Constructing an Urban Future:

The sustainability and resilience of cities – infrastructures, communities, architectures
AMPS CONFERENCE 13

CONSTRUCTING AN URBAN FUTURE: THE SUSTAINABILITY AND RESILIENCE OF CITIES.
AMPS, Architecture_MPS; Abu Dhabi University
18—19 March, 2018

CONSTRUCTING AN URBAN FUTURE: THE SUSTAINABILITY AND RESILIENCE OF CITIES.

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INTRODUCTION

This publication is the product of the conference Constructing an Urban Future: The sustainability and resilience of cities – infrastructures, communities, architectures held at Abu Dhabi University in 2018. The premise of the conference and this publication was the World Urbanization Prospects published by the United Nations that identified we had already crossed the tipping point at which the majority of the peoples of the world live in cities. By 2050 it anticipated that this figure would be 66 per cent of the world’s population. What this means for how we design and build the habitation centers of the future is fundamental. The homes we live may need to change as the density of life increases; our places of work may need rethinking as the home to work commute becomes impossible; minimizing the environmental impacts of travel in denser and expanded cities will be essential; the planning of infrastructures to supply basic needs such as water will be on the agenda; energy consumption in both the domestic and industrial sectors needs control.

Not only are these problems complex due to the interconnected nature of every issue at play, they are further complicated by the diverse scenarios we need to consider from a global perspective. What works in the already developed cities of the global north, with freezing winter conditions, dense living patterns and high personal energy consumption is very different to the needs of the desert conditions of some countries in the global south, with minimal carbon footprints today, ample land for future development, and the forces of urbanisation only now emerging. This publication, and the conference which it documents, examined this complexity and sought to bring minds, disciplines, researchers and professionals together, rethinking the range of interconnected issues involved in the sustainability and reliance of our urban environments.

Both the conference and the publication were organised by the research organisation AMPS, its academic journal Architecture_MPS, and the Department of Architecture as Abu Dhabi University. It formed part of the AMPS program of events, Housing – Critical Futures.
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EVALUATING THE ‘GHETTO’ TERM THROUGH TURKEY

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INTRODUCTION
Cities are places where many different groups of people meet. The practice of socio-cultural, social, and residential segregation brings a heterogeneous identity to those cities in the multidimensional and complex structure of the urban culture. This heterogeneity of cities including ethnic, religious, cultural, and denominational uniformities is surrounded by a homogeneous network of spatial relationships in urban areas called ‘ghetto’s. The ghetto concept prior to the 1980s was an outcome of ethnic, religious, denominational, and cultural discrimination. Thereafter, the term has also been used to describe parts of cities characterized with poor infrastructures, inadequate social facilities, and socio-economically disadvantaged groups. With 2000s, the term referred to modern gated communities as spatial productions of consumer culture. The outbreak of the Arab Spring in 2010 triggered waves of cross-border forced migration and resulted in the formation of ghettos consisting of refugees. In the first part of this study, we examine what a “ghetto” is and display whether the concept is a real conduct or a discursive construction. In the second part, we test the concept through five different case neighbourhoods. While Fener-Balat, Sulukule, Gazi and Mavişehir Neighbourhoods are discussed through their historical process, Önder Neighbourhood in Ankara is analysed as a post-war ghetto of contemporary urban issue. Case studies are based on a field research and in-depth interviews with multiple stakeholders that covered forced migrants and settlement patterns, spatiality and social networks. Moreover, the aim of the field research is to evaluate whether these five neighbourhoods possess the criteria and characteristics of a ghetto.

WHAT IS ‘GHETTO’?
The word “ghetto” is a clear-cut geographical exclusion of a particular racial, ethnic, or religious group inhabiting an urban environment.¹ Historically, the word “ghetto” surfaced to refer to a Jewish quarter of Venice, in 1516.² In medieval Europe, and in order to sustain a minimal interaction with Christians, the church and the state pressured Jews to live in controlled and walled-off areas. Some researchers relates ‘ghetto’ with demography. While Massey and Denton describing ghetto term as ‘a cluster of neighbourhoods, which are dwelled by a large-extended social group (1993), Laura Vaughan, in her study ‘The Urban Ghetto,’ indicates that during a ghettoization process, religious, racial, denominational and ethnic groups constitute minimum 60% of that clustering (1997).³

THE ‘GHETTO’ TERM IN THE LITERATURE AND HISTORY
The ghetto is no longer an officially regulated settlement of Jews. Rather, it is a local cultural area that rose quite informally.⁴ The term “ghetto” in the U.S, focuses particularly on Harlem and Chicago, refers particularly to areas where African-American populations are now heavily concentrated in small neighbourhood.⁵ Therefore, according to Wirth, ‘ghetto’ is a form of accommodation in which a
minority effectually subordinates to a dominant group: a heterogeneous identity surrounded by a homogeneous network of spatial relationships in a multidimensional and a complex structure of urban culture of the cities (1928).

So, can we say that settlers in ghettos choose the neighbourhood voluntarily or they are forced to settle there? For Gans, ‘ghetto’ can be as a place of the voluntary or involuntary division of racial, ethnic, religious, denominational or other minorities, which are found in many cities (2017). According to others, the term is used for the areas where people from a specific ethnic background, culture, or religion live in seclusion, voluntarily or more commonly involuntarily with varying degrees of enforcement by the dominant social group. It is clear that it is difficult to distinguish between the voluntary and involuntary reasons behind the emergence of racial, ethnic, religious, and denominational. On the one hand, Chinatowns could largely be voluntary, but on the other hand, the African-American ghettos in the U.S and the Muslim ghettos in India arguably materialized rather involuntarily by exclusion.

THE EVOLUTION OF ‘GHETTO’ TERM AFTER 1980S

The post 1980’s neo-liberal economic policies changed the meaning of the term “ghetto” to refer to areas with poor services and social amenities. The term “ghetto” until before the 1980s referred to the clusters emerging from social and cultural discrimination. Then in the 1980s, the meaning of a ghetto started to point out parts of cities with poor infrastructure, inadequate social facilities, and economically disadvantaged groups living there.

The mechanization era of the 1990s demanded fewer, but highly skilled employees and moved the job opportunities and living spaces out of cities. In return, this required the relocation of public services as well. Consequently, the meaning of a ghetto hinted at the inner parts of cities, where unemployed, poor and 'dangerous people' live.

In the same era, the term “ghetto” also overtook the term “slums.” Social and cultural amenities of a ghetto cannot be presented in a slum. A simple definition of a slum would be a heavily populated urban area characterized by substandard housing and squalor. Correspondingly, the creation of a ghetto cannot only be confined to the outcomes of poverty, as the latter is neither the reason nor the result of ghettoization. To elaborate, take for example Bronzeville, where the most prosperous African-Americans live, in Chicago and Rinkeby having decent housing environment in Sweden (Figure-1).

Last, the beginning of 1980s added a new dimension to the term “ghetto” to reflect the new living habits of a new middle class. The new middle class escaped pollution and crowd of the urban areas

Figure 1. Bronzeville in Chicago and Rinkeby in Seden
and set up living circles with others of the same income-level. As cited below, this escape also created ‘gated communities’, which are space productions of the consumer culture where housing is an important status indicator.\textsuperscript{12}

**SOCIAL DIMENSIONS OF GHETTOIZATION**

Ghettos are cases of social, political, and economic segregation with identifiable physical features and cultural markers. These segregations / pressures in urban areas can be variable by social status and historical background. For instance:

- Under South African apartheid, blacks and whites were required by law to live in separate areas.\textsuperscript{13}
- Black ghettos in American Midwest emerged as freed slaves moved north to seek a new life within a white majority that was racially prejudiced. Although there were no laws restricting location by race, privately initiated racial restrictive covenants operated well into the 1950s.\textsuperscript{14}
- In third world countries, ghettos are often informal squatter settlements in the outskirts of large cities because poor migrants from the rural areas cannot find affordable formal urban housing. Such are favelas of Brazil, the ‘gecekondu’ settlements in Turkish metropolitans, or the ghettos in Asian cities. The impoverished settlers in these areas are often of distinct regional or ethnic origin.\textsuperscript{15}

In brief, the cumulative social and economic forces in ghettos cause political, economic, and social inequality and isolation, moreover this situation indirectly brings the defining a separation between inferior and superior status of groups.

**MAIN CHARACTERISTICS AND PARAMETERS OF ‘GHETTO’**

The isolation in ghettos usually results in social, political, and economic isolation. Such separation can also directly or indirectly convey superior status and privilege on majority group members on the segregated group. Alongside of these results, in this study, features and cultural markers that describes the ‘ghetto’ terms can also be classified and exemplified with five different keywords. These key words were separately claimed as a ‘character of ghetto’ by various sociologists and are discussed during our research as a whole characteristics of ‘ghetto’ concept (Figure-2).
According to our study, parameters and main characteristics of the ‘ghetto’ concept are:

1. **Residential segregation** refers to any kind of sorting based on some criteria such as race, ethnicity, religion etc.\(^{16}\)
2. **Homogeneity** in urban areas is based on a single set of values concerning the quality of the social life. This homogeneity increases the isolation between the area residents and the rest of society.\(^{17}\)
3. **Social exclusion** is the process of which people are systematically blocked or denied full access to various rights, opportunities, and resources that are normally available to members of a different group.\(^{18}\)
4. **Isolated area** is an area, where is physically separated and has minimal contact with other parts of the city. Park’s view implies that isolation from other neighbourhoods actually protects residents from some of the “disintegrating influences of city life.”\(^{19}\)
5. **Population density** has been used as a tool for ghettoization in many researches.\(^{20}\) Laura Vaughan in her study *The Urban Ghetto* indicates that during a ghettoization process racial, ethnic, religious, and denominational groups constitute a minimum of 60% of that clustering (1997).

According to comprehensive discourse, comparative research of the main characteristics and parameters can be crucial to understand the concept and future of ‘ghetto.’
THE PROCESS OF GHETTOIZATION

During this research, there are five different urban spaces were examined by considering the main characteristics and parameters as mentioned above. While Fener-Balat, Sulukule, Gazi Neighbourhood in Istanbul, Mavişehir Neighbourhood in İzmir were discussed, Önder Neighbourhood in Ankara were mainly and detailed discoursed because of the contemporary issue of ghettoization in recent times (figure-3).

Figure 3 The evolution of ‘ghetto’ at five case studies.

Jewish Ghetto of Fener/Balat, ISTANBUL

Fener-Balat is a neighbourhood located in the historical peninsula. It has the honour of belonging to the UNESCO World Heritage List with its 2000 years old history. It is located on the west side of the Golden Horn.

Table 1. ‘Ghetto’ parameters for Fener-Balat Neighbourhood

<table>
<thead>
<tr>
<th>Key-word in terms of ‘Ghetto’</th>
<th>Positive/Negative for Fener-Balat</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Density:</td>
<td>X</td>
<td>Until the mid. of 20th. c., Jews population were basis of population density.</td>
</tr>
<tr>
<td>Residential Segregation:</td>
<td>X</td>
<td>As records, residential segregation is beside the point for today’s Fener-Balat.</td>
</tr>
<tr>
<td>Isolated Area:</td>
<td>√</td>
<td>Physically isolation is beside the point, but there are observed dangerous behaviours of dwellers</td>
</tr>
</tbody>
</table>
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<table>
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<tr>
<th>Homogeneous Relation:</th>
<th>X</th>
<th>There is no an observation about homogeneous relation among residents.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Exclusion:</td>
<td>X</td>
<td>Social exclusion is beside the point for today’s people of Fener-Balat.</td>
</tr>
</tbody>
</table>

From Byzantine times to 1940s, this neighbourhood tended to be the area of choice for Istanbul’s Jewish community. However, it can be said that, the neighbourhood has begun to lose its real meaning of ‘ghetto.’ First, in Istanbul, a huge earthquake occurred in 1894 and shocks of the earthquake turned many buildings into charred ruins. After the earthquake and caused fires, most wealthy Jews moved to other parts of Istanbul and those who stayed could not rebuild dilapidated buildings. Second, with the foundation of Israel, a good part of Jewish settlers has moved from the neighbourhood to their new country. Consequently, according to research and parameters of ‘Ghetto’ in Table-1, Fener-Balat Neighbourhood had a meaning of ‘Ghetto’ until the middle of 20th c., but it has no longer carried its real meaning of ‘ghetto.’

Roman Ghetto of Sulukule, ISTANBUL
Sulukule Neighbourhood is one of the oldest Roman (Gypsy) settlement in all of Europe. During the Ottoman era, gypsy settlers in the neighbourhood were dealing with music and entertaining the elites of the palace in ‘entertainment houses’ in the neighbourhood. Especially for Sulukule gypsies, these entertainment houses were their only opportunity to work and provided employment for around 3500 people. However, after the municipality closed down these houses in 1990s, roman settlers had difficulty finding jobs in other sectors. Correspondingly, some residents were involved in illegal activities and others started to work in marginal sectors such as plastic or paper collection, fortune telling, street vendors, etc. As a result, social and financial problems emerged among settlers and the area gradually turned into a deprived urban area.

**Table 2. ‘Ghetto’ parameters for Sulukule Neighbourhood**

<table>
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<tr>
<th>Key-word in terms of ‘Ghetto’</th>
<th>Positive/Negative</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Density:</td>
<td>X</td>
<td>Approx. 17% of settlers are gypsies in Sulukule</td>
</tr>
<tr>
<td>Residential Segregation:</td>
<td>X</td>
<td>After moving of Romans in 2005, there is no longer residential segregation.</td>
</tr>
<tr>
<td>Isolated Area:</td>
<td>X</td>
<td>After urban regeneration project, the area is no longer isolated.</td>
</tr>
<tr>
<td>Homogeneous Relation:</td>
<td>X</td>
<td>After urban regeneration project, the area is no longer homogeneous.</td>
</tr>
</tbody>
</table>

After middle eastern conflicts
Social Exclusion: ✓ during 2010s, Syrians moved to the area. There is a few exclusion against immigrants.

After 2000s, Sulukule has begun to lose its real meaning of ‘ghetto.’ Because urban regeneration project for Sulukule was introduced by the municipality in 2005. Before the regeneration project, the area is mostly occupied by slum areas. Although, the social aim of the project can be arguable among many scientists, the neighbourhood has been changed at spatial level (Figure-4).

When the project of the regeneration started, 5000 people were living in Sulukule. However, according to Fatih Municipality’s questionnaire, while 90% of the people were Roman before 2005, now this ratio is only 17%. Therefore, it can be said that, the application of this project was triggered gentrifications, expropriation, forced evictions and displacement of Roman people. According to the parameters and key-indicators of our research, Sulukule Neighbourhood has a meaning of ‘Ghetto’ early 2000s, but it has no longer carried its ‘ghetto’ meaning.

**Denominational Ghetto of Gazi Neighbourhood, ISTANBUL**

Istanbul’s Gazi Neighbourhood plays politically eventful role in Istanbul, because illegal groups are dominant here. On the other hand, Gazi Neighbourhood is predominantly Alawi (heterodox Islamic groups) with 60% ratio. The history of Gazi Neighbourhood started in the late 1960s and early 1970s with the migration of Anatolian Alawis to metropoles and this migration brings a small-scaled economic relation with it. Every Alawi settler in the area has an economic and social relationship with each other. They constitute a majority and have dealings with each other in the local market and they have social production in their own space.

**Table 3. ‘Ghetto’ parameters for Gazi Neighbourhood**

<table>
<thead>
<tr>
<th>Key-word in terms of ‘Ghetto’</th>
<th>Positive/Negative for Gazi</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Density:</td>
<td>✓</td>
<td>Approx. 60% of settlers are Alawis in Gazi</td>
</tr>
<tr>
<td>Residential Segregation:</td>
<td>✓</td>
<td>Alawi houses are marked with a ‘red X’ by unknowns.</td>
</tr>
<tr>
<td>Isolated Area:</td>
<td></td>
<td>The neighbourhood is not isolated from other</td>
</tr>
</tbody>
</table>
There is an economic and social relation among the Alawi settlers in Gazi.

Social exclusion against Alawis is observed at national scale and neighbourhood level due to political authorities.

From time to time, some disagreements and conflict are occurred between police forces and illegal political groups because of political and pressure authoritarian reasons in the neighbourhood. For instance, on March 12, 1995 began a series of armed attacks through Alawis. These political issues can bring 'ghettoization' process with it like in Harlem.

According to the parameters and field research, Gazi Neighbourhood is settled by dense Alawi residents; and the residents face with residential segregation, social exclusion and they have homogeneous relation with each other. Accordingly, Gazi Neighbourhood has a real meaning of ‘Ghetto.’

**Modern Ghettos (?) / ‘Gated Communities’ of Mavişehir, İZMİR**

After Europe, with neo-liberal politics of Turkish Government in 1980s, Mavişehir residences, which has more functional and spatial circumstances, was started to construct. After the application of master plan, high-income groups of the city moved to newly constructed residence towers and triplex villas in the neighbourhood. It can be observable that, the building complexes in the neighbourhood has generally high-separator walls, high-security controlled gates; includes shopping malls, gigantic pools, social facilities, schools, sport facilities, recreational areas, playgrounds and parking lots.

<table>
<thead>
<tr>
<th>Key-word in terms of ‘Ghetto’</th>
<th>Positive/Negative for Mavişehir</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Density:</td>
<td>X</td>
<td>There is no any ethnicity, race or religion in comparison with other parts of the city.</td>
</tr>
<tr>
<td>Residential Segregation:</td>
<td>X</td>
<td>Residential segregation is beside the point for the area.</td>
</tr>
<tr>
<td>Isolated Area:</td>
<td>√</td>
<td>The neighbourhood is isolated with separator walls and controlled gates.</td>
</tr>
<tr>
<td>Homogeneous Relation:</td>
<td>X</td>
<td>There is no any economic or social relation among the neighbours.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Some householders outside from the area regard</td>
</tr>
</tbody>
</table>
Social Exclusion: X Mavişehir residents as ‘worlds apart.' However, this is not an indicator for exclusion.

First, although high-income residents settle in the neighbourhood, this situation cannot be an indicator for population density. Second, the settlers in Mavişehir has a weak social network with each other and other urban spaces. Last, the parameters of residential segregation, homogeneous relation and social exclusion are beside the point for Mavişehir. Brief, although some sociologists claim that ‘gated communities’ are modern ghettos, according to our research, Mavişehir doesn’t have real meaning of ‘Ghetto.’

**Post-war Ghetto of Önder Neighbourhood, ANKARA**

The break out of the Arab Spring in 2010 triggered waves of forced migration and refugees of a homogeneous social status came together to form a post-war ghetto. Today, Turkey hosts 3.5 million Syrian refugees who are spread in urban settings all over the country with a special concentration in the southeast region next Turkey-Syria border. Ankara is home to 97,719 Syrians and Önder neighborhood in Altindag district (Figure 5) in the northeaster side of the capital is considered as an important shelter for a significant number of Syrian urban refugees.

![Figure 5 Önder Neighbourhood and its surrounding.](image)

The size of Önder neighborhood is 43 hectares with a population of 3,088 people, including 434 squatters, of whom 90% are Syrians.

![Figure 6. Population and Gender Distribution for Önder Neighbourhood](image)
The population of Önder Neighbourhood started to decrease in 2013 when the municipality of Altindag declared Önder as an urban regeneration area. As a result, the municipality demolished 2,150 buildings and the ground-breaking of 40 mix-used buildings took place. The demolished area, however, remains without any signs of erected buildings so far (figure-6). Consequently, 6,000 people between 2013 and 2017 relocated themselves temporarily to other places in Altindag district.

The social network between Syrians and locals of Önder is based on minimum interaction. Almost all locals of Önder moved to Mamak, and leased properties to Syrians. Consequently, the locals remaining in Önder stand out by publically showing a message of identity by hanging out Turkish flag or painting it on the roof of the residences. Moreover, the economic ties are exclusive to nationality: Syrians shop from Syrians and locals shop from locals of whom only a grocery store owner, a butcher, and a hairdresser remain open in Önder. As for Syrians’ economic activities some streets are dibbed as Little Aleppo\textsuperscript{38} where all of the Syrian shops are unregistered and do not pay taxes.

Socially, Syrians have created their own habitat and reproduced their culture under precarious conditions by clustering in Önder. Economically, they opened grocery stores, tailor shops, small bakeries, restaurants, furniture stores, and clothing stores. In relation, there is a weekly open market called Syrian Markets. Nevertheless, all of these shops and stores are not officially registered. This means Syrian businesses manipulate prices the way they deem necessary whereas the local counterparts abide by the regulations set by the municipality. In return, this causes unfair economic competition and feeds social tension.\textsuperscript{39} Moreover, the locals’ general perception of Önder is
exclusionist in nature. For instance, on 2016, the media made news about a lynching attempt against Syrian refugees in the neighbourhood.40

<table>
<thead>
<tr>
<th>Key-word in terms of ‘Ghetto’</th>
<th>Positive/Negative for Önder</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Density:</td>
<td>√</td>
<td>Approximately 90% of settlers are Syrians.</td>
</tr>
<tr>
<td>Residential Segregation:</td>
<td>√</td>
<td>After Syrian war in 2010, Syrian refugees has started to settle the area.</td>
</tr>
<tr>
<td>Isolated Area:</td>
<td>X</td>
<td>The neighbourhood is not isolated by any structure or social group.</td>
</tr>
<tr>
<td>Homogeneous Relation:</td>
<td>√</td>
<td>Syrian residents have economic dealings with each other and Arabic alphabet is used on signboards often.</td>
</tr>
<tr>
<td>Social Exclusion:</td>
<td>√</td>
<td>Moving of Turkish residents and news about lynching against Syrians has increased.</td>
</tr>
</tbody>
</table>

Önder neighborhood according to the findings of the field research meets all the characteristics of a ghetto. When we run our findings from Önder against the parameters and characteristics of a ghetto, we find that Önder is a classic meaning of a ghetto (Table-5).

CONCLUSION AND DISCUSSION

Our research investigated respectively the terminology, history, and literature related to the evolution of ghetto concept. Then we ran through the characteristics of a ghetto: residential segregation, homogeneous relation, social exclusion, population density, and isolated area to understand the past, present, and the future situation of a ghetto in a social, spatial, economic and political manner. We found out that the meaning a ghetto stood its ground until the 1980s when the neo-liberal policies turned it to a class-based instrument. This created an illusion about the concept as an income instrument. As such, the concepts of ‘slums’ and ‘gated communities’ confused with the real concept of a ghetto.

