Rural–Urban Adaptation in Dwelling Patterns in an Informal Settlement in the Dominican Republic  
- A Case Study of Azul in San Francisco de Macorís - 

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Abstract 
The aim of this paper is to consider a core-housing model that suits the local culture and customs of the Dominican Republic. The study is based on a survey that was conducted in an informal settlement called Azul, in the municipality of San Francisco de Macorís. The goal of the survey was to study rural–urban adaptation patterns in the dwellings, and to identify the minimal core that could be used as a basis for the proposal. The survey was divided into two stages: 1) questionnaires were administered to the local residents to identify the residents’ profiles, and 2) direct observation and mapping was used to identify the dwelling patterns. Sixteen residents were interviewed and 15 dwellings were mapped for the analysis. The results showed that the dwellers built their homes initially based on the traditional rural dwelling pattern, and then adapted and improved their dwellings according to their capabilities and life cycle stage. Based on the survey results, a basis for a core-housing model that takes into account the Dominican lifestyle is proposed.

Keywords: informal settlements; rural–urban migration; adaptation process; core-housing; questionnaire survey

1. Introduction and Background 
1.1 Informal Settlements in the Dominican Republic 
In the 1960’s, an economic and social crisis developed throughout the Dominican Republic in rural areas, and a large number of farmers and their families had to seek other income-generating activities to supplement household incomes. This created an increase in migration to urban areas (Municipality of SFM, 2008). According to the United Nations (UN, 2014), it was estimated that by 2014 the urban population in the Dominican Republic would have reached 78% of the entire country.

The rural–urban migration led to the formation of informal settlements in the urban areas. As the new urban residents adapted to a new environment, they began to create a new living system. In order to analyze this system, it is important to understand the residents' efforts to adapt to their new environment. Although these settlements could be considered as underdeveloped areas, they are nevertheless part of the reality of the development process of Dominican cities, and attention should be drawn to them for future sustainable development.

1.2 Defining Informal Settlements 
The UN (1997) defines informal settlements as:
1. areas where groups of housing units have been constructed on land that the occupants have no legal claim to, 
2. or unplanned settlements and areas where housing is not in compliance with planning and building regulations (unauthorized housing).

Many times informal settlements are seen as a negative phenomenon. However, for the purposes of this study we consider their positive sides, e.g. the different forms, characteristics, and interesting patterns that display the local culture of living, and tendency to build in a specific way.

1.3 Case of Study: Azul Settlement in San Francisco de Macorís 
The San Francisco de Macoris municipality (SFM) is the capital of Duarte Province in the Dominican Republic. It is located in the Northeastern part of the island (Fig.1.). The city has 188,118 inhabitants (ONE, 2012), and the city is characterized by its agricultural industry.

The Jaya River flows through SFM (Fig.2.) and acts as its main water source. The rapid migration from rural areas led to a vast development of spontaneous settlements on its margins. In 2008, the authorities
of SFM’s City Council initiated a project, called *Improvement of the bank of Jaya River* (Municipality of SFM, 2008). The objectives were to relocate the communities that were most affected by flooding to areas that met planning regulations, and to improve the green area along the river. However, the project did not succeed, and the settlements remained as places that hold migrants who come to the urban center in search for jobs and a better life.

According to the project report (Municipality of SFM, 2008), there were 54 settlements informally established along Jaya River. The total population in these areas was 38,653 inhabitants, which represented 21% of the total population of the municipality (Table 1). The river was divided into *upper rural*, *lower rural*, and *urban* streams (Fig.2.). The urban stream was the most populated area, with 28,245 inhabitants in its informal settlements. This showed clearly the extent of migration to the urban center.

Azul is one of the spontaneous settlements located in the urban stream of Jaya River. It is located less than 1 km from the city center, which has public facilities (e.g. schools, hospitals, public transportation), recreational facilities (e.g. a central plaza, churches), and commercial areas (e.g. grocery stores, local shops). Although the settlement was originally formed as a community of rural migrants, it has become rather individualistic due to constant migration in and out of the area. The residents are autonomous in producing and repairing their houses. Nevertheless, the settlement lacks proper infrastructure, and its residents have an insecure residential status.

