses of the morphological forms of ViCs are needed in the future studies. Several frameworks presented in the existing works could potentially be applied in further research. Jacobs sees the city as a self-organized system, which illustrates evolutionary behavior and morphogenesis [54]. Nguyen's PhD project assesses patterns in the urban development of Hoian in Vietnam based on Alexander's properties and Lynch's qualities, and explores the generative process reflected in traditional urbanism [54–56]. Hillier uses space syntax to examine the connectivity and configuration of settlements [57]. Gao explores discrepancies between the academic categorization of public spaces and the communities' own perception and organization of public spaces [58,59]. All of the above-mentioned works provide research methods for further developments in the subject to gain a better understanding of the morphology of ViCs.

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