When we projected the main characteristics and parameters of a ghetto on a clustering of different social groups and urban spaces, we found out, firstly, Fener-Balat, Sulukule Neighbourhoods had real meaning of ‘ghetto’ concept, but when we look at today’s situation, those places cannot be described as ghettos. Second, Mavişehir Neighbourhood is an isolated area, which have high security walls and gates. Although some sociologists claim that ‘gated communities’ are modern ghettos, we can say that ‘modern ghetto’ term is only an illusion to describe those areas as a ghetto. Finally, Gazi and Önder Neighbourhood can be described as ‘ghetto’s according to this research’s main parameters. While Gazi Neighbourhood is a ghetto at denominational level, Önder Neighbourhood is a ‘post-war ghetto’ because of its settlers’ population density, social exclusion, homogeneity, segregated residences. The Syrians in Önder are divided into registered and unregistered groups.
Taking into account, under the light of this research, if the ‘ghetto’ term is considered as a social or spatial urban product, -as a result of the developing metropolitan areas- it must be examined and evaluated with by a powerful instrument such as an inventive urban design projects and distinctive social approaches.

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THE CHANGING ROLE OF ISLAMIC IDENTITY IN SHAPING CONTEMPORARY CITIES IN SAUDI ARABIA

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INTRODUCTION
Cities in Saudi Arabia have been shaped by two main factors. First, the role of Islam in influencing the daily life of Muslims. Second, the socio-cultural values which widely control the pace and magnitude of change which also impacts on the built environment. In this context, this paper will discuss the meaning of Islamic identity so as to identify basic Islamic principles and socio-cultural values that define the integration and coexistence between human beings and their environment. Within this context planning regulations, zoning systems and land uses will be discussed in both traditional and modern cities to identify the key drivers that shape the urban fabric of contemporary Saudi Arabian cities.

URBANISATION IN SAUDI ARABIA
The total area of Saudi Arabia is approximately 2,150,000 km² with a population of 32,000,000 based on the latest census. Between 1940-1970, the gross density of inhabitants in Saudi Arabia was around 8 persons/km². During this period the country consisted of metropolises with a high population density and small villages which were occupied by a small number of the population. In response to the oil boom and economic expansion during the 1980s, the Saudi Government approved the establishment and growth of around “10,365 rural settlements and 343 urban settlements”. Within these settlements, Jeddah and Riyadh are the most urbanised settlements, each with a population of around 2 million persons. Thus, rapid urbanisation following the oil boom has led to increasing the proportion of the urban dwellers from around 48.7% to 77.30% between 1970 and 1990 in Saudi Arabia. “In Riyadh a staggering average population growth rate of 6.4% was observed unusually high for a growing city.”
The rapid urban growth of Saudi Arabian cities has led to issues such as insufficient transport connectivity and lack of adequate access to electricity and water as the infrastructure of the cities has not improved parallel with the rapid urbanisation. Under pressure for better outcomes, the Saudi government recruited non-Saudi planners to find solutions to these mounting concerns caused by rapid urbanisation. However, the implementation of these plans has created additional problems and challenges in urban areas, such as increasing socio-cultural conflicts between inhabitants where new neighbourhoods and housing layouts are not reflective of the needs of local people. These changes in urban morphology at the local scale also led to the Islamic identity being not diminished in Saudi cities.

ISLAMIC IDENTITY

Each nation has its own identity that represents the prevailing beliefs, social values, and culture of its inhabitants. Identity is constructed through a socio-cultural and political process that occurs between the inhabitants and the built and natural environment. Forms, structures, and patterns have all been used to develop the national and local identity. Jassim Al-Yaseen has highlighted three main components for a nation’s identity: (i) the religious belief, (ii) the language which differs from one nation to another, and (iii) socio-cultural heritage. In particular, Islamic identity refers to a cluster of ideas about an Islamic nation that includes socio-cultural values which shape the profile of cities. This paper will focus on the various ways religious beliefs and socio-cultural values are expressed at the local scale places and spaces in Saudi Arabian cities.
ISLAMIC PRINCIPLES THAT SHAPED THE TRADITIONAL CITIES

Islam provides a framework for Muslims to deal with all aspects of life. Some of these aspects regulate the relationship between residents and the built environment so as to achieve an acceptable level of socio-cultural integration. There are two main resources for these principles in Islam: the Qur’an and the Sunnah. However, since the establishment of the municipality ministry in Saudi Arabia, jurists were responsible for developing other principles to regulate the built environment that were not mentioned in the basic sources of Islam.

Islam has been identified as an urban religion. Islam has stressed the need to have an ‘urban life’ that helps in practicing religious duties such as praying. Though the Qur’an and Sunnah do not provide precise regulations for planning cities, Islam has provided a socio-cultural framework which includes a set of principles that regulate the daily life of Muslims in the city. At the local scale, Islam has asserted the concept of society by considering it as a significant part of faith to be observed by all Muslims.

Several Islamic principles regulating the layout and the growth of traditional cities exist to foster the solidarity and fidelity between Muslims. First, the size of the neighbourhood. It has been concluded that the size of the neighbourhood is forty houses based on the following hadith:

"Al-Hasan was asked about the neighbour and said, "The term 'neighbour' includes the forty houses in front a person, the forty houses behind him, the forty houses on his right and the forty houses on his left." 18

Second, the location of the mosque. Muslims are praying five times a day at the mosque, so providing an accessible location where the building can be oriented east-west is important. Third, the dimensions of alleyways. The width of alleyways ranged between 3.23m to 3.50m in traditional cities based on the available forms of transportation at the time, such as the camel. The constrained widths of the alleyway reinforced the human scale whilst providing shade and enclosed spaces for sociality. Fourth, neighbours’ rights are to be abided by in respect to Allah’s commands whilst avoiding the creation of social tensions. It was narrated from Abu Hurayrah that the Prophet said:

"Jibra’il kept enjoining good treatment of neighbours until I thought he would make neighbours heirs.” 19

Thus, Islam has prohibited harming neighbors in any form and this is reflected in the general concept of “La dhararwa la dhirar”20,21,22.

Finally, privacy is the most effective principle that contributed to forming the traditional cities because the need for privacy shapes the lifestyle of Muslims, houses designs and other aspects23,24,25,26. Privacy is a wide concept and includes the daily practices of Muslims with implications for planning of cities27.

SOCIO-CULTURAL VALUES OF ISLAM IN THE TRADITIONAL CITIES

In addition to Islamic principles, there were a set of socio-cultural values that shaped the traditional cities. Islam embraced the necessity of having a socio-cultural framework that regulates social practices between Muslims. That framework in Islam is called “Mu’amalat” and is responsible for regulating daily practices in society, such as the "interaction, collaboration, showing kindness, benefiting each other and avoiding harming others” 28.
There were several socio-cultural values that shaped traditional cities. First, social justice was achieved in traditional cities by considering the concept of ‘Ummah’. The concept of Ummah in Islam has paved the way to create a unique urban pattern that helped to ease potential social tensions between the inhabitants. This was achieved by offering equal opportunities to interact within the urban fabric of the traditional city by enhancing the brotherhood in Islam between Believers. The family is an essential element in Islam. Thus, the relationships between family members are permanent because they are based on fixed Islamic principles as well as socio-cultural values. As such, most of the dwellings in traditional cities were designed to accommodate the extended family.

Islam eliminated any behaviours that could lead to injustice, discrimination, or harm so as to protect the social ties among inhabitants. Thus, modesty has been expressed in the daily life activities, from the Prophet Mohammed to Believers, so as to avoid arrogance and show good manners, modesty, and equanimity. This socio-cultural mechanism has widely contributed to the character of traditional cities in Saudi Arabia.

**URBAN PLANNING AND REGULATIONS IN THE TRADITIONAL CITY**

There were no specific regulations to regulate the traditional cities in Saudi Arabia. The regulations that were present developed based on the disputes which were reported to jurists. Based on the most frequent dispute matters, three main rules can be observed that regulated the traditional cities. The first rule pertains to confirming ownership rights between public and private space to prevent harm to the society, whilst making sure the rights of society to benefit from private as well as public ownership can occur. Second is the right of way which refers specifically to regulation of the dimensions of streets and cul-de-sacs. Jurists in Islamic cities have divided the alleyways into public and private. Public alleyways belong to the inhabitants and all have equal right to use it. Private alleyways such as cul-de-sacs are a private space equally owned by the landlords of the surrounding dwellings. The Prophet had specified the width of the alleyways, as quoted by Abu Hurairah:

"When you disagree over the road, then make it seven forearm lengths."

The seven forearms mentioned in the above hadith is equal to 7 cubits, or 3.20m to 3.50 m.
Thirdly, there exists the notion of space in Islam which includes the difference between the *Fina’* and the *Zuqaq*. This rule clarifies the notion of who is permitted to use these spaces and how. *Fina’* refers to an open public space in the front or along a building which belongs to the community. *Zuqaq* (a cul-de-saq) is a semi-private space that belongs to the landlords of the surrounding (cul-de-sac). A semi-public space location was identified in the residential neighbourhoods by the inhabitants who were living close to the semi-public space in the same neighbourhood and who equally shared the right of using that space. The users of the ‘*Zuqaq*’ enjoyed more freedom than the users of the ‘*Fina’* because it is a public thoroughfare which belongs the whole community.

**URBAN ZONING AND LAND USE IN THE TRADITIONAL CITY**

The urban fabric of the traditional city was divided into several districts. These districts comprised quarters (blocks) so as to maintain social ties between society members and thereby reinforce the concept of Ummah through implementing various urban forms.

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*Figure 2: The standards for streets mentioned by the Prophet were based on their function.*

*Source: derived from Besim Hakim*
There are several factors that have affected land use in the traditional city, such as protecting privacy, defining and determining the location of the mosque, and achievement of social justice \(^{37,38}\). For example, public space was designated in locations close to the mosque and market to facilitate prayer. Semi-public space locations were identified in the residential neighbourhoods by the inhabitants who were living close to the semi-public space in the same neighbourhood. Finally, the private space at the end of the cul-de-sac was used by neighbours to conduct their socio-cultural activities such as celebrating Eid, weddings as well as for prayer. Though based on socio-cultural and religious factors, this hierarchy was effective because it was built on a fundamental understanding of the needs of Saudis living as an integrated Islamic society.

![Hierarchy of urban spaces in the traditional cities at Saudi Arabia such as Jeddah, Riyadh and other cities, Source: The Authors](image)

**Figure 3: Hierarchy of urban spaces in the traditional cities at Saudi Arabia such as Jeddah, Riyadh and other cities, Source: The Authors**

**URBAN PLANNING AND REGULATION IN THE MODERN CITY**

The exporting of oil changed the economic profile of Saudi Arabia which impacted on the style and type of urban development, as well as the socio-cultural values and Islamic identity of the nation. In 1940, Saudi society was described by Americans as "inward-looking, xenophobic and conservative" \(^{39}\) due to the social conflict between Saudis and American workers in the eastern region of Saudi Arabia during oil exploration works by Aramco in the late thirties. However, Saudis in 1940s started to adopt modernity by moving from walled to modern urban layout. The suburban areas were planned in a gridiron pattern that featured wide streets instead of the narrow alleyways as found in the traditional cities. The urban transition that had started in the 1940’s continued well in the 1950’s when the Saudi Arabian Government launched a modern suburban development called Al-Malaz in Riyadh. This was the beginning of the introduction of modern western planning policies as well as building regulations in Saudi Arabia. While Al-Malaz was a large-scale urban development, the envisaged structure plan did not to come to full fruition. The project had offered around 754 houses, 340 apartments, and public facilities including a library, fire and police stations, and health center. The construction of Al-Malaz
represented the shifting from the walled city to a modern entity, including transitioning from attached houses to detached, but was not fully supported by local policy-makers, practitioners and residents. The street network of Al-Malaz was divided into three levels, namely, highways, major roads, and services roads. Their widths were 54, 30, and 18 m respectively. The total area of the residential quarters was around 45-9 m². These small quarters were divided into rectangular lots that repeated the same length, namely around 8 m and widths ranging between 8 to 33 m. Al-Malaz was the first governmental project that introduced modern urban form and structure to accommodate Saudis wanting modern lifestyles. Since then, these same urban development patterns have been included in all major cities of the Saudi Arabia, but questions remain about their wider effectiveness and applicability.

URBAN ZONING AND LAND USES IN THE MODERN CITY

In 1973, the Ministerial Council announced the first master plan as designed by C.A. Doxiadis would be implemented so as to develop the new city of Riyadh. Key elements of the Riyadh Master Plan have since been adopted in all major cities in Saudi Arabia. There were three main principles for the Doxiadis’ Riyadh Master Plan. Firstly, the gridiron pattern was used to divide Riyadh into huge super blocks, the size of each block being 2 km by 2 km. These superblocks or grids were surrounded by highways, thus connecting the suburban grids as they grew into urban sprawl. Contrary to the traditional city, Doxiadis divided the urban structure of the city into different areas based on the economic status of the inhabitants. For example, south and south-west areas were planned to accommodate low-income inhabitants where the industrial activities also took place. This division of an entire city based on the economic status of the inhabitants encouraged social and spatial segregation, a concept not present in the structure of the traditional cities of Saudi Arabia. In this respect, F.A. Mubark stressed that the urban sprawl of the suburban areas, especially in Riyadh, was similar to the structure of growing cities in the United States.

CONCLUSION

Contemporary cities in Saudi Arabia exhibited several urban features which greatly differ from those found in the traditional cities. The traditional built environment was a result of a deep understanding of Islamic principles which were tightly interwoven with the socio-cultural values of the inhabitants and resulting urban form and structure. This included a configuration of place and space strongly reflecting local identity. In contrast, urban development in modern cities aims to enhance economic status including individual wealth with mixed regard to Islamic principles and or consideration of the wider socio-cultural norms of the society.

For example, the application of the gridiron urban pattern and its sub-divisions in the early stages of urban development in Saudi Arabia in the post-oil period aimed to assist in accommodating the sudden increase in people who emigrated from the traditional cities to the modern cities, plus meet expatriate needs. This gridiron pattern, however, introduced a new scale and ordering principles for housing, public spaces, mosques and other public facilities such as strategically located local medical centres. As well, a different range of stakeholders were involved in making the contemporary city. It is argued that the gridiron urban pattern has failed to acknowledge the ‘indigenous local pillars’ of successful urban development because it did not address core Islamic principles, such as the hierarchy of the public spaces and socio-cultural values, such as the privacy of the residents.

In this context, the absence of having a local urban pattern that could accommodate both local and international needs resulted in the “deterioration” and realignment of Islamic and socio-cultural principles that once strongly defined Saudi Arabia. The ‘rush’ towards modernity including
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encouraging western style city master-plans, sub-divisions, western house designs and shopping centres has replaced the backbone of the traditional urban principles that were once strongly anchored on specific socio-cultural and Islamic principles. It is argued that this model does not represent any local or nuanced contextual solutions. Continuing to apply this ‘one size fits all’ urban pattern and its principles in Saudi Arabia needs to be reassessed as the complexity and diversity of the city including its residents and their needs are recognised.

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CONCEPTS OF SUBURBAN DEVELOPMENT IN CYPRUS:
THE SPATIALITY OF AGEING

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INTRODUCTION
During the first decade of the 21st century, the World Health Organisation has started a broad discussion on age friendly communities. It has also been set as one of the WHO main targets, revealing the importance of two major issues from the site of urban designers and city planners. The first arising issue is the visibility of old age citizens as considerable parts of the debate on social exclusion, segregation and socially sustainable places, when the concern was traditionally about ethnic, economic or gender groups. The second issue is the need to investigate, define and assess what is actually an ageing friendly city or an ageing friendly community. In 2011, WHO published a guideline referring to measurable indicators for the place assessment on ageing friendliness1. These indicators refer to walkability, accessibility of public spaces and public transportation, affordability of housing, social attitude, engagement in volunteer, local, sociocultural or paid activity, availability of health, social services, information and economic security.

Suburban development in Cyprus is almost the only pattern of urbanisation on the island, which has a short history of less than 80 years2. One could claim that the ageing urban population at this moment represents the first generation born and brought up in urban environments, adopting urban life styles in the newly built suburbia of more than six decades ago. In this aspect the notion of “ageing in place”, which is a positive attribute is embedded in this type of suburban fabrics3.

The aim of this paper is to make a rough assessment of the age friendliness of two typical neighbourhoods in Nicosia, characterised by different densities, layouts and development laps, in order to construct a set of preliminary research questions that will inform future, more in-depth approaches. The main research argument of this paper is whether suburbia, as a spatial structure, in its Cypriot version retains age friendliness. Which are the pros and cons for the ageing population of a suburban quarter in relation to a traditional one? The paper is going through properly selected case study areas in order to base its discussion arguments. Extended semi directed interviews and field observation provide qualitative data on the above-described issues. Interviews examine ageing under a spatial aspect, and focus on a qualitative assessment of the neighbourhoods as products of planning and urban design.

HOW THE SPATIALITY OF AGEING COULD BE ASSESSED?
The study of Minas et al4 on “homeownership, family and the gift effect: the case of Cyprus”, can shed light on the impact of intergenerational relations to sprawled urban expansion and low residential mobility in Cyprus. A young couple, especially from the ’50s to the ’90s, was usually donated a house or a plot by its parents. In most of the occasions, this plot or house was in close proximity to the family house and in some cases, it was actually an extension of the family house. If the family had no
available house or adjacent plot then the couple was donated a plot in the nearest developing area, which was usually of lower land values than the already developed neighbourhood of their childhood. The average built space per person increased from 20m²/inhabitants in the sixties, to around 60m²/inhabitants today. Normally, this couple would spend its entire life at its initial residence, regardless of the changing number of people in the household. In several cases, when the parents die, their children move back to their old family houses in order to leave the newer buildings to their grown-up children. There are also cases, where parents renovate the old family house and donate it back to their children in order to not have to move out from their first house at all. Economic recession and societal shifts of the ‘10s have altered these models, but these circles still occur revealing the spatiality of relations of an extended family. Cypriot old people feel attached to their neighbourhood and maintain strong social relations with their family members.

Residential mobility is called the easiness of changing place of residence due to cultural and socio-spatial conditions. The processes of home donation reveal limited residential mobility, which is essential for retaining social networks and contacts, and support ageing in place. This condition provides the elderly with a sense of security, a sense of belonging and a feeling of health and worth. For the case of ageing friendly cities, it is obvious that sprawl and low densities are preventing walkability and access while residential mobility is reducing social networking and of course prevents ageing in place.

In order to formulate sound and specific spatial assessment criteria for the Cyprus neighbourhood case, the twelve indicators set by WHO should be refined. One main quality of daily life depended on space is social inclusion, i.e. the extents of the opportunities to be active at the same place with other people. Moulaert et al (2017) are setting exclusion to be the third peak of the Age – Space – Exclusion triangle, which interprets on a diagram the relations of age with space. How can material manifestations of a neighbourhood foster inclusion? A study on the microenvironment of daily life could indicate the level of satisfaction developed through the relation of the occupants to their built environment.

Neighbourhood walkability indicates whether a neighbourhood layout and the condition of routes support walking. Walkability (i) is related to the condition and specifications of streets and pavements but also to other issues such as safety or liveability, and mixed-use space. Walkability could be measured both by observing visibility of the aged population in the community or by interviewing aged people on their opinions. Accessibility of public spaces (ii) and accessibility of public transport vehicles (iii) and stops (iv) could be again measured both by observing visibility of the aged population in these locations or by interviewing aged people on their opinions.

Indicators v to xii [(v) engagement for volunteer activities (vi), paid employment (vii), engagement in sociocultural activities (viii), participation in local decision making, availability in information (ix) and social – health services (x), economic security (xi) and quality of life (xii)] depend on more general issues at the national level. WHO indicators i to iv, are the ones most affiliated to the concepts of suburban development in Cyprus, they are site specific and different in different neighbourhoods. Public transport in Cyprus plays a very limited role in daily commuting; there is a high depreciation of the liability of the system, since its usage goes below 2% it is not worth any further investigation.

Walkability and accessibility are the two site-specific parameters, significantly differentiated in each neighbourhood, obviously related with planning, and design restrictions. Indirectly these two parameters affect social contact and networking, which is essential for an ageing friendly community.
One would normally expect that low densities and sprawl would have a negative impact on these indicators.

CASE STUDY PROFILES

Pallouriotissa District is an early suburb of Easter Nicosia, the capital city of Cyprus, in which one can find a variety of urban fabric typologies and layouts, almost representative of the recent history of urbanisation and city expansion on the island. Field and land registry research has revealed four different typologies of neighbourhoods according to their development laps (Figure, 1): i. Old Core, ii. Early Suburbia 40’s-70’s, iii. Post-Colonial Suburbia 80’s-90’s, iv. Late Suburbia 00’s-10’s. These are questioned in terms of pattern, density and average population age, through the census data of 2011 (Statistical Service, 2011).

Pallouriotissa core (1 in Table 1) goes back to the ottoman period. It is a quarter of terraced small-scale residences of one or two storeys high. Around one third of them are abandoned and economic immigrants occupy the other third. The fabric pattern is irregular with narrow streets (3.60-10.00m width) and the buildings are set on the street line. Its density is quite high for urban reality in Cyprus, while the age of the population is similar to the Nicosia average. Ten years ago, an urban upgrading project was implemented along the main streets, fronts and the central square.

Early suburbia was developed mainly before the 1974 military events, where 520m2 plots and free standing single houses were the rule. Neighbourhood street network, designed to facilitate exclusively car traffic, is completed after decades of fragmentary and plot-to-plot expansion processes (Ioannou, 2016). Its density is quite high compared to the average neighbourhood in Cyprus, almost the same as the core, while the age of the population is similar to the Nicosia average.

Post- colonial suburbia was produced just after the 1974 military events, and it consisted of 520m2 plots and freestanding single or double houses or multi-storey residential buildings. Neighbourhood street network, designed to facilitate exclusively car traffic, has almost been completed after decades. Its density is almost average for urban reality in Cyprus, while the age of the population is similar to the Nicosia average.

| Table 1. Nicosia - Pallouriotissa district - Neighbourhood features |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| fabric pattern                  | i                               | ii                             | iii                            | iv                             |
| density                         | medieval/ irregular             | car fabric/ completed          | car fabric/ completed          | car fabric/ incomplete         |
| average age                     | 38.5                            | 38.5                           | 38.5                           | 32                             |
| population                      | 800                             | 5,500                          | 1,000                          | 2,200                          |
Late Suburbia has been built from the ends of the 90’s to today, consisted again of 520m2 plots and free standing single or double houses or multi-storey residential buildings. The neighbourhood street network was designed to facilitate exclusively car traffic, but it is not yet fully completed because of the fragmentary and plot-to-plot development processes. Its density is low, and it includes a huge proportion of empty plots, while the age of the population is younger than the Nicosia average.