### 1.4 Approaches to Informal Settlements

#### 1.4.1 Sites and Services

Many countries in South America, Asia, and Africa have adopted the Sites and Services approach to solve the problem of informal settlements. In this approach, plots of land, essential infrastructure, (e.g. roads, water supply, drainage, or electricity), and possibly a basic shelter, are provided, with the goal being 'slum clearance'. Thereafter, the beneficiaries build their own houses on that land.

The World Bank (1990) initiated a Sites and Services project in the Dominican Republic in the 1980's to provide housing for the urban low-income residents in the capital, Santo Domingo. The goal was to provide housing for about 8,000 families, using a loan from the World Bank. However, in the end the project was dissolved, because of radical changes in housing policies.

#### 1.4.2 Core Housing System

The Core housing system is a form of self-help housing for underdeveloped countries (Abrams, 1969). It is a variation of the Sites and Services approach, where one complete room structure is provided to the beneficiaries. The local culture and living habits need to be considered in order to apply the core housing system successfully in different places.

There have been various academic works regarding core housing and dwelling adaptation (Tanaka et al., 2003; Fukuki et al., 2004; Chiranthanut and Funo, 2008; Tamura, 2014). These studies concentrated on the transformation of a given basic core by the dwellers' activities.

Tanaka et al. (2003) studied the spatial characteristics of extensions performed by the occupants of core houses in Thailand. They noted that the residents did not follow the originally projected extension process, partially due to the absence of a management system to support the activities. Instead, although there were

| River stream  | Settlements | Dwellings | Population |
|---------------|-------------|-----------|------------|
| Upper rural   | 21          | 848       | 3,778      |
| Urban         | 26          | 6,129     | 28,245     |
| Lower rural   | 7           | 1,447     | 6,630      |
| Total         | 54          | 8,424     | 38,653     |

Table 1. Population of the Communities Settled along Jaya River

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Fig.1. Map of the Dominican Republic, and the Location of San Francisco de Macorís (SFM) in Duarte Province

Fig.2. Jaya River in San Francisco de Macorís
different types of cores, the residents tended to expand their homes in certain ways that were defined by the local culture.

Fukuki et al. (2004) studied the implementation of extensions and renovations in the core housing in Manila, Philippines. They pointed out the importance of water supply location. Four out of six households in their study had relocated it to the back of the house as a part of the expansion and adaptation process.

Chiranthanut and Funo (2008) did not consider directly an applied core housing system, but analyzed the transformation and spatial formation processes of traditional Kaloeng houses in Thailand. For example, they observed that the local culture and traditions have a strong effect on the orientation of the houses and direction of the made expansions.

Tamura (2014) analyzed the dwellers' expansion activities in the Lusaka Sites and Services project area, in Zambia. The study showed that also computerized methods, in their case CONCOR, can be used to identify spatial patterns in the expansion process.

We did not find cases of core housing in the Dominican Republic, although the country's rural–urban migration has led to a steady formation of informal settlements in urban areas. This is why we try to find a core housing system that takes into account the Dominican culture and lifestyle, and could be applied in the country.

2. Objective of this Study
This study considers how dwellers build and expand their houses after moving into informal settlements. The goal is to analyze the rural–urban transitional process of the dwelling pattern in Azul, in order to:
1. see how migration and change in lifestyle affect the dwelling pattern,
2. study the nature of the adaptation process,
3. and propose a basis for a core housing system for use in the Dominican Republic.

Analyzing this process could create a better framework for improving the residents' living environment, and could contribute to the creation of a new, more sustainable dwelling system. Perhaps, understanding this informal process may also give us a clear approach for its integration to the formal system.

3. Methods
3.1 Survey
In order to analyze the dwelling patterns of informal settlements in the Dominican Republic, a local survey was performed in the Azul settlement in SFM, from July 15 to 31, 2013. SFM is an agricultural city that has a growing migration to the urban area. Thus, it was expected to clearly show a rural–urban transitional adaptation process.