Old Core and Late Suburbia are performing the most edge profiles among the four. The first has compact, pre-industrial shaped fabric of high densities limited distances, human scale and an average age distribution. The second is a sprawled neighbourhood of limited walkability, hosting mostly young couples. For this reason, both are chosen for a further assessment.

The old core, outlined with blue in Figure 2, is an old neighbourhood where 30-40% of the residents are economic immigrants mainly from third countries or the EU. The quarter is attractive to immigrants because of its low rents, which reflect the bad condition of the buildings and the lack of private parking spaces. Most of the Cypriot residents today are ageds or couples that have lived all their lives in the neighbourhood.

The neighbourhood has a focal point, a central square, recently redesigned, and adjusted to an old community church and two local clubs (one left wing and one right wing). A dense network of retail and service amenities covering almost every daily or weekly need surrounds the area. Both the surrounding commercial streets and the square are in a walking distance of less than 500m from any dwelling. Street parking places are limited because streets are narrow. Additionally, there is no private parking space in most of the cases. However, around 20% of the residences have their own private parking places.

The Late Suburbia, outlined with blue in Figure 3, is a new neighbourhood developed mainly after the 90’s, where a big part of the residents are primarily young local couples and a smaller part, less than 13% are economic immigrants. The quarter is attractive to new local settlers seeking single houses or apartments due to its location and the availability of land for new developments. Aged residents have moved there mostly after the 90’s, coming from other areas nearby.
The neighbourhood has no focal point, no central square, only a church operating on a part time basis. There are fourteen pocket green spaces, scattered around the neighbourhood. Most of them are abandoned and underused. The one only larger park at the southeast site has not yet gained an important role or considered a focal point, neither is a part of the community identity. There is a commercial street at the south-western boundary, but retail and service uses available are inadequate to cover daily or weekly needs. Services and retail lie more than 500m from any dwelling. In fact, all movements for service or consuming purposes are done by car. There are adequate private parking places and plenty of parking space on the street. Distances, low densities and empty plots (approximately 50% of the divided plots stay dormant) discourage walking and moving on foot.

FIELD RESEARCH RESULTS

As mentioned in the first part, walkability, accessibility and social contacts are the parameters more related to each neighbourhood layout and design. These indicators are approached qualitatively through site observation and semi directed interviews in the two case study areas selected. Field research and interviews were conducted in December 2017. Interviewees were equal numbers of men and women (5+5), with an average age of 68.1 years old. Interviewees are all car owners and active drivers, being at their early ageing period. At this stage qualitative research is explorative so there is no methodological need whatsoever for quantitative representativeness13.

Interviewees were first asked about their satisfaction on the walkability of their daily life in terms of opportunity, pleasure, amenity and safety to walk in their area. Secondly, they were asked about accessibility in retail and services. And finally, about their satisfaction from the quantity and the quality of their social contacts, regarding the opportunities given in or around their neighbourhood boundary. The demand or their satisfaction from ageing in place (Thibault et al, 2017) was supplementary discussed.
Field observation has been carried out at the same period, just prior the interviews. The observant spent three hours (one in the morning, one in the afternoon and one in the evening) walking through each neighbourhood recording human presence in public space, as well as the image and condition of space and infrastructure.

Both neighbourhoods are not designed or equipped to foster walkability. In both cases green and shade is limited and this is a discouraging factor for Cyprus where sunshine discourages walking for about eight months a year. Old Core narrow streets, where pedestrians and cars share the same floor, are not actually safe for the ageing population. Parked vehicles creating difficulties to the pedestrian movement usually block narrow sidewalks and narrow streets. Late suburbia is equipped with 2m width sidewalks that separate vehicle and pedestrian movements in the street. Nevertheless, sidewalks are not always free from obstacles.

Figure 3. Late Suburbia (blue outline), Services and Retail (red), Green and Open Spaces (green)

Human presence in the public space is limited in both cases. In the Old Core, there is a stable presence of one or two people per fifteen or twenty minutes in a street field of view. In the late suburbia you can see few people walking for the purpose of exercising or to walk their dogs, either only late in the afternoon or early in the morning.
Interviews have revealed some interesting facts. Ageing people in the Late Suburbia are more satisfied from their daily social contacts than the people in the Old Core. It should have been the opposite since the second are supposed to live in a close proximity and in walking distance from their friends and relatives. The fact that most of the interviewees are in their early ageing period, and the fact that households in both areas are car depended can give the answer, which was also clarified with further questions to the interviewees. Early Suburbia provides numerous and more comfortable on street parking places in close proximity to every dwelling. Ageing visitors and residents of the suburban quarter are encouraged to use their cars with limited parking stress. For some of the possible visitors of the Old Core, parking difficulty is an agent that prevents them from visiting their friends and relatives so often.

On the issue of access to services and amenities, the Core is more privileged of density and proximity to services and this is admitted through their answers. In reality, this privilege is not so much admired by its residents; instead, the suburban residents do not feel excluded from retail or services since again they have access through their private vehicle. Residents of the Old Core are restricted in using their cars for these short movements due to the parking difficulty; in some cases, they feel that walking is mandatory and unpleasant.

Finally, by examining the issue of walkability, another argument is imposed: whether the ageing population admits walkability as important. The Old Core has the scale, the densities and the capacity of being a walkable quarter, but in fact, the design of streets and public spaces has done minimum towards this direction. On the other hand, the suburban quarter sounds attractive and walkable to its ageing population just because it has adequate sidewalks and minimum traffic. These two issues are enough to satisfy ageing people walking only for recreation and exercise around their houses.

A last interesting outcome from the interviews is that the interviewees expect to continue their mobility, commuting and socialising habits until they are deeply aging, since they expect to be served by relatives, friends or domestic assistants. The reality is that they cannot imagine themselves without their own private vehicle at any age.

### Table 2. Field research results

<table>
<thead>
<tr>
<th>Key issue</th>
<th>Old Core</th>
<th>Late Suburbia</th>
</tr>
</thead>
<tbody>
<tr>
<td>accessibility</td>
<td>Adequate access to retail, services and amenities</td>
<td>Limited support of the daily needs</td>
</tr>
<tr>
<td>social contacts</td>
<td>Moderate to inadequate</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>human presence</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>space and infrastructures</td>
<td>Green and shade: limited, streets and sidewalks: cared but narrow</td>
<td>Green and shade: limited, streets and sidewalks: cared and sufficient</td>
</tr>
</tbody>
</table>
CONCLUDING REMARKS

Ageing people, in the case study areas especially at their first ageing years, are mostly active and car depended commuters. The attribute of car dependency is actually so strong that mitigates walkability, accessibility and social contact differences among suburban and traditional neighbourhoods. In fact, ageing people as far as they are self-serviced retain the lifestyle, moving and commuting habits of their previous life.

Dense and compact neighbourhoods, like the Old Core, have the potential to encourage walking and enhancing social contacts with close neighbours, but they lack in public space equipment, green and shade and mostly safety and protection from traffic. As a result, walkability is not admired as a place virtue at the degree a scholar would expect.

Suburbia on the other site could take advantage from low traffic and give more space to bicycles and pedestrians.

Social contacts and bonding in place is essential, as a generic community goal and certainly important for the deeply aging population, which was not under the focus of the paper. Increasing pedestrians in the street would certainly add to all the above.

This short research reveals the degree of car dependency in Cyprus, as part of the imaginary and lifestyle regardless of densities and urban design parameters. There is a great difficulty to increase life satisfaction and vibrant ageing in a place without seriously considering this fact.

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DUTCH CIRCULAR CITIES BY THE ENERGY OF PEOPLE: POST PHD BEST PRACTICES RESEARCH ON AMSTERDAM AND ROTTERDAM CITIZEN INITIATIVES.

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INTRODUCTION
Dutch best practices of circular citizen’s initiative projects in Amsterdam and Rotterdam show that making cities sustainable and circular not only depends on the technological developments and framing governmental policies. The involvedness of the people is the crucial factor. Without the support and initiatives of citizens most technological and regulatory stimuli for making cities circular become food-loose. Creating circular architecture in the Netherlands dates already from the time of sixteenth of the former century when architect John Habraken (Habraken, 1961) introduced dividing the construction and the closeout of housing, to divide difference of lifespan. Some architect as Thomas Rau (Rau and Oberhuber, 2017) nowadays promote to lease short lifespan closeout parts as heating, light and solar energy installations to make housing more flexible for circularity.

The focus of citizens comparing to that of the professionals from municipalities and government related organizations like energy producing entities and housing authorities, differs in time-horizon and area-bound scale, being one of the conclusions of the dissertation of Fred Sanders (Sanders, 2014). Citizens their priorities by taking initiative do lie in the immediate living-area heading for results on short notice what differs from the focus of these professionals. That hampers citizen’s initiative support and citizen-initiatives results. Still in the Netherlands citizens do create growing numbers of initiatives in the fields of liveability, of care-giving and sustainability nature nowadays (Sanders and Van Timmeren, 2017a).

Circularity the coming deepening step related to the Paris climate agreement does needs the success and enthusiasm of these citizen sustainability initiatives, because circularity is even more strongly behaviour coupled (Hobson and Lynch, 2016). Citizens initiatives though show to be dependent on front running starting up citizens, a group based business case and clear targets. Green initiatives are the ideal initiatives for citizens to have their first experiences (Sanders and Van Timmeren, 2017b). Secondly comfortable local regulations and the support from municipality and government related professionals like energy producing entities, welfare and care organizations and local housing authorities seems to be important too (Sanders and Timmeren, 2016). How en when Dutch people step into circular projects and housing is less known.

Therefor circular and related citizen initiatives in the Dutch twin cities Amsterdam and Rotterdam and their comparison have been studied. Comparing twin cities results and differences is worthwhile because these do have the cultural and physical circumstances in common, what makes research conclusions more significant? The results are direct related to themes as community sustainability responsibility, social resilient behaviour, city housing development and urbanization. The conclusion of this post-PhD added research is: That 1. Circularity comparing to sustainability as assignments related to climate-change is much newer to people and much more radial in their way of life, 2. That’s why people have to be motivated and facilitated to step in circularity for instance by front-running people they know from their neighbourhood or other nearby projects, 3. In situations where the municipality
created facilities for citizen’s bottom-up circular initiatives instead of output-oriented initiative regulations, the results will be better, and 4. There must be acceptance that the business-cases related can be of hybrid character whereby not only the initiative and the circular results gain benefit, the citizens and professionals working on the initiatives can have personal benefit too.

1. Circularity and citizen initiatives in the Netherlands

A circular economy is an economic and industrial system based on the reuse of products and raw materials and the restorative capacity of natural resources. It attempts to minimize value destruction in the overall system and to maximize value creation in each link in the system (WEF, 2014).

1.1 Circularity in the Netherlands

“In Dutch Parliament in 1979 a proposal for providing a hierarchy in the national waste management approach was presented [the ‘ladder of Lansink’]. Priority should be given to limiting the generation of waste, followed by promoting reuse and recycling, and then incinerating waste and finally disposing of waste in landfills (Lansink and De Vries-in’t Veld, 2010).

1.2 Citizen initiatives in the Netherlands

Urbanization is increasing worldwide and in the Netherlands the Amsterdam city is in special growing too (UN, 2014a). Recent forecasting predicts that Amsterdam will grow with 300,000 houses from 850,000 towards 1,500,000 inhabitants in the coming 25 years (Amsterdam, 2015b). This trend of urbanization growth is a trend of global magnitude including new cities on all continents by which 70% of the people at 2050 will live in cities globally (UN, 2014b). Dutch practice shows that cities will only become UNFCCC 2016 Paris Agreement sustainable proof when citizens besides government are willing to take responsibility for these cities too (Sanders, 2014). In the Netherlands stimulated by national government and its municipality’s citizen initiatives little in numbers has become a growing phenomenon though. Citizen initiatives show to be social and cooperative of nature, reasonably often into producing of renewable energy on the neighbourhood scale. It feels a realistic hypothesis that by increasing urbanization the existence of citizen initiatives and therewith citizen responsibility becomes more important to reduce the need for governmental control (Hajer, 2011). Recent developments proof that Dutch governmental organizations have become more successful by stimulating citizen initiatives in recent years. For the citizens themselves these initiatives should be attractive enough for the group and each of the participating individuals. Motivation feelings and neighbourhood conditions are the key success factors (Sanders and Van Timmeren, 2017a).
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Citizen group initiatives seem to flourish when their household base is on order, when the group is searches social togetherness instead of bonding and when the municipality facilitates the small scale of such initiatives (Sanders, 2014). Citizen group initiatives differ much in their goal setting and involvement though, that’s why difference is found in between passive and active citizenship (Tonkens, 2009) (WRR, 2012) related to the ladder of participation (Qu and Hasselaar, 2011). Secondly difference is made concerning the governmental attitude towards such initiatives, being static or dynamic, directive or facilitating (Hendriks, 2006) (Oude-Vrielink and Van de Wijdeven, 2011). What made it for the SBE16 Amsterdam citizen initiatives research handsome to distinguish three stages of citizen initiative called: thinking-along [a passive citizen ship, citizens reflect and advice by accepting governmental initiatives], joining-in [a passive citizen ship, citizens participate in and support government initiatives] and investing-in (an active citizen ship, citizens take responsibility for initiatives dealing with government) all stages of exceeding citizen empowerment of citizen involvement.

1.3 Citizen versus governmental responsibility (Sanders and Van Timmeren, 2017b)
Within this special research done for the Dutch SBE16 Utrecht Congress, there was found that the stages of citizen participation called joining-in and investment-gave the best sustainable results researching the number of Dutch IKS2 city projects (Sanders and Timmeren, 2016). As said in this congress peer-reviewed publication: “The research concerned the Dutch 2010 innovation program for speeding-up the transition of cities towards climate neutrality 2010 [IKS] (Ministerie-VROM, 2009). This program contained 20 projects at the start [IKS1] from which 8 projects ended-up in project real- ization [IKS2] being innovation project realistic enough for execution and 4 projects concerning neighbourhood coupled renewable-energy sustainability projects. The 2013 evaluation of this IKS program (Boon et al., 2013) scanned all climate neutral activities in 55 of the 400 [2009] municipalities working on climate neutrality. The conclusion of this 2013 research was that municipality civil servants and citizens by acting together could make the difference between failure and success. To make the picture more clear these 4 IKS2 are given a closer research for this SBE16 Congress. Analysis of these four IKS 2 projects in 2015 for the SBE16 Congress is done using these three stages of citizen participation. This diversity of stages helped to make the differences of citizen participation in the projects clear and made it possible to couple the renewable-energy results to these. The conclusion was that project dominated by local government the municipality and citizen initiative both can be successful. Hybrid cooperation’s of both are less successful. As given a picture in figure 2.

Figure 2. Cooperation success of citizens and municipalities (Sanders and Timmeren, 2016)

2. Circular citizen initiatives in the Netherlands
“Dutch national government appeals to the bigger cities in the Netherland catching up on the smaller cities into circularity.” [Dutch: “Het kabinet een beroep op de grote steden om hun achterstand ten
opzichte van de meeste andere gemeenten op het gebied van circulariteit in te lopen.”] (Ministry-I&M, 2016)

### 2.1 Circular citizen initiatives in Amsterdam and Rotterdam

Amsterdam and Rotterdam are the biggest cities of the Netherlands respectively 850,000 and 650,000 inhabitants average. Besides the city of The Hague with 530,000 all other cities are below 250,000 of number. Both cities Amsterdam and Rotterdam are frontrunners in green, sustainable and circular developments. Knowing what the policies, results and contribution of citizen initiatives in these cities is should give therewith an insight of possible developments for the Netherlands as a whole. Amsterdam and Rotterdam are interesting to compare too, because these cities could be seen as representatives for the southern and northern part of the ‘Delta’ area where most of the Dutch people live: 7,5 million [40%] on 8.200 km2 [20%] each with its own different cultural background. Amsterdam is in general seen as a city with higher educated people, more traders then the labour-like people of Rotterdam (CBS, 2017). Secondly the Amsterdam and Rotterdam municipality their policies for circular economy differ on some aspects too.

**Amsterdam**

The Amsterdam circular economy policy as part of the ‘Sustainable Agenda’ with the input of the 2015 Circular quick scan, has its focus on innovation stimulating start-ups. Amsterdam shows to be proud on its first experiments: a 3D concrete printer, dismountable housing and using coffee extract for growing mushrooms (Amsterdam, 2015a). The circular policy of Amsterdam is twofold: 1. Stimulating more innovation pilots and 2. Exchanging the knowledge gained, to come into transition from a linear towards a circular economy citywide. Amsterdam therefor sees the city and its people as a giant Living-lab and focuses on chains of production with priority for the building business, renewable energy and organic sectors. This program should end-up in 2018 in a defined strategy for long-term planning. Young people, students, small and bigger firms are seen as natural partners. Citizens though are not given a central place in this program, unless they take initiative themselves. Amsterdam sees itself as a circular entity in the future that manages and connects production chains mainly.

**Rotterdam**

The Rotterdam municipality policy for becoming a circular economy approaches the city as a Living-lab of inspired people and organizations. For this Living-lab approach there is no special plan its more an attitude of embracing all kind of initiatives and experiments from individuals and organized citizens, firms and NGO’s (Rotterdam, 2015). From-out the municipality creative places are stimulated and communication is activated to motivate people to be active for making the city circular. Secondly the Rotterdam city starts circularity in activities it’s responsible for: soil reuse, green and park planning, city cleaning and area development. Creating new jobs should according to Rotterdam be part of the results too. The approach fits in the previous 2015-2018 plan for making Rotterdam sustainable with the citizens, as this plan is called: ‘Sustainability closer to the people’ (Rotterdam, 2015).

On the first sight these plans confirm the by the CBS given differences between the Amsterdam and Rotterdam cities, there were Amsterdam want to create circularity by innovation and learning does Rotterdam embraced all initiatives from the population without having a selection methodology on forehand. What makes it interesting to focus on what happens in these cities in reality, what initiatives have become operational in recent years [see chapter 2.2].
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2.2 Circular initiatives; the Amsterdam - Rotterdam comparison

In the Netherlands the www.maex.nl website has proved to show a reliable picture of civilian initiatives that are actual in the country. The website facilitates civilian initiatives that they can place their initiative on the website, in a list and on a map, that other civilians can join their initiative. Therewith the website gives a good and actual insight of most of the initiatives that are in operation. The website gives information on the stage of the initiative, from start-up to operational, and the numbers of people that should have benefits of the initiative in the surrounding area. The 1345 initiatives that on 20 January 2018 are placed on the website are labelled to themes 22 in number and ‘Sustainability and Energy’ is one of these. Focusing on this theme the circular initiative could easily be recognized. The result for the cities Amsterdam and Rotterdam is respectively 25 and 36 ‘Sustainability & Energy’ related initiatives, see figure 3, from which 7 and 12 are of circular content, comparing to 4 other subthemes, see table 1.

![Figure 3. The ‘Sustainability & Energy’ related citizen initiatives in Amsterdam and Rotterdam.](image)

<table>
<thead>
<tr>
<th>Theme: ‘Sustainability &amp; Energy <a href="http://www.maex.nl">www.maex.nl</a></th>
<th>Amsterdam</th>
<th>Rotterdam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social cohesion</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Food production</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Energy production</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Flora &amp; Fauna</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td><strong>Circular activity</strong></td>
<td><strong>7</strong></td>
<td><strong>12</strong></td>
</tr>
<tr>
<td></td>
<td><strong>25</strong></td>
<td><strong>36</strong></td>
</tr>
</tbody>
</table>

Focusing on the circular initiatives of both cities a sub dividing could be made to the activities of: goods refurbishing, plastic recycling, waste reuse, house building and entrepreneurial activities, see table 2.

<table>
<thead>
<tr>
<th>Circular initiatives sub-divided <a href="http://www.maex.nl">www.maex.nl</a></th>
<th>Amsterdam [15.698 people facilitated – 5 initiatives are in grow &amp; steady phase]</th>
<th>Rotterdam [53.209 people facilitated – 5 initiatives are in grow &amp; steady phase]</th>
</tr>
</thead>
</table>

Table 1. The citizen initiatives of Amsterdam and Rotterdam in subthemes divided.

Table 2. The citizen circular initiatives of Amsterdam and Rotterdam sorted out to activity.
2.3 Circular initiatives in Amsterdam and Rotterdam, the lessons to be learned

In general based on these results could be concluded that Rotterdam has twice the number of circular initiatives in relation to the number of inhabitants of the city. Amsterdam and Rotterdam respectively having 1 initiative on 34,000 and 17,750 inhabitants. The number of people facilitated in Rotterdam is 3.5 times more then in Amsterdam. Rotterdam reaches this higher level of activities to be more active in ‘Goods refurbishing’ and ‘Plastic recycling’ and is lesser active in ‘Waste reuse’. Still the numbers of initiatives comes over a little comparing to the plans for making these cities circular. Secondly it looks like that the cultural difference between the Amsterdam and Rotterdam people [chapter 2.1] by these numbers is confirmed, in Rotterdam there are more circular initiatives and these are facilitating clearly more people. The numbers of initiatives that have passed the planning and start-up phase are equal with 5 initiatives. Examples of initiatives that Rotterdam gives this head start in circular citizen initiatives are: Operatie Afval, Kringloop App, Verdraaid Goed and Community Plastics.

3. Acknowledgements and cases added

The building sector in the Netherlands shows to be responsible for an average of 35% of all the waste production in general [37% in 2015]. The logistic transport percentage for the Dutch building sector is 25% average whereby the building activities in the Netherlands have great impact on the national yearly CO2 outburst in the Netherlands (Bijleveld et al., 2014). Therewith concerning circularity the building sector is of decisive importance. Interesting therefor are the circular initiatives that create results on short notice, for instance by using refurbished materials from demolished houses and building in new developments. For making the state of circularity in the Netherlands more clearly sequentially the citizen group initiatives in Amsterdam and Rotterdam from the inventory [chapter 2] are given more attention and a new project using refurbished materials in the Amsterdam project named KOMST [related to the Dutch word ‘toekomst’ what means future] is illustrated.

Metabolic the Dutch consultancy agency that helped creating the project KOMST one of the Amsterdam citizen initiatives, recently facilitated the two Dutch cities Utrecht and Amersfoort to stimulate circularity in the local house business. The conclusions were somewhat double: 1. Re-using of building materials from demolished houses into new housing has its limitations because of governmental safety regulations and the new need for materials [to a average maximum of 30%], and 2. The effect for the environment footprint depends on the acting of household members too. ‘Milieucentraal’ the Dutch independent NGO for environment related advising to civilian households, municipalities and related companies concluded recently that achieving the national goals for waste separation [80% instead of the actual average result of 50%] depends on the motivation and deployment of people too [www.milieucentraal.nl]. Braungart and McDonough in their books state that ‘Cradle to cradle’ [C2C] total circularity can only develop if respectively economic effect and value increase develop too, due to satisfactory consumer behaviour (McDonough and Braungart, 2002) (McDonough and Braungart, 2013). Interviewing Thomas Mason of Metabolic [May 2018] expert in ‘Urban mining’, the approach by which waste materials of cities of all kind are seen as the source for new local products, that unless the need for technology development and changing governmental regulations the positive attitude of
consumers to the new ‘refurbished’ products is decisive for the result and reduction of the environmental impact. What confirms the importance of citizens in making our society circular.

Remarkable for the circular citizen initiatives of the cities Amsterdam and Rotterdam on the moment of the 2018 inventory [chapter 2] is that both cities only counted ‘one’ initiative both; the ‘Hemp collective’ project in Amsterdam and the ‘Woody’s housing’ in Rotterdam. Both initiatives have their focus on making healthy, sustainable and affordable housing out of sustainable materials that need less energy and are almost CO2 neutral in its use.

The Amsterdam ‘Hemp collective’ promotes the use of hemp for housing, clothing and bio-pharm products. Hemp is a fast growing plant that needs less pesticide that grows throughout the year, which reduces land use and maximizing the CO2 taking back from the air. The initiative not only promotes the use of hemp, it also started the production and processing. As given on the website: www.hempcollective.nl.

‘Woody’s housing’ in Rotterdam designs and builds small houses, a kind of tiny houses, that can be places solitary, connected and stacked and customized. The final products is said to be cradle-to-cradle concerning sustainability using wood as the building material mostly, healthy to live in and affordable focusing on low producing costs, see www.woodyshousing.com.

Both initiatives though show to be semi-commercial. The business-cases behind the initiatives are partial to introduce a new sustainable circular product in line with climate change UN Paris agreement targets on the market, tailor-made for special needs and special people, while at the same time the initiators manage their livelihood out of the revenues. Therewith these initiatives act as a hybrid form of business-case both, partial societal and partial commercial. The societal face of the initiatives shows to be embraced by a number of other firms and organizations for support and mutual business developments. The commercial side of the initiatives shows to be connected to educational and societal organization in forms of cooperation. The relation of these initiatives to the immediate environment shows to hybrid of character too. Taking into account the size of the cities of Amsterdam and Rotterdam and the small number of only two circular initiatives in the building business, it’s scientifically not possible to add robust conclusions to these insights of the initiatives. What can be suggested is that circularity in the building business a business that deals with large investments related to risks certainly when innovation is involved, cannot be developed without hybrid forms of business-cases.

The mentioned circular citizen initiative in the building sector KOMST started by the commercial housing developer BPD in Amsterdam not included in the maxx website, shows a similar hybrid business-case construction. The project basically concerns a traditional housing development started by a commercial building business contractor. The contractor though chose to make a circular project out of it by which the buyers should be involved in the choosing and working out. Therefore the buyers got a voucher from the contractor to buy demolished and refurbished material from demolished houses, as part of the price they already paid for their house. So they were stimulated to make circular choices and were still free to do so or not. To be supported in making their choices the architect of the houses was paid by the contractor for this extra work. The result became and is becoming special, each of the nineteen houses is becoming different, external and internal, because of the different choices for refurbished building materials each of the households made. In the meanwhile the initiative of the contractor is partial taken over by the buyers themselves forming a kind of citizen learning initiative group. The contractor and the buyers group together gained support by related stakeholders like the building material depots and the municipality afterwards. A organizing builted up ‘step by step’ that became more complex, more intertwined and hybrid in this business case. What confirms that creating circular initiative in the building sector, even when the original initiative comes from the contractor, leads to a complex hybrid situation.
4. Conclusions and suggestions for a city circularity breakthrough

Comparing the municipality policies of Amsterdam and Rotterdam for stimulating local circularity there is a meaningful difference between these twin cities, Rotterdam clearly focuses more on bottom-up initiatives. Amsterdam on the other hand gives priority to innovation and learning. The www.maex.nl websites for signing-up citizen initiatives show the positive results of the Rotterdam policy, twice more circular initiatives and 3,5 times more people potential related, what gives the impression and conclusion that involving people in a bottom-up approach creates better results. The twenty-one by maex presented examples confirm that.

Focusing on circular initiatives in the building sector the two initiatives for Amsterdam and Rotterdam by maex registered, a sector responsible for 35% of the waste production in the Netherlands, the role of citizens and commercial parties in these projects shows to be mutual intertwined. Their business cases thereby show to be hybrid of character too. Unless the sample of initiatives studied was small, these conclusions are stated by all the initiatives in case. The two projects, one in Amsterdam and one in Rotterdam, and the project KOMST of Amsterdam shows that the role of the citizens, individually and in group action, will not be there when commercial parties are not involved in the circular challenge and the business case of both.

For more and a deeper insight in the impact of circular citizen initiatives based on this post PhD research concerning circular initiatives in the Dutch cities Amsterdam and Rotterdam, it would be better interviewing these initiatives in Amsterdam and Rotterdam added with initiatives of other cities too. Questions that should be taken into these interviews should concern the context created by the municipality, the role of the citizens in the group initiative and their relation with commercial parties involved. This all would be an interesting and important next step for additional research. Because making cities circular is important in the case of climate change and the future economic prosperity of cities.

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THE ABU DHABI WATERFRONT; EVOLUTION, LAND USE DYNAMICS AND THE QUESTION OF THE OPEN CITY

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“Despina can be reached in two ways: by ship or by camel. The city displays one face to the traveler arriving overland and a different one to him who arrives by sea. When the camel driver sees, at the horizon of the tableland, the pinnacles of the skyscrapers come into view […] he thinks of a ship. He knows it is a city but he thinks of it as a vessel that will take him away from the desert…
In the coastline’s haze, the sailor discerns the form of a camel’s withers […]. He knows it is a city, but he thinks of it as a camel […] taking him away from the desert of the sea…
Each city receives its form from the desert it opposes; and so the camel driver and the sailor see Despina, a border city between two deserts.”
Italo Calvino, Invisible cities, p. 14

INTRODUCTION

Waterfronts are some of the most dynamic urban elements. They reflect the inner social and morphological conditions that carve the city. They provide opportunities (such as tourism, real estate, infra networking and landmarking) and constraints (industry, waste, sea level rise). They display the historical layering of urban evolution and are key to any future projections. Furthermore, they are associated with citizens’ well-being for both physical and mental health and of course to tourism.
Abu Dhabi is a city connected to the sea by its origins. Its geographical position, its brief history and rapid urban growth follow the shoreline along the Abu Dhabi Island, the mainland and all the adjacent islands. This paper is part of a research project whose objective is to identify and analyze the quantitative and spatial properties of this intricate sea-city interface through its urban history and project to its Strategic plan for future predictions. The analysis leads to a qualitative interpretation of the urban characteristics of the shoreline development through the years, and the interactive impact between the sea and the urban fabric (including social, land-use and morphological factors).
The analysis results also address the trending question of the “open city” and the “accessible city”, in terms of accessibility to the sea as a major urban component, as a key factor of physical and psychological wellbeing and as a civil right.

Abu Dhabi: An instant city

Abu Dhabi may be counting just five decades of modern history – a blink of an eye compared to the vast majority of other cities with similar population and magnitude – but may also take pride in the galloping growth that transformed it from a seasonal fishing post to a global hub. Revenues from the booming oil industry combined with the extravert and dynamic presence of the late Sheikh Zayed in the steering wheel of the city and the United Arab Emirates are the factors to credit.
The pre-oil settlement kept a small distance from the windward seaside with the exception of the dhow pier. Apart from pearling-fishing related activities, the rest of the waterfront was out of use. Leisure and tourism were notions unknown to the mentality and culture of that time (Al Fahim, 2013). However, the oil boom triggered sweeping changes. The first master plans for Abu Dhabi manifested both Zayed’s pragmatism and strong influences from Doxiadis’ modernist approach on other cities in the region (Kyriazis, 2017). The iron grid applied eradicated the old city and soon spread to cover the entire island in the Superblock pattern. Just like in many other Gulf cities, the influence of the automobile and the shift of the housing typologies from the Arabic pattern to the western villa had profound implications on the urban growth (Kyriazis, 2016), pushing on inland development and the birth of Abu Dhabi’s major suburbs. Compared to that, adjacent islands were already reclaimed or were being developed at lower paces. However, 2004 benchmarked a shift for Abu Dhabi’s vision from a nation’s capital city to a global destination for tourism and culture, as Khalifa succeeded his father Zayed into power (Elsheshtawy, 2008). Since then, a series of flagship projects have dominated the seafront throughout the metropolitan area of Abu Dhabi, in accordance with its ambitious Framework 2030 Plan (Samarrai, 2016).

**Research question**

The main research question arose in a rather trivial way, as the outcome of a stereotyping verbal comparison on the response of the urban forms of Abu Dhabi and Dubai to their waterfront. The easy and most popular answer was that Abu Dhabi with the help of its unique island geography (figure 1) was responding in a much more open, family-friendly way than Dubai, whose contemporary growth is driven along its highways in a neoliberal manner (Kanna, 2015).

![Figure 1: Satellite image of Abu Dhabi, its mainland sprawl and the surrounding islands (source: Google Earth: Landsat/Copernicus)](image-url)

However, while this comparison with Dubai will have to wait, the question stands for Abu Dhabi: is it a truly coastal city? Of course, not in terms of geography but accessibility and openness of the waterfront to the sum of its potential users: citizens and visitors. Furthermore, how did the waterfront evolve
through the city’s brief but inflating past and what predictions can be made for its future? In order to carry out such a study, the waterfront may be measured in two ways:

First, as a total length, that would highlight its evolution through time. Then, if superimposed to the main urban metrics (i.e. population and urbanized area) it could provide an insight to the evolution of the city’s urban growth model.

Second, accessibility could be addressed only by introducing specific properties of the shoreline, related to the urban form and ultimately to land uses. Such a quantitative breakdown could also yield qualitative outcomes, essential for crystalizing the big picture and simultaneously focusing on isolated points of interest along the seashore and their transition patterns.

**Literature – Global Waterfronts**

Such a study is a first for Abu Dhabi – since there is no similar literature – would produce a valuable perspective: The waterfront’s inherent property to follow the urban growth in time, to unfold along the city-sea boundary and narrate transitions based on sociocultural and spatial properties. The urban equivalent of an MRI² anatomy scan. However, most Abu Dhabi literature is dedicated to its superblock interior (Kyriazis, 2017), the modernist heritage (Menoret, 2014), housing (Elsheshhtawy, 2016), hubs of informal activity (Elsheshhtawy, 2011) and the like. Even in the very analytical manuals issued by Abu Dhabi’s urban Planning Council, waterfront development regulations are remarkably limited and a new Framework for the Emirate’s coastal areas is highly anticipated³ (DPM, 2018).

One can explain the lack of literature in this domain by the shallowness of the modern history for Abu Dhabi and other cities in the Arabic Gulf. Being such young cities they missed the global developments that scarred the urban form in Europe, USA and other regions. Arguably the most important one was post-industrialization and the shift of many cities to a broader economy basis accompanied by wide restructuring of their waterfronts (Mah, 2018). Either by exploiting major events’ opportunities (like Barcelona and the 1992 Olympics) or by investing in tourism and services (like Bilbao and London) through flagship architecture and urban design projects. Interestingly, Gulf cities including Abu Dhabi currently experience a similar transition of post-industrialization from oil dependency to a more sustainable future that involves high-tech industries, green infrastructure and tourism through culture (Low, 2012).

Post-modernism and the issue of popularity has reinforced the active role of the waterfronats. Imagery of LA’s beach lifestyle – based on eliminating the difference between vacations and work (Picon-Lefebvre, 2013) – has become a new paradigm for many cities and a bourgeois dream for the expatriates. Waterfronts have become the new frontier of a social imaginary, a spectacle (Picon-Lefebvre, 2013). Especially regarding urban beaches, social boundaries dissolve and the public space becomes highly unpredictable in terms of the end-user. It is exactly the ability of the waterfront to function as a major social capacitor, that attracted the attention of major real estate ventures. By investing on producing, maintaining and enhancing the seafront zones to diversified destinations of culture, sports, leisure and services (Elsheshhtawy, 2008) combined with exclusive housing and other related uses, cities have converted the urban seashore into a lucrative asset and a social segregation tool.

Lately, the debate on the new urban condition has shifted from a static and deterministic approach controlled primarily by the markets laisser-faire to more sensible, inclusive, dynamic approach that respects locality and manifests openness. The principles of the Athens Charter are to be replaced by a more incomplete and bottom-up approach. The “right to the city” as an integral part of a more democratic model of governance is highlighted into the directives formulated at Habitat III summit and the New Urban Agenda (UN-Habitat, 2017; Sennett, 2018).
To the same wave-length, a lot of cities or their active citizens have seized opportunity to highlight malpractices that oppress freedoms, rights or the expression of commons and have initiated processes of mild urban regeneration that excludes the drawbacks of gentrification (such as displacement and segregation). Urban waterfronts contribute greatly to this: from the reactivation of Mumbai’s north-west waterfront by the people of Bandra neighborhood (Kaasa, 2011) to the resistance of independent institutions and academia to the privatization and gating of Athens’ former airport field called Elliniko (and the adjacent waterfront), as this is planned and streamlined by the central Government and the fiscal guarantors of the Greek debt situation4. So it seems that direct democracy and the right to the city have a rough way ahead.

Methodology
This research subject was both privileged and unfortunate enough to sail though uncharted territory: While literature related to Abu Dhabi is still in low numbers, sources related to its waterfront are even fewer. Furthermore, data collection is a constant issue, especially when it comes to digital mapping information. The project’s mapping is based primarily on historical documentation and secondarily on site visits, photography and observation. Aerial photography and satellite imagery are the main sources of information with regards to the mapping analysis, namely the creation of waterfront outlines with all necessary qualitative attributes. Most aerial photographs used were acquired from existing reports of the Abu Dhabi Municipality (ADM, 2003), while satellite imagery used was retrieved from Google Earth history and from a Geography research program of the Paris Sorbonne University Abu Dhabi. While pixelation and accuracy are inversely proportional on older imagery, qualitative attributes were provided with the help of historical photography, early master plans of the city and descriptions of daily life issues on literature related with cultural heritage and the development of the city. In the absence of any similar digital background, Abu Dhabi’s waterfront line had to be digitized from scratch, together with a package of characteristics that would allow its quantification. Those characteristics are primarily the land uses associated with the shoreline and up to a certain logical depth from it. Land use categories were created in a way that would accommodate all findings and later on would highlight some very distinct properties of the city’s waterfront space, as the land reclamation status and accessibility (in terms of privacy and permeability). The land use categories proposed are:

- Residential (including hotels and with partially accessible waterfront to public),
- Commercial (usually private, i.e. malls but with fully accessible waterfront),
- Palace (highly private and inaccessible waterfront),
- Government (Ministries etc., with inaccessible waterfront),
- Industrial (with inaccessible waterfront),
- Public (parks etc. with fully accessible waterfront),
- Barren (reclaimed land and a defined-constructed shoreline but devoid of any uses),
- Waterfront (reclaimed land and a constructed shoreline with limited accessibility, i.e. certain beaches with entry fees) and
- Seashore (a natural, undeveloped shoreline).

After tracing over all available aerial and satellite background imagery, a shore polyline was created for nine specific timings: 1968, 1976, 1978, 1980, 1984, 1987, 1994, 2004 and 2015. This shoreline would be measured in its total length but also broken down to its aforementioned land use categories, thus allowing the quantification and visualization of the waterfront evolution through time (figure 2). However, for the extraction of much more precise and useful comparison information on land use development trends, not all maps-datings were used on the graph analysis that follows. Instead, only six

![Figure 2: Mapping of Abu Dhabi's waterfront evolution from 1968 until 2015, with land use categories allocated.](image)

**Development Trends**

Despite the fact that Abu Dhabi was just a small seaside fishing post in the early 60s, the first master plans of the post-oil city were targeting on the mainland urban development rather than a potential linear growth along the shoreline. The oil revenues spurred an unprecedented urban growth that needed a plan capable of accommodating it (along with the satisfaction of the Emirati citizens). The rigid grid proposed by almost all masterplanners and implemented was reflecting both the political pragmatism of Sheikh Zayed and the values of Modernism, as influenced by Doxiadis and his work on other cities in the region (Kyriazis, 2017).
However, through these fifty years of evolution, the waterfront was – and still is severely manipulated to the benefit of the city. Originally, reclamations would serve adjustments along the boundary between the grid and the sea. Just like the Corniche and the Khaleej Al Arabi street. But then they would create massive flat areas, islands devoid of any use, waiting for the city to expand to them. The islands of Saadiyat, Yas, Reem, Maryah, Hudariyat and then the mainland shores of Raha Beach and Musaffah are the most characteristic ones of this model of development. The famous Lulu Island, reclaimed at the early half of the 90s to serve as a breakwater for the city itself, remains undeveloped; however, its future also holds a possible urban development.

It was very early in the modern history of the city that it was realized that the main island itself would not be sufficient to hold the urban growth. The mainland was the easy step ahead. The two waterfront edges of the mainland are still under constant development; however, the urban sprawl against the desert interior could alter the character of the city. On the other hand, urban takeover of adjacent islands (i.e. Saadiyat and Yas) has led to the engulfment of significant mangrove marine forests and various smaller islands by a city ring, thus having to consider them as parts of the urban agglomeration and therefore adding them to the calculations. The presence of these sensitive environments within the city has increased the risks but has raised awareness on their protection.

THE SEA, THE CITY, THE PEOPLE
As aforementioned, in each map created, a polyline is used to describe the total length of the shoreline as well as its land use categorization. All values created are in running meters. Also apart from the geospatial information of the waterfront evolution, such a quantitative approach is important in order to commence addressing several qualitative questions as well. However, as far as this very paper is concerned, the qualitative element shall confine itself to a generic review of the waterfront transformations citywide and shall not proceed to a more detailed analysis of land use transitions in specific coastal areas, hoping that this research will spark a debate to this direction.

Therefore, after transferring information of all polylines created (including the broken down land use segments) about their actual length, a major data table was created, from which all following findings emerged.

Seashore length and urban area
The first chart (figure 3) indicates the overall seashore length and its growth over half a century and its comparison with Abu Dhabi’s total population and urbanized area. Three major points show up.
First, there seems to be a slowdown of waterfront expansion during the 1984-1994 interval, possibly between the completion of the main island shoreline and the next major reclamation works (i.e. Lulu Island). Second, there is another slowdown since 2004 on the total urbanized area, right after the main completion of the major suburban communities in the mainland, such as Khalifa City, Shakhbout City, Shamkha and Mohamed Bin Zayed City.
The strongest point however derives from comparing the growth rate of the waterfront with the ones of the total population and the urbanized area. While these growths move in parallel lines until 1984 (equal rates), there is a clear gap ever since, only to be restored and equalized after 2004. This shift coincides with the change of perspective for Abu Dhabi’s aspirations once Sheikh Khalifa took power following Sheikh Zayed’s passing (Elsheshtawy, 2008).
By combining the growth of the urbanized area of Abu Dhabi with the one of its seafront, a new graph emerges, that articulates the integral ratio of the city’s growth model (figure 4).

Apparently, the shift of perspective from a nation’s capital city to a global hub that occurred in 2004 had its impact on the growth model of the city. What used to be a city that prioritized the urbanization in depth and distance from the waterfront (especially through the mainland suburbs), turned into a more balanced model where waterfront caught the attention of major developers. The global aspirations of Abu Dhabi paved the way for the exploitation of all surrounding islands and their conversion to a leisure, entertainment, sports and luxury epicenter. These new uses however have produced skyrocketing land values and an internal exclusivity, thus altering the seashore properties.
Evolution of Waterfront land uses

While the growth of the overall seashore length along the last six decades provides a glimpse on the city’s development model, breaking down to the land use groupings may reveal the anatomy of the transitions that took place on this sensitive threshold.

Figure 5 demonstrates the values (in running meters of waterfront) of all land use groups explained earlier. Land reclamation happened fast enough for actual urban development to follow so there were and still are significant areas of constructed shoreline but devoid of any land use. Furthermore, there is a remarkable increase on government related uses (especially by the reclamation and use of islands like Samaliyah and Massnouah) and on the “waterfront” use (due to the public but limited-controlled access to Reem Island, Maqta City channel, Yas channels and Marina Mall breakwater).

Figure 5: The evolution of land uses along the Abu Dhabi waterfront from 1968 until today.

Some more patterns emerge when land use categories are displayed as percentage columns (figure 6). Each decade column represents the total seashore length (100%). In this graph, the most notable feature is the shrinkage of the natural shoreline from 92% in 1968 to 13.6% in 2015. However, this percentage may still be considered high if compared with other waterfront cities of the same size. The mangrove forest takes most of the credit in this regard, highlighting though the need to preserve it as the pressure from surrounding urban development builds up.

Another remarkable point is the steady reduction of the “barren” waterfront, which keeps on occupying a mere 32% of the total coastline (in 2015) and awaits for the urban sprawl to catch up. Equally important is the inflated presence of the “residential” group in 2015 to 3% of the total, marking a transition to more exclusive residential projects along the seafront.
Seashore Accessibility

One of the key properties of the urban waterfront is its accessibility. Both in terms of physical access to any kind of shoreline and in terms of affordability. Accessibility to the seashore is a factor of paramount importance, in an effort to address the question of the “open city” and the “right to the city”. Nevertheless, it goes beyond that notion and the democratic values reflected. Waterfront accessibility is associated with better physical and mental health for the citizens. It improves creativity and inclusiveness. Furthermore it could potentially prove more beneficial in cases of any climatic-weather threat.

To calculate the amount and fraction of accessible waterfront in Abu Dhabi, an assumption was introduced for each one of the land use categories allocated. Industrial, Government and Palace areas (due to privacy, security and safety restrictions), “waterfront” areas (due to limited access in terms of the introduction of entrance fees) and “residential” areas (due to their exclusive character) shall be added up to the inaccessible segments of the seashore. Opposed to them, all other land use groups – including the “barren” zones in which several informal activities take place – shall be considered as openly accessible to the public.