The study uses a field survey for data collection and direct observation. In the survey, 15 dwellings were mapped and 16 households were interviewed. Furthermore, in order to analyze the residents' lifestyle and living system, we collected data on their socio-economic status and background through questionnaires. The samples were selected based on household diversity in order to obtain a set of data that would correspond to the variation in the dwellings in the area, and to see the different types of adaptations and expansions.

One of the limitations of the study was a lack of information about the settlement. Therefore, some physical data, such as a site map (Fig.3.), was created.

4. Survey Results
4.1 Residents' Characteristics
The main results of the household interviews are listed in Table 2. Most of the dwellers of the community were former migrants from other municipalities and rural areas, who had migrated to SFM pursuing jobs and a better life. Some of the current residents had also come from the surrounding urban area. The average number of members in a household in the surveyed area was 4.

4.2 Dwelling Characteristics
The results of the dwelling mapping are shown in Fig.7. A typical dwelling in the area had a living, dining, and kitchen area (LDK), two bedrooms (BR), and a toilet separate from the house (Fig.4.).

The houses in the survey were not built as complete houses at once, but rooms were added and adjustments were performed gradually according to the dwellers' needs.
The basic structure of the self-built core consisted of a cement block foundation, a wooden structure, and an iron sheet roof. Most of the residents performed adaptations in their houses. The most common expansion was the addition of extra bedrooms. We noticed that almost all adaptations had been done separately from the neighbors. However, we found also a case of collective adaptation (samples 14 A and B), where rooms had been added between two neighboring houses to combine them (Fig. 5).

4.3 Building Materials

Residents in the surveyed area were familiar with carpentry. However, when it came to making improvements in their homes, they preferred masonry, because of its durability. Nevertheless, masonry techniques require hiring workers and consequently imply higher cost. Thus, most of the improvements were performed by the residents themselves with the help of family members. This improvement was based on the availability of materials that could be easily purchased and were affordable at the time.

Commonly, the materials used to build the main core at the initial stage were a wooden structure and thatched roofing. In the latter stages, these materials were gradually replaced by cement bricks and corrugated iron sheets respectively. However, this construction process could take years, and there were houses that could still be regarded as unfinished, even though families had been living in them for many years.

4.4 Other Observations

4.4.1 Residents' Lifestyle

In the surveyed households, as can be seen generally in the Dominican Republic, the living room was the chosen place for family activities, such as eating and socializing. Therefore, the space included living, dining, and kitchen (LDK) functions, or the kitchen was right next to, or directly connected to the living and dining (LD) area.

We also noticed that the introduction of electronic equipment caused changes in the residents' lifestyle, as well as in the use of space in the dwelling. For example, most of the residents had a television, a washing machine and a refrigerator, which were used in daily life.

4.4.2 Veranda as a Social Space

Durán Núñes and Brea García (2009) describe the typical rural dwelling in the Dominican Republic as having a bedroom, a living and dining room, and a veranda (Fig. 6.), with the kitchen located outside the house. In the survey area, the veranda did not exist as a built structure. However, the front of the house was still used as a space for social interaction. These previously rural residents were accustomed to living in a free standing landed house, so they had continued
Fig. 7. List of Surveyed Dwelling Units and Dwelling Expansions
the same behavioral patterns despite the change in the lifestyle. The house became more closed in relation to the outside.

4.4.3 Orientation of the House
In rural areas it is common that residents build the service building separate from the house. In most cases it is built initially for common use. It was expected that the orientation of the house and the location of the service building would be in the backside of the house, because of its relation to the river. However, based on the survey and our observations, we could state that the orientation of the house was more related to the main road of the settlement and that the service building was located in the backside of the house for privacy reasons.