Following these groupings, figure 7 strikingly reveals a trend that keeps on building up since the commencement of the post-oil history of the city. In its majority, the Abu Dhabi seashore remains fully accessible to the public. However, the growth rates between accessible and inaccessible areas are opposite to each other (with increasing values during the last decade). If these rate values persist, the majority of Abu Dhabi’s urban waterfront areas will be inaccessible to the public by 2020 (figure 10). This may be considered as both a psychological threshold and a reality check for the city’s compliance with the newest urban resilience and sustainability guidelines that will be addressed in the next paragraphs.
Population and Accessible waterfront

If the accessible fraction of Abu Dhabi’s urban waterfront is decreasing soon to become the minority, how does this evolution reflect to its citizens in terms of statistics? The urban growth implies a population one as well. However, the rates may differ thus producing alternate perspectives on the question asked. By comparing these rates (figure 8) though, it is clear enough that the population growth of the city outnumbers the one of the total waterfront. This makes sense taken into account the constant densification of the existing urban area as well as the mainland sprawl, far away from the sea.

The worrying part of this graph however lies on the increasing growth gap between the total seashore length and the open part of it (as described in the previous paragraph and figure 7) as well as the even more strikingly increased gap between the total population and the accessible part of the waterfront (which has roughly grown since 2004).
That increase in both line gaps may be visualized as an evolving ratio that combines population to running meters of seafront. Figure 9 shows exactly the development of this ratio through the studied period. Both lines may be observed individually as density indicators. According to them, the density of people per running meter of accessible urban seashore is increasing rapidly, almost become doubled since 2004 (from 1.5 persons per meter to 3 persons per meter today), without considering non-permanent population, like tourists etc. This finding signifies that despite the overall increase of the urban waterfront, its exclusive-oriented properties and the even greater population increase could lead to overpopulated public waterfront spaces and to a decrease at the qualities and the services provided. Furthermore, this densification of the available seafront should trigger alarms in terms of responding to the “right to the city” since high enough numbers could jeopardize the waterfront’s social capacitor abilities.

Lastly, another finding is the widening gap between the two ratios, reiterating previous findings about the decrease of the accessible fragment of the urban waterfront.

**Figure 9: Ratio of People per running meter of Abu Dhabi’s urban waterfront.**

**BEYOND THE NUMBERS**

Despite the fact that Abu Dhabi is a coastal city, its blink-of-an-eye evolution that is based on a real estate vicious circle of ongoing projects is impelled to preserve or boost furthermore its profits through land values. Currently, a significant number of flagship projects is underway along the seashore, including Saadiyat Island, Raha Beach, Coconut Island and Yas Island developments. Most of these spots coincide with areas designated as “free zones” for property ownership by expatriates. The projects’ high-end qualities may attract skilled expatriates in the country, but they also increase exclusivity and overmanagement, unavoidably leading to inaccessibility.

At the same time, the anticipated and ambitious project of the Capital District combined with other new suburbs and mainland projects like the Riyadh City and Masdar City will increase the total urbanized area, the city sprawl against the desert and the total population, thus building up even more pressure on the existing accessible seashore.

The positioning of the expatriate ownership free zones along the coast and of the major suburbs for the nationals comes with an urban planning rationale, yet it also contains ideas of a regularity in terms of...
nationalities. Not surprisingly, the architecture of the free zones tailor fits the description of Ash Amin (2018) of “telescopic urbanism”: a top-down and rapid implementation of buildings and spaces with little to do with the scale, texture and fabric of the existing neighborhoods but fit neatly into ownership patterns and political boundaries. It is the perpetuation of the spectacle and lifestyle both for these privileged enough to enjoy and for those who covet from afar.

At the bottom line, it could be the cultural context to be held responsible for triggering and preserving this spatial particularity. While more research on that field is essential in supporting such an argument, it is clear that issues related to privacy, to daily Islamic routines, to family and social relations and customs that expand to behavioral patterns are highly associated with such an arrangement. For example, different cultures use the waterfront with its leisure content in different ways. Bedouin culture was no exception, since it emphasized its interaction with the desertscape. Swimming and all beach and water related activities were less popular or even banned in the previous decades, apart from the essentials related to fishing and trade.

Today, it is tourism, leisure, arts, sports and services that Abu Dhabi advertise to the world exclusively through its idyllic waterfront. Its latest addition, the Louvre Abu Dhabi expresses the end of orientalism (Elsheshtawy, 2018) by combining elements of the Arabic architecture (the mashrabiya dome) and urbanism (the white volumes and the interlocking public spaces) to house priceless art from – and for all humanity at the very edge of the sea. However, interestingly enough, the Museum is built on a contextless area, a “barren” site (according to this analysis): without any doubt, an example indicative of the thin line upon which Abu Dhabi is balancing.

Figure 10: Two views from the same island: On top, the reclaimed but barren beach of northern Yas Island is packed with informal activities related to water sports - a nation-wide reference point. Unfortunately this site is blocked by recent construction works for a private venture. On bottom,
opposite Yas Island, the highly exclusive residential developments along Raha Beach have created a segregated waterfront devoid of human scale diversity. Both photographs © Apostolos Kyriazis.

CONCLUDING REMARKS

It is Abu Dhabi’s geographical position that signifies its front window character; a coastal city spread on islands next to delicate mangrove forests and along a threshold with the vast Empty Quarter desert (figure 1). Its shift towards tourism and culture has started capitalizing on that unique landscape dualism that feeds an imaginary for tourists, expatriates but also nationals as well. It seems that the urban waterfront amplifies the clashes generated by cultural particularities and issues related to privacy, gender segregation and customs. Its evolution has reached a fine line, a reminder, a call for everybody to consider with regards to its future character. It is the same balance instituted since 2004 between seafront and mainland sprawl, that increased the pressure of high-end, private, exclusive projects to the sensitive marine environment, while raising costs on island-connecting infrastructure.

The urban seafront growth does not come without asterisks. It is highly commercialized and privatized, thus serving as a lucrative asset rather than a civic right. Free and unconditional accessibility to the sea that could reflect the city’s openness and inclusivity and celebrate multiculturalism is at risk.

Consequently, Abu Dhabi tends to become a coastal city without a horizon. However, this is an open-ended research with more steps to follow. A comparison with cities of similar scale, magnitude, history and governance models is of paramount importance, in an effort to identify the validity of the main question and produce all necessary conclusions. Parallel to that, another research approach could zoom in specific land use shifts along the urban seashore through time, using a solely qualitative vantage point. A direction that could shed light on the cultural parameters that carved the public space and the morphology of the city.

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1 It would be interesting to conduct this comparison not only in terms of the main research methodology presented here, but also as part of a questionnaire that would address the relationship of the two cities to their waterfronts in terms of leisure, free time, accessibility and affordability. The author has already initiated such a research project.

2 Magnetic Resonance Imaging.

3 So far there was just one manual dedicated to a specific waterfront development, namely Al Bateen. A new Plan Maritime is expected to “be announced in the upcoming months” (DPM, 2018). According to its preview, the Plan “facilitates the integration of the interests and responsibilities of all those involved in the development, planning, management and use of the coastal areas. Plan Maritime delivers a plan-led framework for development of these coastal areas. Plan Maritime is intended to be the mechanism to ensure the Emirate of Abu Dhabi’s internal waterways, mainland/island coastlines and waters of the Arabian Gulf maintain a balanced and diverse array of maritime activity within a sensitively and responsibly managed planning framework for the marine and maritime environment”.

4 Greece’s Constitution protects by a rather invincible article the openness of the natural seashore and safeguards it from any private property enclosure up to a certain offset width from the actual end line of the sea. This includes all highly touristic urban waterfront along Athens’ southern suburbs (where the former city’s airport used to be). Since the fiscal recession, Greece has committed in selling off major state-owned assets and property to “key investors” to reduce operational costs, invite foreign investment and create jobs. A sellout is agreed with the Lamda Investment Group (a consortium of investors from China, UAE and Greece). However, the luxurious proposed Master Plan – designed by Foster & Partners – has met legal resistance from academic institutions and local residents for breaching a series of articles related to forestry, archaeological sites and of course the seafront open access character, by introducing exclusive and highly segregated skyscrapers along the beach. Links: http://www.lamdadev.com/en/investment-portfolio/the-hellinikon.html and
Abu Dhabi’s population and urbanized areas were extracted from SCAD statistics and ADM, 2004.

The identification and documentation of informal spaces and activities along Abu Dhabi’s waterfront is a major endeavor that deserves further research attention. So far it was only the interior of the city that all scholars have focused on (Elsheshtawy, 2011). Some of these waterfront informal spots will soon be presented by the author for the needs of an ongoing research program dedicated on social mapping of Abu Dhabi’s public spaces.

Recent developments in Abu Dhabi may increase these rates even more and shorten the time horizon of this prediction. Indicatively, the country-wide famous for its kite surfing community Yas North beach (with all other equally informal accompanying uses like fishing, swimming, camping and barbequing) was recently blocked from its dedicated visitors for the sake of three construction sites that would fence the beach and exploit it for exclusive tourism and sports services.

On one hand, the vast flat mainland offers easy space for urban sprawl with low cost for infrastructure. Contrasted to that, the islands infrastructure proves to be expensive enough even to justify the higher land values.

The national clarity of the suburbs — in order for the residents to stay out of influence range from the different lifestyles of expatriates — is manifested through the specially designed “Emirati neighborhood” in the official manuals of Abu Dhabi’s Urban Planning Council.

Information retrieved from full paper authored by Apostolos Kyriazis and Myrsini Apostolaki, peer-reviewed and presented at the ARCC-EAAE 2018 Conference in Philadelphia USA, in May 2018, entitled: “A cultural paradox and the double shift of the housing typologies in the Arabic Gulf area: Undergraduate research case studies in Abu Dhabi”. Its online proceedings were not still available at the time this full paper was submitted.

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WHERE OMANIS WALK? A COMPARISON BETWEEN THE PERCEPTION AND THE MORPHOLOGY OF THE BUILT ENVIRONMENT IN DIFFERENT NEIGHBORHOODS OF MUSCAT.

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INTRODUCTION
Countries of the Gulf region experienced a great cultural shift in the four last decades as an effect of the economic growth based on oil export. This Phenomena had an impact on people’s mobility patterns and led to an increase in health problems due to sedentarism, as well as social disaggregation. This paper is based on a comprehensive study of the walkable potential conducted in six different districts within Muscat: Al Hail, Al Khoud, Al Mawaleh, Bawsher, Halban and Mabaila. The study was structured in two Phases. The first was a cross-sectional quantitative survey on the perceived qualities of the built environment. The second, was an on-site assessment on the physical characteristics based on the same attributes assessed during the survey. A comparison of both, the perceived and the physical characteristics measured on site was expected to reveal the biggest constraints to Muscat’s pedestrian mobility.
It is a common sense that the walkability is a key factor for a healthy, wealthy and socially integrated neighborhood. This paper explores the comprehensive methodology to assess active mobility levels and ways to integrate walkability studies in planning processes in the specific case of Muscat.

Growth and car dependency
Many authors stress that cities benefit of growth and urbanization due to the so called economy of scales as services and infrastructures are shared by multiple users leading to efficient uses of energy and surface. Rapid urbanization as observed in Oman processes a strong pressure over authorities due to increased demands for infrastructure. In Muscat, the distribution of land is managed by the government which intends to provide young Omanis equally with a piece of land, but due to the lack of control mechanisms generates an inefficient occupation, inequity and unsustainable patterns.
New developed areas stay deprived of basic services for undetermined periods, constraining the potential of active transports and undermining the use of public spaces. The consequence is a built environment which doesn't support physical activity and strengthen the prevailing rates of individual motorized vehicles dependency causing traffic jams and high rates of accidents (in Muscat 20 deaths and injuries per day). Additionally, the records of non-communicable diseases observed in Oman are growing exponentially which showcases the gravity of this development pattern.
According to the World Health Organisation, Oman’s leading causes of health related deaths are Heart Disease and Diabetes. They further state that Percentage of population living in urban areas within Oman is set at 73.4%, while 20% of the population are categorised as “Obese”. Physically inactive lifestyles are becoming more prevalent worldwide, as are the chronic diseases they cause.
There is substantial evidence linking the design of communities and access to recreational facilities with active transportation and recreation. Land development practices in many countries are increasingly based on automobile-oriented, suburban patterns that are risk factors for inactivity and overweight.\(^6\)

**COMPREHENSIVE STUDY SUMMARY**

These scenarios set the task of understanding the walkability rate within the city of Muscat, the social environment, outlooks towards the idea of walking within the city, and ways of introducing walking within neighborhoods. A comprehensive study of the walkable potential in 11 different neighborhoods within the six previously stated districts in Muscat are included in this paper in order to present them as case studies.

In general, the neighborhoods tend to be of a residential character with single family houses and possess a low level of pedestrian infrastructure between the built environment. Single family houses are the dominant typology currently spreading to the city borders of Muscat; a result of factors such as lottery systems for land ownership, and big families requiring large amount of space. However, with the development of the city quickly reaching the strict set borders of Muscat, the neglected open plots within the city are more noticeable. The selected neighborhoods contain a high number of these neglected open spaces that aren’t being used by the neighborhood community. The selected cases are crucial in two aspects: they represent a valuable insight to the reality of the city in terms of social life and integration, and they are meaningful examples for assessing Walkability practices.

\[\text{Figure 1. Lack of Pedestrian Infrastructure, Maabelah 2018}\]

**METHODOLOGY**

The theoretical construct of this paper is based on the results of the IPEN project. It combined both a variety of objective, measurable characteristics (attributes of the physical environment) with perceptual elements related to behaviour as its complementary pair.

To overcome certain limitations of objective measurements, sociologists have been applying various principles – starting from “ecometrics”, the science of assessing environments through systematic observation’, drawing from neighborhood “audits”, often employed in urban planning contexts\(^8\), coming to many articles that have explored the degree to which perceived measures of the walkable neighborhood (via surveys of residents, for example) overlap with objective measures like audits and GIS data\(^9\).
The IPEN project and results
Using a common design and comparable methods, an observational study known as The International Physical activity and Environment Network (IPEN) adult study was used in cities of 12 countries. The project began by selecting neighborhoods and recruiting participants from their local communities. It combined two questionnaires aiming to first identify the level of physical activity and subsequently using another questionnaire in order to correlate the level of walkability with different attributes and elements of the built environment.

The Neighborhood Environment Walkability Scale questionnaire
Modifications of IPEN Adult Study questionnaires were used as an assessment method. The perception of the citizens towards the same built environment collected resulted in quantitative data. As one of the several questionnaires designed to measure residents’ perceptions of the environmental attributes of their local area, it consists of number of items grouped into subscales to assess the basic constructs of neighborhood density, land-use mix, street connectivity, pedestrian infrastructure, safety and aesthetics. Those six attributes are defined to facilitate empirical evaluation of the built environment and the perception of it – they are based on the existing research studies and methods of assessment (IPEN, NEWS, NEWS-a), but modified to answer the current situation in local culture and environment. They also aim to connect neighborhood designs to pedestrian behaviour and their perception of walkability. The goal is not to evaluate the neighborhood as walkable, but to use the measures employed to identify their variations in walkability.

Selection and modification of items of NEWS for the WOW survey
In order to address the situation in Oman in a more sensible way, the WOW survey was created as an adjusted version of NEWS/IPEN survey. In order to maximize and validate the variability outcomes, a limited study field of 400 m radius per neighborhood was set. This allowed the questionnaire to be surveyed in a 5-minute walking radius in each location.
According to the topic of the research “Where Omani’s Walk”, the targeted community was the locals. This pre-requisite of sampling was considered a reflection of the demographic structure of the population.
Students in the BArch Urban Planning and Architectural Design programme at the German University of technology in Oman were involved in this study for design projects. The neighborhood locations were randomly selected from students’ personal connections within these 11 local communities. Having working groups not only as the observers but also as members of the community led to an easier establishment of contact and community engagement in the research process.
The sample population was composed of females and males of different ages that were residents of private homes. Adults living in the selected neighborhoods completed surveys on their physical activity behaviours and perceptions of the neighborhood environment, conducted using a mobile phone device. Perception of neighborhood attributes was assessed using an abbreviated NEWS scale (NEWS-a)\textsuperscript{13}. To create the adjusted version, content of items was analysed taking in account the characteristics of physical and socio-cultural environment. Adjustments are referring to redefining some of items and the attribute of Safety:

More specific questions, such as identifying how common certain residential typologies are (attribute of Density) were modified to correspond with typologies in Oman. Here the type of Detached single-family residencies was replaced with the Single-family villa, while Multi-family houses types (low, medium and high rise) were replaced with Twin villas (low rise) and Apartment buildings (up to 5 stories) or High rise apartment buildings (more than 6 stories). High-rise multi-family buildings (more than 20 stories) was omitted as it is inapplicable in Oman, with building height limits set at 15 stories maximum in business districts.

Evaluating the perceived land use mix was based on significant and positive associations with the amount of time of walking.\textsuperscript{14} Survey takers were asked how many times during a week did they walk to the listed business or facility. Contents of this item was modified to include uses that are common for urban areas in Oman; such as a place of worship (the mosque).

Unlike in most of the countries, crime rates in Oman are significantly low\textsuperscript{15}, which might lead to repetitive findings. Therefore, the new version of the survey rebranded the attribute of Safety, and shifted it’s focus onto traffic safety.

Besides these modifications, a certain number of items reduced when there was no application for the physical and socio-cultural environment of Oman. Repetitive questions aimed for the same elemental result and were subsequently left out in updated versions of the questionnaire, or swapped in for a more relevant topic. Questions addressing activities of cyclists or social interaction in public spaces were excluded as these situations are not common in the region.

A translated version of this survey into Arabic was created in order to connect with Arabic-first-language speaking demographics.
Preliminary Survey Results
Survey results revealed the heterogenetic perception of the built environment in the different neighborhoods. After more detailed insight it was noted that answers towards the land-use mix perception were showing high results due to the proximity of specific uses (such as Mosques, which were commonly visited 5 times a day). More walkable areas were those with mosques in their surrounding.

Subsequent development a visualization method was aimed to achieve a more pre-emptive evaluation of the survey results. The results overview is shown in polar graphs using two shades of two colours. Those polar sections are representing 6 attributes. The size of a section is defined by the number of items in section. The position of section is displayed in order, counter clockwise.

The colour scale represents the evaluation of items. Each item was evaluated with 4 different values (1 = “very low”, 2 = “low”, 3 = “high”, 4 = “very high”). Low values are represented with pink colour (darker shade for “very low”, lighter shade for “low”) and high values with green colours (lighter shade for “high”, darker shade for “very high”). Coloured shares are distributed gradually along the radius, starting from centre with the lowest score, ending on the edge with the highest.

Stacked bars are representing survey items (questions). The length of a bar is derived with the number of answers by participants for each question and coloured as the share of responses in each category (“very low”, “low”, “high”, “very high”). What is shown is how many people perceive some area as very low graded in a certain category.

![Figure 3. Visualization of the general perception of the built environment in Al Mabaila](image)

The graph represents the sum of all results - the collective experience of the built environment in a certain neighborhood. Showings from the graph are analysed as the ratio of “low” and “high” results per neighborhood. The amount of colour in visualization displays corresponding value.
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Figure 4. Comparative graphs on perceptions of 11 neighborhoods

With these graphs, we are able to compare situations against one another, yet these only retain the community’s perception of the space. Therefore, the next step in understanding each case study is comparisons between the built up space and survey results.

PERCEPTION VS PHYSICAL
The WOW questionnaire translated into symbols produces possibilities for Analytical maps that can compare to survey findings. The translation into mapping elements is a visual representation. The recording of elements was conducted during on-foot field assessments. Various elements needed experiments to back up and record them on a map, in order to quantify the non-tangible situations. The results are conditional, with different timings of the day creating different results. The final results are portrayed in 6 analytical maps, based on survey questions and produced in the limits of each neighborhood.

Keywords
Most questions in the survey focused on the quantity of a certain attribute. These attributes were identifiable through the main keywords within each question. When a survey taker is asked if there is a lot of Trees along the streets in their area, there is a tangible item which is in reference (Tree) on a commonly used element (Street).
Logically identifying and formulating these keywords, we are then able to use them as mapping tools. Therefore, the Aesthetics attribute gains these set of elements from a single question. Combined with other questions asked on Aesthetics, one can derive from the maps the quantity of spots that are messy, areas with garbage, interesting sites, beautiful facades and the amount of trees in a location. This visual representation of the site also allows viewers to compare ratios and amount of good versus bad situations that can affect a pedestrian’s outlook on the area’s walkability. These logical translating steps were done to each Attributes set of questions. Experiments on recording certain elements were introduced after the identification of the necessary Keywords. In the case of Traffic Safety, the attribute required the mapping of areas with high and busy traffic jams. This non-tangible element was experimented on through counting traffic at different streets and intersections on in a site. This was done through video taping various locations in the site, then counting the interpolated number of Vehicles per hour moving in either direction in the visible video field. The original video clips typically capture a 15-minute observation period on a sidewalk, which are played back in time lapse videos at 12 times the original speed. The counted number of vehicles observed in the said 15-minute period is generalized to an hour by multiplying by four (e.g. 40 cars per 15 minutes’ equals 40*4=160 cars per hour).
With the maps produced compared against survey findings, the ultimate outcome is the possibility to understand reasoning behind certain results, areas in need of change and underlying problems of the area. The aim is to use these maps and community responses in the early stages of planning interventions as an aiding tool into understanding and improving the functionality of a neighborhood.

Maps and Surveys
When put against each other, most human perception of their spaces were warranted. With Oman’s rapid expansion and a majority of the neighborhoods included in this case study highly affected by it, these reviews are expected. However, these are quantitative data based on a 4 point Likert system, compared to maps that show specified elements in a rigid format. The qualitative aspects of some spaces are bound to be absent. When comparing an element such as the number of trees in one location to another, this leaves aside spatial qualities such as types and amount of shade. These are minor disparities in the case studies.

CONCLUSION
In the case of Oman and the question “Where Omanis Walk” these surveys and maps answer the question to various degrees; from where do Omanis walk to, how often and furthermore in which conditions do they walk. This can give us a further insight into spaces and attributes in need of improvement. In order to form these answers The methodology in which to achieve a comparable situation between one’s Perception and Physical will only be possible if it is in plausible, applicable and is done in ways understood by the communities. These case studies are effective when done in large quantities by the local community who are more likely to engage in their areas. There are a few further steps to improve like moving from general quantitative assessments to qualitative direct research. It might reveal other cultural aspects preventing active transport. In terms of implementations direct participation in form of concretion workshops seems to be another complementary approach to support case sensitive development strategies for specific neighborhoods.

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INTRODUCTION
Following the transformation of many cities around the world based on the different patterns of urbanization provided in the 18th, 19th and 20th centuries, a number of experts sought to examine the urbanization of the last century, and the positive and negative features of each of these Cities are moving towards reforming parts of contemporary urban planning. Since the past trend has caused environmental damage, global climate change, loss of biodiversity, and host for other environmental challenges, the city's experts have different concepts such as sustainability, eco-city, green urbanism, biophilic cities, and so on. Introduced as models for contemporary urbanization. In the following, each of these patterns and relationships are discussed in detail.

In the following, the most important dimensions of each approach that make them different with each other, will be addressed.

SUSTAINABLE URBANISM
Sustainable urbanism appears, at least ostensibly, to have emerged out of the two interconnected crises in the late 1960s and early 1970s: the first of these crises was ecological, the second urban. The ecological crisis was a product of the culmination of the large and small-scale environmental damage that had been wrought by rapid industrialization. The urban crisis, on the other hand, had two major components. The first was connected to the ecological crisis and concerned the environmental impacts of rapidly sprawling and heavily polluting cities. The second concerned the deteriorating quality of urban life for many urban residents within the rapidly expanding cities of the global South. sustainable urbanism is really the product of a series of advances in economics, ecology, planning and architecture during the 1980s (Flint,J & Raco,M.2012:31).

It is precisely in this context that sustainable urbanism has now become almost synonymous with the planning paradigms of new urbanism and smart growth and the associated tools of transit-oriented development, urban villages and anti-sprawl zoning laws (Flint,J & Raco,M.2012:32).

When the urbanization can provide economic sustainability through increased levels of production and employment, increases the quality of urban life by creating social well-being and social security in the city, as well as Presenting the healthy, peaceful and relaxed environment conditions of living in a clean and green environment, in full compatibility with nature, then the sustainable city will be realized.
ECO CITY
The overriding dimension in Eco cities is environmental issues that’s more important than Social & Economical Concerns. Energy Use, Ecology & Natural Environment are the 3 main subjects that make the content of environmental concerns.

Urban sprawl, dependence on cars, the pollution caused by the use of resources, and the depletion of resources are the characteristics of most cities around the world. These cities do not take advantage of comprehensive urban design and development program that interacts with nature.

Urban Ecology, now more than 20 years old, states that its mission is to create ecological cities by following these 10 principles:

1. revise land-use priorities to create compact, diverse, green, safe, pleasant and vital mixed-use communities near transit nodes and other transportation facilities;
2. revise transportation priorities to favor foot, bicycle, cart, and transit over autos, and to emphasize 'access by proximity';
3. restore damaged urban environments, especially creeks, shore lines, ridgelines and wetlands;
4. create decent, affordable, safe, convenient, and racially and economically mixed housing;
5. nurture social justice and create improved opportunities for women, people of color and the disabled;
6. support local agriculture, urban greening projects and community gardening;
7. promote recycling, innovative appropriate technology, and resource conservation while reducing pollution and hazardous wastes;
8. work with businesses to support ecologically sound economic activity while discouraging pollution, waste, and the use and production of hazardous materials;
9. promote voluntary simplicity and discourage excessive consumption of material goods;
10. increase awareness of the local environment and bioregion through activist and educational projects that increase public awareness of ecological sustainability issues (Roseland.M. 1997:197-202).

GREEN URBANISM
“Green” as defined by the GTA, adapts the WTO definition of sustainability and thus refers to four main pillars: environmental responsibility, local economic vitality, cultural sensitivity & experiential richness (Gibson.A, Dodds.R, Joppe.M, Jamieson.B.2003)

Beatley firstly studied the concept of Green urbanism in the book named “GREEN URBANISM Learning from European Cities”.

Green urbanism effectively captures both the central urban and environmental dimensions of the agenda I will be discussing. It emphasizes the important role of cities and positive urbanism in shaping more sustainable places, communities, and lifestyles. And, it implicitly emphasizes that our old approaches to urbanism—our old views of cities, towns, and communities—are incomplete and must be substantially expanded to incorporate ecology and more ecologically responsible forms of living and settlement. Cities that exemplify green urbanism are:

Cities that strive to live within their ecological limits, fundamentally reduce their ecological footprints,
Cities that are green,
Cities that strive to achieve a circular rather than a linear metabolism,
Cities that facilitate more sustainable, healthful lifestyles & Cities that emphasize a high quality of life (Beatley.T. 2000:5-8).
Green infrastructure is a neutral way of saying we like wetlands and trees and forests because they provide services to us.

**BIOPHILIC CITY**

The main concept of the Biophilic city is based on the psyche and the emotions of the mankind. Biophilia suggests that there is an evolutionary and biological need for contact with nature, even when we have become very clever at believing we can live without it. Nature in our lives is not optional but essential. We need it for our emotional health and well-being, and we need it for planetary health as well (Beatley, T, 2011:16)

A biophilic city is a natureful city. It puts Nature at the core of its design and planning, not as an afterthought or an ornament. It’s key to everything that happens in the city. Nature we experience every hour, to be happy and healthy and have meaningful lives, we need that connection with Nature. In Biophilic cities the emphasis is on imagining places we want to live that are full of Nature (http://citiscope.org, January 23, 2015).

<table>
<thead>
<tr>
<th>Time &amp; Local Beginning</th>
<th>Approach</th>
<th>Definition</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975 USA</td>
<td>Eco city</td>
<td>It emphasizes the Environmental issues, such as energy use, ecology &amp; natural environment &amp; its next priority is Social &amp; Economical Concerns</td>
<td>Roseland.M. 1997. Dimensions of the eco-city. Cities, Vol. 14, No. 4, pp. 197-202 Quoted from Engwicht</td>
</tr>
<tr>
<td>1993 USA</td>
<td>Biophilic City</td>
<td>Biophilia suggests that there is an evolutionary and biological need for contact with nature. Nature in our lives is not optional but essential. We need it for our emotional health and well-being, and we need it for planetary health as well.</td>
<td>Beatley, T, 2011. Biophilic City: Integrating Nature into Urban Design and Planning. Washington: Island Press</td>
</tr>
</tbody>
</table>
ANALYZING APPROACHES
The most important dimensions of each approach are categorized in Table 2. Sustainable Urbanism encompasses environmental, social and economical aspects. Eco cities put the most focus on environmental issues. The social and economical concerns are the second priority in such a city. Finally the most important dimension is the natural environment in Green Urbanism and The Biophilic cities. Both of these approaches focus on nature but with two different points of view. Green urbanism uses nature as a tool to achieve its goals while the Biophilic cities consider nature as the main goal. Everything in integrated with nature in such a city, so this is the closest concept to Nature-Based Design.

Table 2. Summarizing the Main Strategies of each Late Approaches

<table>
<thead>
<tr>
<th>Sustainable Urbanism</th>
<th>Eco City</th>
<th>Green Urbanism</th>
<th>Biophilic City</th>
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<tbody>
<tr>
<td>Environmental</td>
<td>Energy Use</td>
<td>Natural Environment</td>
<td>Natural Environment</td>
</tr>
<tr>
<td>Social</td>
<td>Ecology</td>
<td>Nature as a Tool</td>
<td>Social &amp; Economical Concerns</td>
</tr>
<tr>
<td>Economical</td>
<td>Natural Environment</td>
<td>Energy Use, Social &amp; Economical Concerns</td>
<td>Social &amp; Economical Concerns</td>
</tr>
<tr>
<td></td>
<td>Social &amp; Economical Concerns</td>
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</tr>
</tbody>
</table>

Although Tim has long been a leader in advocating for the "greening" of cities, in the book “Biophilic Cities: Integrating Nature Into Urban Design And Planning” (2011) he says, urban greening efforts focus on everything except nature, emphasizing such elements as public transit, renewable energy production, and energy efficient building systems, and these issues are important for urban living but not enough. Beatley emphasizes on the innate need of humans to the nature. Biophilic cities place the focus squarely on the nature, on the presence and celebration of the actual green features, life-forms, and processes with which we as a species have so intimately coevolved. A biophilic city is even more than simply a biodiverse city: It is a place that learns from nature and emulates natural systems, incorporates natural forms and images into its buildings and cityscapes, and designs and plans with nature. (Beatley.T.2011.P:46)
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Biophilic city cherishes the natural features that already exist but also works to restore and repair what has been lost or degraded. (Review of Biophilic Cities: Integrating Nature Into Urban Design And Planning (Beatley.T.2011).
The relationship between the mentioned approaches is shown in the figure 1.

![Fig 1. Analysing the Relationship between Different Approaches](image)

Nature is seen everywhere in the Biophilic city. From the Architecture and interior design to public realm and allover the city. It's not something you need to go and visit. Nature is all around you.

![Fig 2. The difference between biophilic cities and green infrastructure](image)
The best biophilic cities are places where the different scales such as building, block, street, neighborhood, community, region overlap and reinforce biophilic behaviors and lifestyles—children or adults should be able to leave their front door and move through a series of green features and biophilic elements, moving if they choose from garden and courtyard to green street and municipal forest and then to larger expanses of regional nature (Beatley.T.2011:83).

The following items are the Biophilic Urban Design Principles & some samples of Biophilic design in the Architecture and urbanism is shown in the pictures:

- Green Regions and Compact Cities
- Parks, Trees, and Urban Forests
- Reimagining the Interstices of the City
- A River Runs Through It
- Biophilic Streets and Infrastructure
- Food and Agriculture in the City
- Biophilic Urban Neighborhoods
- Limiting Cars, Expanding Nature
- Re-Earthling Older Urban Neighborhoods
- Healthy Buildings
- Greening the Vertical: Green Walls and Green Rooftops

**CONCLUSION**

When it comes to basis in urban design, it’s better to see the change in urban design process as well as the impact of nature on design criteria. It's important to find the differences made in urban design process by Nature-Based approach.

After defining the problem, Nature-Based approach play an important role in the phase of visioning and the primary goals expression. Visioning should be based on the site potentials. Generally the context is a pivotal issue in site analyses and design in this kind of approach. So everything is based on reality and the existing conditions. Designing in accordance with the existing conditions itself is one of the basic criteria in the Nature-Based design.
After visioning and the primary goals expression, it’s time to recognize and analyze the design field. Site analysis should be more based on design needs and focus on design criteria. Understanding strengths, weaknesses, opportunities and threats based on the Nature-Based criteria would be very helpful in providing strategies and design steps.

The most important Nature-Based urban design dimensions according to the author's studies are:

1. Strengthen the natural substrate
2. Appreciation of biodiversity
3. Creating more walkways
4. Sustainability of the local economy
5. Environmental education

Each of these topics mentioned above has its own importance and weight, and all of them should be considered in Nature-Based Urban Design.

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HOW WILL AUTOMATION IN TRANSPORT FLOWS IMPACT FUTURE URBAN FORM?

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Institution:
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INTRODUCTION

Today transportation sector is facing many disruptive transformations. On the one hand, mobility management systems are being transformed with the rise of technologies like ‘Internet of Things’ (IoT) that generates vast amounts of data and can enhance operations, and ridesharing platforms that enable shared mobility¹ and mobility on demand services. At the same time, the vehicle itself is experiencing a technological shift with the rise of electric vehicles integrated with smart grids and wireless communication², and the much hyped autonomous vehicles³. Some advocates predict that by 2030, autonomous vehicles (AV) will be sufficiently convenient and affordable to displace most human-operated vehicles⁴. Although at present the AV revolution faces many hurdles before it begins to benefit cities as claimed, many commentators, academics and policymakers assume the AVs will eventually become a norm⁵. They often base this assumption on precedents that seem to show that when some technologies mature, converge, and become economically competent, they become dominant and shift the paradigm. In transportation, the horse drawn carriage was overtaken by the cable car, and subsequently the bus and automobile (Figure 1). As AV technology matures, and converges with the other disruptive transformations in transport, will it mark a similar paradigm shift? If it does, then there will emerge new challenges to urban and design and planning disciplines in this shifting technological context.

In the first section of the paper I define the two-way relationship between urban form and ‘transport flows’. I hypothesize that the advent automated vehicles signal a larger ‘revolution’ in transport flows when seen in conjunction with other upcoming technologies. In the second section I list the potential benefits and dangers of automated vehicles, revealing the inherent contradictions in the impacts based on different initial assumptions. In section three I selectively review recent urban visions for
automated vehicles and identify some prevailing issues. In the final section I outline some key properties for new methods to conduct urban design with transport flows in this shifting technological context.

**URBAN FORM AND TRANSPORT FLOWS**

Urban form is intuitively considered fixed, durable and physical, but in reality it is constantly shaped by a variety of flows – water, energy, information, people and goods. The last two can collectively be defined as transportation flows which have played a crucial role in shaping urban form. In fact, this constitutes a strong two-way relationship, wherein nature of transport flows impacts how the city is shaped, and planning and design of urban form influences travel behavior. Urban designer and theorist captures this relationship well when he argues that:

“Settlement form, usually referred to by the term ‘physical environment,’ is normally taken to be the spatial pattern of the large, inert, permanent physical objects in a city: buildings, streets, utilities, hills, rivers, perhaps the trees... I will take the view that settlement form is the spatial arrangement of persons doing things, the resulting spatial flows of persons, goods, and information, and the physical features which modify space in some way significant to those actions including enclosures, surfaces, channels, ambiances and objects.” 7

Lynch places emphasis on the importance of including activities performed in a city and the resulting transport and information flows in the definition of urban form, by arguing that these flows modify urban space. While Lynch talks about spaces like enclosures and objects, transport scholar Peter Muller analysed this relationship on a metropolitan scale. He theorized a ‘persistently strong relationship between the intra-urban transportation system and the spatial form and organization of the metropolis’8 by relating Adams’ four transportation related eras9 with the distinctive pattern of intra-urban spatial organisation in the United States. A conceptual illustration of how changes in transport technology shape the city is shown in *Figure 2*. Conversely urban design strategies also influence travel behaviour and consequently transport flows. Cervero and Kockelman10 summarised the properties of built environment that influence travel demand as 3Ds – density, diversity and design. Mitchell and Rapkin11 conceptualised this relationship between land use and ‘channels of movement’ as a two-way correlation.

![Figure 2: Diagram adapted by author from Peter O. Muller's four-stage model of intra-metropolitan transport eras and associated growth patterns in America.](image)

If urban form has a strong, two-way relationship to transport flows, as this tradition of scholarship suggests, then the current development AV technology raises the question whether it will influence urban form, and if so how. Does automated vehicle technology, in other words, herald a fifth stage in Adams’ model?
Automated Vehicles and the Fifth Transport Era

Automation technology itself is not significant as a sole driver for a technological shift in transport flows paradigm. Automation in transportation is already widespread in controlled environments like drones, automated container ports and driverless trains. In fact visions of driverless cars have existed in fiction for a long time, for example the advertisement from 1957 in Figure 3. But achieving this vision was limited by the systems and technologies available at the time. Today automation technology reinforces, or is reinforced by, several parallel technological disruptions in transport flows.

Characterising the upcoming AV revolution with the arrival of a car *sans* driver does not appropriately capture this broader technological shift.

**Figure 3:** Driverless car in an ad from 1957 Source: Matt Novak, Paleofuture.com

- Automation enable ease of personal mobility like never seen before. The autonomy that comes with high level of automation will make in-vehicle time more productive and facilitate on-demand service, door to door service.
- The steep rise in car and ride sharing industry in recent years may be accelerated by automation to eventually mark the end of personal car ownership. Since most private cars are
used less than 10% of the time, if cars do not need a driver, car sharing will become more viable. New operational paradigms and fleet management strategies will start emerging with the rise of car-sharing.

- Electric vehicle (EV) technologies are maturing and become more affordable today. But currently one of the biggest problems of EVs is their limited range. If large AV fleets can employ different kinds of vehicles for different trip distances, they can sidestep this problem. The two technologies can couple and reinforce each other to make vehicles on road cleaner and quieter.

- The rise of transportation related applications of IoT will enable a truly connected and ‘smart’ mobility environment that can be used to optimise public transit routes, improves safety and reduces vehicle congestion. In fact, connected transportation is crucial to realize the full potential of AVs.

- Similar to how the automobile ‘unglued’ transport flows from infrastructure, from rail bound trains to cars that go as far as the road does, AVs will further this ‘ungluing’ process. Small electric AVs may not even need to be restricted to the ‘road’ any more. Additionally, unlike traditional buses, shared AVs do not need to be ‘glued’ to pre-determined routes, rather could be dynamically routed based on demand.

When all these technological shifts enabled by high automation in road transportation are considered in totality, it may be fair to conclude that transportation flows are undergoing a paradigm shift. Fully automated and connected vehicle technology with a nearly 100% market penetration will create new needs and conditions for design of urban form. It is as yet unclear how this will impact urban form and travel patterns, but there have been several speculations on the positive and negative impacts of automated vehicles.

**SPECULATIONS ON BENEFITS AND DANGERS OF AUTOMATION IN TRANSPORTATION**

The benefits (or dangers) of AVs are only speculative in nature at present. For the impacts of the AV revolution to be significant, almost full market penetration of fully automated vehicles is needed and speculations for such a long time horizon are inevitably based on uncertainties and assumptions.
Time: More efficient use of time vs more travel time
Travelers may gain time through more efficiently managed connected transport system, self-parking, and more productive in-vehicle time. At the same time, induced demand due to better managed travel might ironically add to congestion slowing travellers down. New demand from those previously unable to drive, coupled with trips drawn away from healthier modes like walking and cycling, could all add to congestion. Tolerance for travel distance might also increase due to productive in-vehicle time.

Space: More space efficiency vs. more sprawl
Current width standards for lanes, shoulders, clear zones, and medians could probably be shrunk or revised since AVs are expected to require less physical space, and drive with greater precision than existing vehicles. For example, a four-lane highway may be converted into a five-lane highway with minimal investment. Further space can be gained from reduced parking space requirement. However some studies point to an increasing attractiveness of suburban residential districts, that are greener or cheaper, when autonomous driving becomes available.

Mobility: Enabling mobility for some vs restricting mobility for others
AVs offer new mobility options for previously unserved population including people with disabilities, elderly and children. But this may be paralleled with decreased mobility for those using non-automated modes of travel. If AVs travel much faster and closer than present day vehicles, they may pose a larger risk for pedestrians, cyclists and other vulnerable road users. Alternatively, AVs may be over-cautious in their response to pedestrians, which can slow them down significantly. As a consequence, even greater restrictions may be placed on pedestrians and cyclists, like grade separated sidewalks or fences, in effect restricting their mobility.

Emissions: Fewer emissions or more
AVs are expected to use existing lanes and intersections more efficiently through shorter headways, coordinated platoons, and more efficient route choices leading to fuel savings. On the flipside, we can also expect increased total travel distance due to sprawling, new travel demand from non-drivers and induced demand due to travel time savings, less congestion, and ironically, fuel savings.

Safety: More safety of more safety concerns
AVs have the potential to dramatically reduce crashes, since currently most of them are a result of driver error. But there are still several unresolved questions around liability in case of an accident, security issues due to vulnerability to hacking attacks and loss of privacy due to perpetual location tracking. As is evident, the benefits can just as easily translate to dangers, under different base assumptions. Planning decisions can enhance benefits in one area, while endangering another. Many urban design visions have been put forward that address both ends of the spectrum.

URBAN VISIONS FOR AVS: PREVAILING ISSUES
Leading architecture and engineering firms as well as governments have speculated on a future vision for automated flows, usually in the form of imagery in the design fiction genre. Speculative design and design fiction does not try to predict the future but uses design to speculate, criticise and open up possibilities. Upon critical examination of a selected set of imagery, five prevailing issues were identified.
1. The Importance of Context

While it is worthwhile to explore how the benefits of automation can be harnessed to imagine a new urban form, in the absence of the geographic, social, planning and policy context, AVs might be misread as a technological panacea in these visuals. Low density Midwestern American cities requires a different transportation strategy (as illustrated in Figure 5) than high density Asian cities. This differentiation is often not made apparent visionary imagery.

2. AV ≠ (Car – Driver)

While it is worthwhile to explore how the benefits of automation can be harnessed to imagine a new urban form, in the absence of the geographic, social, planning and policy context, AVs might be misread as a technological panacea in these visuals. Low density Midwestern American cities requires a different transportation strategy (as illustrated in Figure 5) than high density Asian cities. This differentiation is often not made apparent visionary imagery.
The AV revolution is not summed up by the driverless car, but by the convergence of several transformative disruptions. However, urban visions for AV often bear a resemblance to modernist responses to automobiles in the fifties and sixties. The separation of flows on multiple levels in Colin Buchanan’s seminal report ‘Traffic in Towns’ (Figure 6) resonates in Ministry of Transport’s AV vision for Singapore (Figure 7). The overall shift in technological context needs to be addressed in future urban visions and not just the driverless-ness.

3. Heaven or Hell Narrative

Figure 7: Concept of a future town centre in Singapore with autonomous Vehicles. (Source: Ministry of Transport)

Figure 8: Matthew Spremulli’s visualization of a low density AV suburb Source: MIT
The imagery for AV futures tend to follow either a heaven or a hell narrative. For example the optimistic shared AV zone proposed in Figure 9 versus the dystopian sprawl proposed in Figure 8. The circularity and uncertainty of assumptions that the speculative impacts of AVs are based on make it clear that extremes in either direction (heaven or hell) are highly improbable. It might be more appropriate to use imagery to make trade-offs explicit instead. For example in Figure 9, the lively shared mobility environment is a trade-off for more smooth flowing traffic. However, this cannot be represented easily in a static image.

4. Form without Flows
Imagery is an appropriate medium to communicate physical aspects of urban form, and to an extent activity, but falls short in representing aspects of flow - speed, viscosity, friction and volume. When imagery is used to communicate a future urban vision responding to transport flows, there’s a danger that it communicates only half the story mainly because of the nature of the medium.

5. Flows without Form and People

Figure 9: An AV zone imagined by WSP Parsons Brinckerhoff and Farrells in 2016

Figure 10: Representation of Metro Transit Flows (Source: Yu Shen et al)
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There are many studies that make nature of flows the center of investigation. For example Yu Shen et al\textsuperscript{25} model the potential impacts of on-demand shared AV in Singapore, using an agent based simulation model. A simulation models the behaviour, movement and interaction of agents, based on the assumption that current behaviour and patterns can be extrapolated. This assumption means that the results tend to under-represent uncertainty of long term future\textsuperscript{26} and also ignores the two-way relationship of urban form and transport flows.