5. Survey Result Analysis
5.1 Dwelling Pattern Classification
The structures that were originally built in the surveyed area were, as expected, similar to the typical basic pattern seen in rural areas (Fig.6.). The most basic form of dwelling. In order to analyze the process of transition, we classified them into three types of basic dwelling patterns. (A, B, and C) based on floor area and the arrangement of rooms, and identified them as the basic cores (Fig.9. top). These basic cores consisted of a living area (social) and one or two bedrooms (private) with an overall floor area of 16 m$^2$ to 28 m$^2$. This floor area depended on the residents' building capability at the beginning of occupancy. After this basic core was built, residents performed adaptations and addition of rooms.

5.2 Transitional Process of the Dwelling Pattern
The sample households were compared to the typical Dominican rural pattern (Fig.6.) to identify the evolution towards the urban pattern. The samples were sorted based on the total number of rooms, and the level of inclusion of the service building into the main structure; (Fig.9. center). Based on this, three stages of rural–urban transitional process were identified in the dwelling patterns (Fig.9. bottom).

Our observations showed that the residents adapted their dwellings over time to be closer to the typical urban home. This adaptation was based on the development of floor area through the division or expansion of rooms, and the inclusion of the service building, or water source (toilet, kitchen), into the living area.

Stage I: Kitchen is included in the living area, i.e. the pattern changes from LD to LDK. This differs from the original rural pattern, where the kitchen is placed outside and usually shared with a neighbor.

Stage II: One bedroom is divided into two for more privacy. It is perhaps to separate the parents' room from the children's room.

Stage III: Service building (the toilet) is gradually included in the living area. It changes from communal to private. This pattern is close to the urban model.

5.3 Core Housing Proposal for the Dominican Republic
For the implementation of a core housing system to be successful it is necessary to take into account the cultural aspects and background of the region of introduction. This is evident in the disparity in findings between studies done in regions that differ from the Dominican Republic, for instance in Asia. For example in Thailand (Tanaka et al., 2003) and the Philippines (Fukuki et al., 2004), there may be differences in culture of living. Furthermore, there may be some exceptions in the use of space related to the use of electronic equipment, e.g. television, or computer. Other changes in the use of space could also be related to social aspects of the settlement, for instance living conditions, such as overcrowding.

Based on the results (Fig.9. top), we saw that the average size of the original dwellings in the surveyed area was 22 m$^2$. Typically the dwelling consisted of a bedroom, and a living room. The rooms were approximately the same size, the living room being usually slightly larger.

A proposal of a basic core house for use in the Dominican Republic is presented in Fig.8. The proposal is based on the observations on how the dwellers of Azul had built their initial houses, when they had migrated there, and the following expansion and adaptation activities. The proposed core house has two rooms: a bedroom, and a living room that includes the kitchen functions (LDK), for social activities. The service core is provided as an annex to the core house, and it can be later included into the main structure when the residents expand the dwelling.

Fig.8. Core House Proposal for the Dominican Republic (Left), and a Possible Expansion to it (Right)

6. Conclusions
As a result of the survey in Azul, we concluded that the dwellers had adapted their lifestyle and dwellings gradually from rural to urban. For example, in relation with the use of the space, there was no veranda in the dwellings in the survey area. However, it was seen the use of the space in front of their houses as a de facto veranda for social interaction. Furthermore, the service building, are gradually included in the living area. This differs from the original rural pattern, where these services are, in most cases, communal.

With regard to the adaptation and expansion of the house, we could identified that residents of Azul adapt their dwellings over time according to their needs and life cycle stage. This adaptation process can be divided into expansion by adding rooms, and improvement of
Fig. 9. Dwelling Pattern Analysis. Top: Three Identified Basic Core Patterns. Center: Transition Process Analysis, Showing the Original Core and Made Expansions for Each Surveyed Dwelling Unit. The Units are Arranged Based on the Number of Rooms, and the Level of Inclusion of the Toilet. Bottom: Identified Stages of Rural–Urban Transition Process.
the living space, by adding furniture, or other elements. As a result of the analysis of the survey results, we proposed a simple core-housing model for use in the Dominican Republic. This model is based on our observations in Azul, and we believe it is suitable for use in other Dominican cities that have informal settlements that have formed through rural–urban migration. However, further studies in other areas should be conducted to validate the proposed model.

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