How to conduct urban design in a shifting technological context
Based on the review of current approaches to imagining urban form for automated vehicles, it is clear that we need new methods to conduct urban design in this shifting technological context. The following properties are imperative in our search for these new methods.

Understanding two-way relationship of transport flows and urban form
In transport planning, one approach to thinking about future of cities is the ‘predict and provide’ model\textsuperscript{27}, which identifies current needs and extrapolates them into the future. This approach neglects the two-way relationship of urban form and transport flows, and how design can influence travel behaviour. For example, after the automobile revolution, the movement function street overrode place function, discouraging life and activities on street\textsuperscript{28}. Integration of urban form and transport flows for design and representation purpose as early as visioning stage of design, is crucial in order to address this two-way relationship.

Understanding trade-offs
Benefits and dangers of AV exhibit a close inter-relationship and occasional circularity. An understanding of this interrelationship is key to making intelligent design decisions for an uncertain future. The whole lesson of the failure of the modernist vision indicates the need for a more balanced approach, considering both society and technology.\textsuperscript{29} While the quantifiable benefits and costs of technology are relatively easier to estimate, the assumptions they are based on have a high level of uncertainty. At the same time societal and qualitative impacts are harder to estimate and compare and therefore are often ignored\textsuperscript{30}. This is why it is important to establish a baseline ‘good urban form’.

What kind of future urban form do we want?
In addition to refining projections about the future, planning for AVs should also focus on the quality of places we will create. Forecasts are rarely accurate\textsuperscript{31} and unpredictability of the future coupled with fast pace of technological development leaves designers and planners ill-equipped to plan for an indeterminate urban condition. Instead of a technical pursuit of maximum vehicle throughput based on uncertain predictions, the focus needs to shift to the values that inform long term planning and set the tone for the quantitative analysis that follows.\textsuperscript{32}

CONCLUDING REMARKS
Automated vehicles are a significant technological leap in transport flows, and require a visionary response from urban planning and design disciplines. In the early automobile era the question driving the vision was, how do we maximize the opportunities presented to us by this new technology. The focus moved from optimism about technology to accommodating it, as automobile consumption grew beyond all predictions. The need to accommodate growing transport flows led to superhighways that splintered urban communities. As a reaction, the urban design discipline questioned how we can conduct urban design to influence transport flows? As we move into the future era of automation, lessons from this experience indicate that urban design and planning discipline needs to reduce its
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reliance on uncertain predictions and debate multiple visions for future urban form in response to this shifting technological context. In order to do this, we need to adapt and revise existing urban design and planning methods and tools as well.

This paper attempted to present some of the issues with current trends in automated futures visioning in order to build and argument for this. Subsequently properties of these new methods and tools were also outlined. With updated tools and methods, if we can obtain a better understanding of future transport flows and integrate it in the process of designing urban form, we can nudge it towards a more sustainable and liveable city.

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INTRODUCTION
The condition of deprivation has been mostly studied at metropolitan scales, seeking to identify contextual disadvantages or conditions that can conduce to different forms of exclusion.\(^1\) However, little is known about how these disadvantages affect the public realm and those micro-spaces where the everyday life happens. To contribute in filling that gap, this article aims to characterise those physical features which confine the public realm (built environment) of the most deprived neighbourhoods of Santiago; the highly segregated and largest city of Chile (~6.5 million people). It seeks to examine the built environment and how it can mould everyday activities and can jeopardise interventions to improve and regenerate fragile territories.

In this regard, J. Jacobs and others who criticised the effects of the Modern principles on cities\(^2\) provided clear insights about how the built environment affected the daily life of its inhabitants. The features of the facades (e.g. permeability), the presence of shops and other economic activities, the design of the public space, among other aspects of the ‘architecture at the eye level’, can affect the nature and the quality of those social interactions that take place in the public realm, can diversify encounters, can secure public places, promote the creation of capital and so forth.

These ideas inspired numerous studies which sought to identify features that in different degrees can promote healthier habits and counteract obesity and car dependency, decrease greenhouse gas emissions, and so on.\(^3\) Despite the abundance of works addressing the built environment, many have focused on its metrics, not fully explaining the causalities behind the findings and why particular features are more important than others. Other studies tend to disaggregate the built environment in abstract (i.e. density, land use) or highly specific features (i.e. sidewalks, street crossings), diminishing the relevance of the combined effect of the elements, and can neglect contextual symbolisms and local constructs.\(^4\)

A few recent works have highlighted the social and contextual nature of the built environment. A study developed in Northern Ireland understood the built environment in a broader context of latent terrorism; the built environment mirrored that issue and reproduced the violence on the spaces of the everyday life.\(^5\) Gendered studies have delved on how the meanings linked to the built environment can hinder women’s access to the public sphere by modifying the perception of security and reinforcing their role as caregivers.\(^6\) Meanwhile, few works have understood the built environment in deprived communities where a feature can acquire specific meanings and transform the nature of the spaces.\(^7\)

This article addresses these underlying and contextual meanings of the built environment in deprived neighbourhoods of Santiago de Chile. Built under the umbrella of social housing policies, these neighbourhoods have basic services (e.g. drinkable water, electricity, sanitation) and have maintained spaces (e.g. squares) and well-defined streets with sidewalks and streetlights. Nevertheless, the
location of the neighbourhoods in the borders of the city, the lack of services and facilities, and a high
sense of being marginal actors of the society have weakened local communities, increased the distrust
towards the institutions (including the State) and allowed the emergence of multiple forms of violence
(e.g. drug trafficking, drug consumption, prostitution, high rates of school dropout, teenage pregnancy,
domestic abuse, among other problems). Due to these issues, and following international experiences on the matter, the State implemented
several programs to reinvigorate local communities and renovate the public space. However, the
programs of urban regeneration have faced a strong criticism as they tend to disconnect and treat separately the social fabric of the communities and the physical features of the neighbourhoods. Is in
this aspect where this article aims to contribute by deepening in the links between both.

METHODS AND MATERIALS
The results of this article are part of a research which seeks to inquire on how a socially-generated built environment influence walking and the public life in general. That research comprised two data collections which were carried out during August, September and October of 2016 and during September and October of 2017. The first data collection involved 32 walking interviews in three deprived neighbourhoods of Santiago de Chile. In these, participants were invited to walk in the neighbourhoods where they lived, or where they were highly familiar, and have a guided conversation about the issues they face in the public realm when walking or performing other public activities. After walking, the conversation moved to the apprehensions and experiences in unfamiliar places, eliciting the conversation with photographs in greyscale. This data collection was complemented with qualitative mapping, non-participant observation of the public space of the neighbourhoods and a selective photographic record of significant places/features/activities.
Considering the results of the first stage, a second data collection was designed and comprised 41 semi-structured interviews with individuals residing in four deprived neighbourhoods and 24 semi-structured interviews with policymakers of the national, metropolitan and local governmental levels. The interviews with individuals living in deprived neighbourhoods were elicited by four images which showed incremental improvements in the built environment of one unfamiliar place and nineteen silhouettes representing public activities of different nature (e.g. people chatting, cleaning the public space, consuming and trafficking drugs, among others). Participants had to place the activities in the scenarios where they think occur- and, after that, answer questions related to their willingness to walk or perform any other activity in each one. The interviews with policymakers inquired on the difficulties to improve deprived neighbourhoods.
The questionnaires which guided all the interviews were designed under a constructivist approach in which the reality is contextual and constructed by participants and researchers. The transcripts were analysed in the software NVivo (Qualitative data analysis software), assigning labels (codes) to relevant excerpts and grouping them into categories to identify underlying narratives and discourses. Codes and categories emerged from the transcripts–and were refined in an iterative process of revision of the data and comparison with the literature on the matters. To preserve meanings, all the analyses were done in Spanish.
Finally, the selected cases of this study represent traditional solutions in the trajectory of Chilean housing policies and evince the transition of the State from an active actor (Case 1, built in 1967) to a subsidiary figure that left in private hands the construction of new neighbourhoods (Cases 2 and 4, built in 1982 during a military dictatorship and Case 3, built in 1998 in democracy). In this process, the urban form passed from a highly designed urban space, with facilities inside, large squares and
plots (Case 1), to simpler forms, without facilities, lacking in public spaces, with higher densities and smaller houses and plots (Cases 2, 3 and 4).\textsuperscript{12}

**DEPRIVED NEIGHBOURHOODS IN SANTIAGO DE CHILE**

As mentioned earlier, Santiago de Chile exhibits a complex pattern of spatial segregation in which the most deprived groups reside in the borders of the city, have fewer opportunities to access the available resources or to encounter individuals living in different, and better, conditions.\textsuperscript{13} Although several factors contributed in the creation of this pattern, Chilean scholars and policymakers agree on the prominent role played by social housing policies which rapidly provided habitational solutions at the cost of siting the least affluent groups onto small houses and poorly equipped neighbourhoods; located in the periphery of the city; far from the available services, facilities and job sources.\textsuperscript{14}

The residing communities of these neighbourhoods constitute a ‘second-generation poverty’ which, having shelter and access to basic needs like drinkable water, electricity and sanitation, suffer from territorial and social isolation, travel long distances to be able to work or study, and have a weak relationship with the public institutions. Unable to maintain the public space, these communities unintentionally transferred it to emerging groups who, facing the lack of opportunities, have fallen into drug trafficking, consumption or other illegal activities (Figure 1).\textsuperscript{15}

![Figure 1. Public space in deprived areas of Santiago. Source: author’s own.](image)

Furthermore, and due to the pattern of social and spatial segregation, personal experiences tend to ‘resonate’ in networks constituted mostly by individuals living in equivalent conditions and struggling with similar issues.\textsuperscript{16} Being mugged, assaulted by drug addicts and traffickers, accidentally involved in gunshots and being afraid to stay in the public space, are ‘normal’ aspects of the everyday life as many members of ‘my’ social network experience them.

**A meaningful built environment**

In the view of the participants who collaborated with this study, the transformation of the nature of the public realm provoked by the irruption of the urban violence and a high sense of being powerless to reclaim it, have transformed the everyday life of the most deprived areas of Santiago de Chile in a difficult and complex chore. Participants feel trapped inside the houses and have little contact with the public space which is, therefore, mostly empty or taken by individuals and groups that can cause harm. To be able to occupy the public realm and perform safely necessary (e.g. walking to bus stops, to work or to the school) and complex activities (e.g. chatting, playing, walking for recreation); participants deduce potential risks from the built environment which is visible from the outside. This built
environment mirrors social constructions, personal experiences and the available knowledge in the social networks and, by doing so, draws the line dividing those activities which are possible to perform in the public from those which are not:

(1) **The deterioration of the built environment** visible in (i) the presence of neglected public spaces within the neighbourhood, (ii) the accumulation of rubbish and debris and (iii) deteriorated streetlights, reflects wakened communities unable to maintain their common goods and to protect their members. It is seen as an intentional process caused by those who need to reduce the attractiveness of a particular place to expel the local community and to create the proper conditions for trafficking illicit substances.

From the point of view of the participants, a rampant deterioration can be reversed by a healthy community which can maintain the public space in good conditions. Nevertheless, many participants expressed that they feel alone, incapable to manage such complex chore due to the fragility of the local community. The State is seen just a secondary actor which can provide ‘some’ litter bins.

(2) **Territorial delimitations** like (iv) vandalised public property and (v) territorial markers (e.g. graffiti, shoes hanging from the wires), reveal an invisible, but active, disputes between groups and are linked to highly dangerous places where a conflict can erupt anytime. In places highly vandalised, with visible markers, public activities are hard to perform. Conversely, (vi) gated streets and (vii) the construction of new facilities, represent responses of the community and the State to reclaim areas in dispute. Staying in the public space around facilities or inside a gated street is possible and safe. However, and despite that benefit, closed streets also evince a fearful community. Familiarity is constructed inwards, inside the gates, increasing the strangeness and fears towards those circulating or staying outside. Meanwhile, the construction of new facilities is seen as a slow and bureaucratic governmental solution that can take years to be materialised.

(3) **The facade of houses and block apartments**, (viii) its sense of order, (ix) its permeability and (x) the presence of shops, indicate the ability to progress of the communities. A ‘good and healthy’ community should allow the emergence of shops, should make unnecessary the construction of highly impermeable facades and so forth. In accordance with the participants, places gathering those features allow social interactions in the public space as the communities living there should be strong enough to protect their public spaces and to control/restrict the power of traffic king and other potentially harmful activities.

Facades and the visible exterior of the private property are especially relevant in unfamiliar places. The lack of permeability and the neglect of the facades and the presence of closed shops can suppress activities in non-familiar places, even in those cases in which the suppression means a restricted access to facilities and services which are key to sustain the everyday life (e.g. healthcare health centres, public transport).

(4) **Aspects of the urban form** like (xi) the building type, (xii) the connection with other neighbourhoods and (xiii) the inner street layout can reinforce any of the features mentioned above and are relevant to put in practice survival strategies to avoid strangers who can be dangerous. For instance, complex street layouts tend to have spaces that are easy to appropriate (either by the local community or by illicit activities) and can have cul-de-sacs which are prone to be ‘gated’. In everyday practices, simple and orthogonal layouts provide ease the identification of alternative routes to avoid strangers.
Moreover, due to particular aspects of the Chilean normative, block apartments tend to have common areas which, by being in the hands of impoverished communities, receive little attention and, hence, are susceptible to be deteriorated and demarcated. Conversely, the public space of neighbourhoods with houses is public property; it is a responsibility of the State, and, hence, receive more care.

Table 1 summarises the relevant aspects according to the participants of the study; these put in evidence the transmission of information through the visible built environment which is ‘signified’ to define what is possible to perform in the public realm. Simultaneously, the meaningful nature of the built environment reveals deeper processes in which the communities are transferring entitlements to other groups. A rampant deterioration, vandalism, an increasing number of territorial demarcations and gated streets, to finish at some point with the suppression of key activities for the everyday life, reflect that transference.

Table 1. Relevant features of the built environment.

<table>
<thead>
<tr>
<th>Aspect of the built environment</th>
<th>Visible in…</th>
<th>Related meanings</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Deterioration</td>
<td>(i) Neglected public spaces</td>
<td>Health of the local community</td>
</tr>
<tr>
<td></td>
<td>(ii) Accumulation of rubbish and debris</td>
<td></td>
</tr>
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<td></td>
<td>(iii) Deteriorated streetlights</td>
<td></td>
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<tr>
<td>(2) Territorial demarcations</td>
<td>(iv) Vandalised public property</td>
<td>Invisible disputes between groups that can be harmful</td>
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<td></td>
<td>(v) Territorial markers</td>
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<td></td>
<td>(vi) Gated streets</td>
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<td></td>
<td>(vii) Public facilities</td>
<td></td>
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<tr>
<td>(3) Visible facades</td>
<td>(viii) Sense of order</td>
<td>Health of the communities living in unfamiliar places</td>
</tr>
<tr>
<td></td>
<td>(ix) Permeability</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(x) Presence of shops</td>
<td></td>
</tr>
<tr>
<td>(4) Urban form</td>
<td>(xi) Building type</td>
<td>Can reinforce the other aspects</td>
</tr>
<tr>
<td></td>
<td>(xii) Connectivity with other neighbourhoods</td>
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</tr>
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<td></td>
<td>(xiii) Inner street layout</td>
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</tbody>
</table>

The narratives behind the built environment also express an increasing apathy towards the public sector and an increasing sense of being powerless to improve any condition. The apathy is often the result of an abandoned ‘resistance’ of individuals who, for example, cleaned the public space or expelled those who were considered potentially harmful, but later gave up. This resignation is always accompanied by a sense of living in a fragile—if not destroyed—community, and by a high distrust towards the State. The figure of the State represents a secondary actor that can eventually provide some support (like litter bins) to the local community. Long-term interventions, like the construction of facilities to re-draw territories, do not constitute realistic solutions either. According to many participants, the State has no interest in improving the living conditions of the most deprived groups. Finally, the process of social construction of the built environment also shows a high normalisation of the urban violence: it is ‘normal’ to restrict the everyday life to well-defined places, such as gated streets or even the house. However, the social networks of those residing in the neighbourhoods tend to difficult the de-normalisation of the urban violence and tend to prevent any change of the known living standard. Many participants in this study had difficulties to position or to imagine themselves in better neighbourhoods/conditions; they are not familiar with other realities and lack of the capital (social and economic) to know them.
REGENERATING DEPRIVED NEIGHBOURHOODS
This article aimed to analyse the built environment of deprived neighbourhoods and contribute to a deeper understanding of the phenomenon. In accordance to the information gathered, the deterioration of the public realm was linked to fragile communities; as part of a broader process of transference of entitlements from the local communities to other groups like drug traffickers. Territorial markers, vandalism, gated streets and the introduction of new facilities revealed a silent dispute which can suppress activities in certain places. The visible facades reflected the progress of the communities and how safe and protected are those occupying the public space. Meanwhile, the urban form can reinforce any of the factors mentioned. In all the cases the built environment was ‘socially constructed’ by reflecting profound fears and apprehensions.

Programs aiming to regenerate deprived areas in Chile tend to separate social and physical aspects during the process of regeneration, neglecting relevant issues which can be visible deepening on the intertwined relationship of both. In this regard, the study of the socially constructed built environment revealed at least three matters that can be pertinent to explore for the existing regeneration programs:

1. **Transference of entitlements** to the community by ‘teaching’ to frightened individuals on how to occupy and claim the public realm. This implies a work in the micro-space and on the quotidian practices which are often suppressed when the built environment reveals high risks.

2. **Diversification of the social networks** to include in the local imaginaries realities that can differ from the traditionally known by them.

3. **Reproduction of the social capital** outside the limits of the neighbourhoods, to decrease the strangeness and distrust towards the unfamiliar and to build bridges with other communities and with the—almost—invisible State.

The work on those aspects can collaborate on re-signifying the built environment, the public realm contained by it, to finally recuperate the public space for the local communities.

ACKNOWLEDGMENTS
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10 21 re-recruited participants and 20 new participants. A fourth case was added due to the difficulty to recruit participants in Case 2.


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CHILDREN’S UNACCOMPANIED TRIPS. HOW DO THE INTERPRETATIONS GIVEN TO THE BUILT ENVIRONMENT AFFECT CHILDREN’S UNACCOMPANIED TRIPS?

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INTRODUCTION

Children are fundamentally curious individuals in the city; they wish to explore, play and experience the world and the places where they live and go. Considering that, the urban environment needs to provide to children enough opportunities for free and safe roam. As children are the most vulnerable users of the city, an urban environment unsafe to them has more chance to jeopardise other users. Moreover, the presence of children in the environment, performing trips or activities, can be understood as an index of a healthy environment. Conversely, the absence of children puts in evidence weakened and fragile communities, unable to protect their members and to be sustainable over the time.

Currently, children in western societies travel less than their counterparts of previous decades, as unaccompanied trips (those performed without being escorted by an adult) has been decreasing in number and frequency. Children depend more on escorted transport modes, which means a decrease in their independence, personal development and the health benefits that unaccompanied trips can provide. There is no precise reason for the decrease in children unaccompanied trips, yet the responsibility may fall to the fashion of these times (e.g. the widespread of TV, video games and social media) as to the form in which cities are developed. The public realm can be an unattractive space that endangers children and compromises their individual and collective development.

In this regard, the recent development of cities tends to be a dual process; while rural and outer urban land is transformed into urban, density developments in inner areas put pressure on existing facilities, transport systems and infrastructures. Streets are improved to accommodate more cars, highways are constructed to boost speeds, sidewalks are improved in congested commercial districts, among others; all for the sake of progress. However, the consequences of those urban improvements jeopardise children’s mobility by restricting their available territory, which may further detriment children’s development and independence.

Through the interpretations of the built environment conceive by families in two contrasting urban environments of Santiago de Chile, this proposal aims to explore how the features of the built environment reflect collective rationalities of distrust and fear, and, by doing so, affect the journeys performed by children. Additionally, the proposal seeks to fill the gap created by traditional studies which have often drawn a direct correlation between the interpretations given by families and children trips, yet potentially neglecting the causalities between both.

Following this introduction, the paper is organised as follows; section two reviews the literature of the built environment effect on children’s mobility, meanwhile in section three is described the qualitative
method utilised. Section four expose the findings of the work and, finally, section five summarises the main conclusions.

**LITERATURE REVIEW**

Children unaccompanied mobility, usually known as children ‘independent’ mobility, is a ‘hazy’ concept, as there is not a precise definition of what is the meaning of independence.\(^8\) It generally refers to those trips performed by a child alone or in the company of other children, but without an adult escort. However, the concept may also include the vigilance of adults present in the public realm.\(^9\) Outside their house, children in the public realm are restricted by the built and the social aspects of the environment; both alter behaviours and define performative rules.

Regarding the built environment, as defined by Cervero & Kockelman, comprises all the “physical features of the urban landscape (i.e. alterations to the natural landscape) that collectively define the public realm, which might be as modest as a sidewalk or an in-neighbourhood retail shop or as large as a new town”.\(^10\) Most of the literature that links the built environment and children trips focuses its efforts on active mobility, like walking or cycling, independently if the trips are performed accompanied or not.\(^11\)

At a macro scale, the mobility of children is usually related to densities, land uses and income; those features are understood as proxies of building typology, diversity of facilities, among others. Nevertheless, the results of studies of that nature tend to show inconsistent results. For instance, a ‘balanced’ mix of land use with high density are both positively and negatively correlated with children active trips. Similarly, causality is not a clear and, therefore, it is not evident if the support for children mobility comes from the diversity of land use, the high densities, or the indirect consequences of both on the public and private space (e.g. people present in the public realm, natural vigilance, etc.).\(^12\)

At a micro scale, numerous studies focus on the features of the neighbourhood such as street connectivity, building and plot sizes, street intersections or presence of cul-de-sacs, and land use. Scholars suggest that neighbourhoods with high connectivity and a mixed land use have a positive effect on active travel, as both features can decrease the distances which are necessary to reach facilities and make feasible the use of non-motorised means of transport. In this line, numerous studies conclude that ‘distance’ is one—if not the only—most significant variables for children active trips.\(^13\)

At a ‘eye’ level, children directly experience the built environment in which they travel. At this ‘street’ scale, children have a different perspective than adults and behave differently as well.\(^14\) Consequently, children trips are more frequently performed in vital and lively environments with few physical barriers (e.g. busy roads, high speed traffic). In aggressive environments of less affluent communities, usually with desolated or congested streets with deteriorated or inexistent urban amenities, children trips exist, but trips are fewer or limited in comparison with more advantaged areas.\(^15\)

**METHODOLOGY**

The study is focused on the city of Santiago, the 6.5 million people capital of Chile that is usually depicted as a highly segregated city. Meanwhile, the medium and the high-income people live near the centre or in rich and well-serviced areas, poor neighbourhoods are in the outskirts of the city in neglected areas, distant to employment sources and lacking of adequate urban services and equipment with good quality.\(^16\) The segregation of the city is moreover complemented with a highly activity-concentrated trip pattern, with most of the employment, health and education destiny of trips to the centre of Santiago.\(^17\)
For this study, two areas equally distant from the city centre were selected; one in a wealthy area of the city and the other located in the deprived periphery. The wealthy area, San Carlos de Apoquindo, is located the richest municipality in Chile (Las Condes). With the first settlements built in 1981, it is composed by detached houses built by private real-estate developers. It is commonly considered as a suburban residential area, served with high quality schools, universities, clinics, shopping malls and other services. Furthermore, in Las Condes, children between 6 to 16 years old are the 10.6% of its population.\(^{18}\)

Conversely, the deprived area, La Pintana Centro was chosen as it is in one of the poorest municipalities in Chile (La Pintana). Located at the southern periphery of the city, dwells in the area consists of self-built houses built between the 1960’s and the 1980’s under the direct action of the State and its social housing policies. The area is served with schools and health centres, but, they are usually busy and have less quality than those located in the most well-off areas. Small and big shops exist in the area, while the former serves a neighbourhood-scale, the latter serve inter-municipal shopping needs. In La Pintana, over 17.2% of the population are children aged 6 to 16 years old.\(^{19}\)

Following a constructivist approach,\(^{20}\) caregivers and children participants were inquired about their shared sense-making, symbolic constructions and perceptions that confine the children mobility performance. Through an interview, participants were asked to point to those environmental conditions—both built and social—necessary for the child to perform a trip according to each mode (e.g. motorised, non-motorised), level of independence (e.g. accompanied by peers, siblings, unaccompanied), time of the day (e.g. morning, afternoon, night), type of the trip (mandatory, optional) and activity (e.g. study, visit) and time of the year (e.g. summer, winter).

A total of 40 interviews were conducted with families living in a deprived and in a wealthy area of Santiago. To support an analysis of children’s mobility behaviour across age ranges, the interviewed families had at least one child between 6 and 16 years. The selected age range emphasise children’s behaviour in relation to their school years, highlighting different management of children’s geographies:\(^{21}\) (i) the first years of primary school in which children between 6 and 7 years old begin a new routine they will follow for several years, (ii) a routine around primary school (children between 8 to 12 years old), and (iii) after the change to middle school (children at 13 to 16 years old), usually located at a further distance from home than primary school.

The interview sought to characterise the children routine, trip behaviour and territorial limits, exposing the characteristics of the built and social environment that support children trips and possible trends and recommendations for a sustainable children mobility. Each topic was supported by two to four guided questions specially designed and tested to prompt the conversation. Additionally, the topics were complemented with the support of three pictorial activities. Participants had to fill a schedule of the children daily activities, children selected their favourite route and both children and parents drew the surroundings of that route, and finally, selected pictures of the neighbourhood that were shown to caregivers and children participants.

The narratives of the interviews were analysed following the procedures suggested by Mason,\(^{22}\) creating concepts (codes) from to the constructions that children and the caregivers give depending on the features of the environment and the permissions that deny/allow a trip. The concepts/codes were created and assigned as they emerged in the transcriptions, and later grouped to in broader categories.
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INTERPRETATIONS OF THE BUILT ENVIRONMENT
The information given by the participants of the study focused on three aspects of the built environments. The (i) aesthetic experience, (ii) maintenance, and (iii) public or private space, were pointed out as highly relevant aspects of children’s mobility.

Aesthetic experience
The physical features of an environment are interpreted by the use of the senses. The features are mainly confined within public realm borders, but many features of the private property may as well experience in the public space. Children and parents experience the physical features while moving, interpreting, assigning value and conditioning the overall moving experience. The aspects of the aesthetic experience of children’s trips were divided into three groups (see Figure 1). In general, the same natural, physical and moving elements were recognised in both wealthy and deprived neighbourhoods.

![Diagram](image)

"Figure 1: Aesthetic experience. Source: Author’s own.

The natural elements recognised by children were: type and presence of trees in the street, and flowers on façades and gardens. The physical features of the streets were: the width of streets and sidewalks, service elements (e.g. electric wiring, light), pavement irregularities (e.g. deterioration, sewer), similar fashion houses and façades, the lack of artificial light during night hours, and the permeability of fences and façades. It was observed that the aesthetic natural and physical features in the environment were predictors of the quality of children trip experience. Elements that were ‘beautiful’ and of good quality were desirable as they encourage children unaccompanied trips (e.g. permeable façades). For instance, ‘ugly’ trees, as well as the lack of them, were linked to abandoned or boring areas.

Moving elements in the environment were also mentioned as part of the aesthetic experience and included motorised vehicles, people in the street and animals. Vehicle-type and value were directly interpreted with the type of environment. For instance, low value or work-related vehicles were recognised only in deprived areas, and big, expensive or comfortable vehicles were mentioned only in wealthy areas of the city. Meanwhile, animals in the public spaces are a positive value the trip
experience in children point of view, yet not in the perception of parents. While the children enjoyed watching and playing with animals, parents worried that those animals (e.g. dogs) may attack their children.

Maintenance

The conditions of the features in the public or private space were directly connected with the community that lives in an area. Parents and children feel distrust towards the people occupying highly deteriorated areas. Aspects related to maintenance were divided into two groups (see Figure 2). In general, high levels of decay, deterioration and dirtiness of the physical features point to unhealthy communities, yet the relation of similar or higher levels of maintenance and healthy communities was specific in each case.

The first group of aspects, cleanliness and flawless, is linked with rubbish and debris on the public realm, neglected play areas, broken or uneven streets and sidewalk, internment debris (e.g. construction debris), the irregular extensions of private property and neglected façades (e.g. wall, fences, roof). Interestingly, the last two aspects are related to the irregular use of the public space by member of the communities who does not obey tacit rules of the common good, while any citizen may be responsible for the dirtiness of the public space.

In deprived areas, the responsibility of deterioration and neglect of several urban features was entrusted to undesirable members the community (e.g. alcoholics, drug addicts). Public institutions were not pointed out. Contrastingly, in wealthy areas, deterioration and neglect of the physical features were almost non-existent, and mainly linked to deprive environments. Also, the community and the municipality were considered key institutions for the maintenance of the urban environment.

The category of natural elements groups two more aspects. During children trips, participants acknowledge the importance of trees and plants maintenance, as well as the amount of dust and mud on street gardens. Children highly valued the maintenance of ‘green’ elements (e.g. trees, plants) for the beauty and enjoyment of them, while parents use the same elements to evaluate and interpret the quality of the community in an area.

Finally, families in wealthy areas have very high standards of maintenance; they usually misinterpret the health of a community for the purity and newness of the urban features. Meanwhile, people in deprived areas pointed certain features in their environment that affect the evaluation of the community.
Public and private facilities

The space that supports children trips is shared with other activities performed by members of the community or outsiders. The activities that could be performed in an area are determined by various factors, yet families revealed the importance of the strangers that are present in the areas where children must go through. Families distinguished differences in both public and private spaces, and the aspects were divided into groups likewise (see Figure 3).

The first group, the public realm, is divided by the condition of an area, like the size and the location of green areas or the type of a street, or the features in an area as the urban infrastructure (e.g. recreational equipment, benches, trees), the transport infrastructure (e.g. intermodal facilities like bus stops) and the vigilance facilities (e.g. cameras, guard post), or the periodic facilities (e.g. free market). Large green areas that are mainly used by families or nannies, therefore, they are considered safe, encouraging the presence of children. Nevertheless, children trips avoid areas if the control is jeopardized by legal or illegal activities that can create conflict (e.g. drugs and alcohol consumption, camping). For instance, families in wealthy areas felt insecure around transport facilities as bus stop attracts people that wait for the bus and that are considered different in manners and attitudes. In deprived environments, families felt insecure at bus stops as mugging and sexual harassment may occur when waiting the bus.

In the same fashion, all families expose that private facilities, small or big as shopping malls, universities, health centres, churches and in-neighbourhood business, are safe places where children were protected or may find support in case of need. Even more, the delimitation infrastructure of private property as gates and fences are strict limits for children in wealthy areas. Children of all ages roamed freely within limits of their gated community and other particularly select known areas. The good perception of private spaces was strongly tied with the presence of guards and sophisticated security systems (e.g. cameras, panic buttons).
CONCLUSIONS

The results of the article show that the features of the built environment are interpreted by families, affecting the trips performed by the children. The interpretation of those physical features may encourage a trip in an area from its sensual (i.e. use of the sense) point of view; a children trip may be performed in a place for the beauty and enjoyment of the area or be discouraged—and even suppress—if the area hold risks from unmaintained urban elements or low levels of community control. Therefore, children present in the public realm hold a direct relationship to the health of a community.

In Santiago de Chile, the relevant aspects of the built environment in a trip performed by children can be divided into three groups; the aesthetics of the physical features, the maintenance of the features and the level of control in public and private spaces. While the same elements are recognised by families living in wealthy and deprived areas of the city, the normal level aesthetic, maintenance and control of the physical features can vary substantially. For instance, families in wealthy areas have high standards of the physical features required to encourage a trip, while families in deprived areas have lower standards but a more accurate evaluation of the conditions of the physical features.

Constrained by its public and private borders, the built environment holds a direct effect on children’s trip and, hence, their development. Moreover, the improvement of children’s experience in the public realm also implies to deepen in the underlying meanings of the built environment. A change in the physical environment can be meaningless if these meanings are not acknowledged. Finally, as children are an integral part of a community sustainability, the privation of them from the public realm can affect the whole community and its future.

ACKNOWLEDGMENTS

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OPPORTUNITIES TOWARDS A SUSTAINABLE FUTURE: THE CASE OF AN INDIAN CITY

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INTRODUCTION
Sustainable architecture strives to minimize the consumption of energy and resources for all phases of the life cycle of the building – from their planning and construction to their use, renovation and eventual demolition. Sustainability is not only about the buildings, but also about the people interacting with buildings. With technological innovations materializing extensively all over the world, the appropriate application of these advancements is very important. Steps towards sustainability and resilience of cities must be taken considering their economic, environmental, social and cultural context.

UNDERSTANDING THE INDIAN URBAN SCENARIO
India is a country that has a huge rural population, 70% but is quickly progressing towards urban lifestyle. According to the Census of India, the country is about one third urban: the official percentage of urban population in India was 28% in 2001 and 31% in 2011 and their projections indicate that urban population is going to constitute more than half the total population by 2041. Therefore, instead of having a common agenda for everyone in the country, each case is to be looked into separately considering opportunities relevant to the context. The following methodologies and examples re-instate this idea.

Social (Soft) Technologies
Any technology is first defined as ‘social’, when although it may incorporate material artefacts, ‘has its origins in the social sciences’ and is aimed at changing human behaviour. Social Technology (ST) comprises products, techniques and/or re-applicable methodologies developed in the interaction with the community and that must represent effective solution in terms of social transformation. It emerges as a viable alternative motion with its inherent simplicity, low cost and consolidated in the culture of its users.

Social technologies distinguish themselves through the following three characteristics:
• they “are enabled by information technology”;
• they “provide distributed rights to create, add, and/or modify content and communications”;
• they “enable distributed access to consume content and communications”.

In all cases, social technologies are the processes that we use in our quotidian practices. Soft technologies are filled with latent possibilities and potentials, enabling many creative and flexible uses, whether they are human processes or embodied in machines. This potential is underlined in the emerging urban context of India through measures like better waste management, passive heating-cooling, wasteland reclamation through sanitary land-filling, urban greening, etc.
SUSTAINABLE WASTE MANAGEMENT

Improper solid waste management leads to many environmental and health issues that disturb the sustainability of the place. According to population size per capita waste generation rate and its growth in India during a decade are indicated in Table 1.

<table>
<thead>
<tr>
<th>Population size</th>
<th>Waste generation* (kg/capita/day)</th>
<th>Waste generation** (kg/capita/day)</th>
</tr>
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<tbody>
<tr>
<td>&gt;2000000</td>
<td>0.43</td>
<td>0.55</td>
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<td>1000000–2000000</td>
<td>0.39</td>
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<td>500000–1000000</td>
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<td>&lt;100000</td>
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Planning Commission Report (2014) projects that by 2050 the urban centers would produce solid waste up-to 436 million tons creating 43,000 hectares area of landfills piled in 20-meter height. Disposing solid waste out of sight does not solve the problem but indirectly increases the same in manifold and at a certain point it goes beyond the control of everybody. The following case study of solid waste management in Ambikapur, an Indian city manifests how socially technology can lead to better waste management hence sustainability.

Case Study of Ambikapur

Ambikapur is a city of population 112,449 (Census 2011) in Sarguja district in Chhattisgarh State in Central India. The city has launched in June 2015, an innovative initiative through the Ambikapur Municipal Corporation called Swachh Ambikapur, (translated as “Clean Ambikapur”), an alternate approach to scientific disposal of municipal solid waste. This sustainable model termed Solid and Liquid Resource Management (SLRM), that serves 31000 domestic and commercial units is a simple approach combined with fringe benefits of urban livelihood promotion and women’s empowerment.

The working of the project was divided into two phases. The first phase focused on Solid Waste management. The objective here was to introduce the system of door-to-door collection (D2DC) of solid waste from homes and commercial establishments and to practice scientific disposal of the waste. The second phase focused on liquid waste management under the workings of the SLRM model.

Expert Guidance:

Social technology transforms social expertise for a purpose, develops ideas for the solutions for social problems. Thus, it also establishes itself as a part of modern government, it can impact governmental decisions, introduction of new techniques and new procedures, new administrative ways of politics and for specific conception of power between authority and subject. The SLRM model was conceptualized by an expert of Indian Green Service (Indian Green Service is an environment protection organisation based on 15 years of extensive field research in the area of Waste Management), who also provided the required technical guidance.

Inclusivity of every citizen and co-operation with the government:

Empowerment needs a structural change. Within this discussion, governmental institutions create the structure necessary for the poor’s participation on the local level and create the concept of community. The community structure of the program was designed by the Collector to implement the solutions and
deliver service on the field. Affirmative action to ensure representation and power to women in local governance, and appropriate capacity building, are necessary to make them effective and equal partners in the development process. 11 300 green jobs were created for women to be working in the SLRM centres. The SLRM Centre, an industrial work-shed that requires approximately 3000-5000 sq.ft plot area is the hub of the entire project. A community structure was formed which entered into an agreement with Ambikapur Municipal Corporation that provides the legal mandate to it to do its work of solid waste management. This structure changed the traditional perception of the job, presenting it as an honorable social service and associating the waste into an income generating resource.

Use of natural processors:
The women were trained to segregate the waste into over 40 categories of biodegradable and non-biodegradable waste. The non-biodegradable waste items, were washed, sundried and piled up for selling to recycling units. The biodegradable waste was converted into compost after mixing it with cow dung. Cows are used as ‘processors’ consuming fresh kitchen waste and converting it into milk, and the cow-dung required for the composting. Likewise, poultry in the Centre can be useful partners in waste management.

![Figure 1. Women at the SLRM centre segregating waste](image)

Management Information System (MIS):
A robust MIS was very important to manage the proceedings at the numerous SLRM Centers. MIS system kept a regular record of the number of households and commercial establishments in each ward. Daily route collection, attendance, segregated/ mixed refuse, organic/inorganic refuse, quantity of items recovered at each Centre, quantity sold, and all financial matters (wages paid, viability gap funding by the Municipal Corporation, etc.) are all recorded systematically and regularly.

Information, Education and Communication (IEC):
The project demands a behavioral change in citizens, hence the importance of IEC. People from every household and commercial establishment were given red and green bins for segregation at source. Over 12,500 school kids were sensitized regarding the project and enlisted as volunteers to promote the initiative. Street plays, colorful inscriptions on the walls of the city with over 1000 messages increased support for the project.
The SLRM model of Ambikapur is socio-technologically knit, easily applicable and flexible according to the context, hence can be applied to cities of every scale, in a decentralized method. Further, for more urbanized cities and unaware rural areas, the following techniques can also pave way to a sustainable and resilient future.

**URBAN GREENING**

The social, economic, commercial, recreational, cultural and visual aspects of a city are as dependent on the open spaces as on the built form. According to the natural model of urban development, the state of equilibrium in a city can be obtained if green spaces of a suitable shape and size and a high degree of conformity to natural conditions are accommodated in its spatial structure. The management, planning, design, policy implementation of urban green spaces as the key discussion issues of sustainable environment are highly integrated and incorporated into the sustainable development at local and global level. Project Green Hands is one such example of large scale Urban Greening that introduced green spaces in urban and rural areas alike.

**An Example of large scale Urban Greening**

Project Green Hands (PGH) is a grassroots ecological initiative of Isha Foundation that has, since its inception on June 5 2004, enabled the planting of 23.81 million saplings by over 2 million volunteers across South India including the plantation of 25,000 trees in tsunami-affected coasted areas in 2005. This project aims to develop a culture of care towards the environment and make the people realize their inevitable dependence on nature through plantation of saplings. The project mission is to increase the green cover of Tamil Nadu by 10% in order to reverse desertification, reduce soil erosion, restore self-sufficiency, recreate sustainability and counteract climate change.
PGH educates people and calls for mass people participation for the wellbeing and environmental security of their cities. It is an inclusive social strategy that involves, businesses, NGOs, students, self-help groups, government agencies, farmers, villagers to bring about self-sufficiency that is in harmony with the ecosystem.

Under their project Trees for Life, the plantation of tree saplings in farmlands is promoted and an agro-forestry model was introduced to the farming communities that added to ecological balance and economic support. This compelling plan re-establishes the power of individual action for large-scale change. The project is a massive effort in community building, encouraging supportive relationships between urban and rural societies, government and industry to shape the course of the world.

PGH also conducts the Vanashree Eco Project, which was started in 2002 to conserve and protect the Velliangiri Mountain Range. Isha volunteers have sown seeds to propagate the native species in the area to revive the ecology and biodiversity of the mountains.

The Green School Movement aims to create “green consciousness” in the younger generation by training them in sapling production and plantation through school nurseries. Right from sowing the seeds to finally growing it into a tree, children are involved in every aspect of the project. Environmental education is delivered as an experience, rather than something in a textbook. 3.18 million saplings have been planted by students through the Green School Movement.

SUSTAINABLE HOUSING

For the part of the country that is living in the urban areas or gradually progressing towards such a lifestyle, the solutions need to more sophisticated and technologically advanced. Many technologies need to be inter-related and woven together judiciously to obtain the required result. The demands of an urban lifestyle should be met with, no compromise should be made in providing all the required
facilities, yet the built environment should be self-sustaining. One such successful sustainable project is the TZED Houses, in Bangalore.

TZED Houses
TZED (ZED stands for Zero Energy Development), Bangalore is a five-acre site comprising of 95 homes built on the principles of sustainable resources by BCIL (Biotech Consortium India Limited). The TZED houses aim at reducing the carbon emissions in the whole life cycle of the building (construction, actual life and destruction) without compromising on the high-energy life style of the inhabitants. With the objective of building a campus for a self-reliant community, the project collectively aims at design, building material, water, waste, quality of air and energy management and works these out through an integrative approach.

Table 2. Approach to various elements in TZED Houses

<table>
<thead>
<tr>
<th>S.no</th>
<th>Element</th>
<th>Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Earth</td>
<td>BCIL has used filler slabs, incorporating fly ash blocks, to save the amount of steel and cement used. Project avoids using bricks, instead soil-stabilized blocks with waterproofing were used.</td>
</tr>
<tr>
<td>2.</td>
<td>Air</td>
<td>Focus on passive and active cooling systems that are energy-efficient and ozone-friendly. Centralised district refrigeration system and air conditioning system using an ammonia-based chilling unit (non-ozone depleting product) has been provided to the campus.</td>
</tr>
<tr>
<td>3.</td>
<td>Water</td>
<td>ZED homes help residents manage their own water and wastewate through rainwater harvesting, ozonation systems and sewage treatment plants. It reduces fresh water demand by as much as 70%</td>
</tr>
<tr>
<td>4.</td>
<td>Waste</td>
<td>Solid waste, wet waste, chemical waste, recyclable waste and every type of waste generated by residents is managed within the residential development using vermicomposting, sewage treatment etc.</td>
</tr>
<tr>
<td>5.</td>
<td>Energy</td>
<td>ZED’s zero energy work strategies are sensitive to ‘embodied energy’ (use of materials like mud and stone) and ‘active energy’ use on consumption.</td>
</tr>
<tr>
<td>6.</td>
<td>Biomass</td>
<td>Emphasis is on native plant species. Green roofs or “sky gardens” provided a planting space for every home while serving as thermal insulation for adjoining and lower built spaces. Each sky garden uses</td>
</tr>
</tbody>
</table>
Apart from the above elements each home also has “conscience meters”, monitoring electric watts and water consumption. An electrical watt-meter fitted in each home indicates the wattage used at a particular time and thus allows users to monitor their power consumption and introduce efficiencies. Meters on the kitchen and bathroom taps help to monitor the volume of water used in litres. Some achievements of the project include 40% less energy demand compared to the regular houses, economic benefits on maintenance charges and power bills, savings on carbon emissions and self-sufficient water supply. Through the project, BCIL has made an effort to provide modern comfortable housing and at the same time, minimize the environmental impact. The advantage lies in incorporating many technologies together in a single project. It serves as a model for energy conscious development in urban locations. The great value of this experience lies in the demonstration, that modern comfort standards can still be met while associating with the principles of sustainable built environment, under the purview of the challenges posed by real estate market mechanisms and cost constraints.

**CONCLUDING REMARKS**

The dichotomy of Indian living gives opportunities to develop solutions that are of a wider spectrum. The majority of rural population indicates that globally acclaimed sustainable techniques will work better when given a social pretext. While the use of social information can seem trivial, the degree to
which these approaches are deployed and the impact they have in shaping the information we retrieve should not be underestimated.\(^{17}\) Social technologies are critical to changing mindsets, attitudes and behaviour.\(^{18}\) Also, keeping in mind the population that is urbanizing and progressing towards global trends, a complex and integrated approach towards all the aspects of sustainability is required. Technically correct, environmentally and economically efficient, and socially significant models will pave way to a sustainable future of the cities. Sustainable measures should be a part developing cities and built-environment from their inception, so as to ensure a lifestyle in harmony with the elements of nature.

**Figure 9. Summarising the idea**

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CAN LEED-ND BE USED AS A SOCIAL IMPACT ASSESSMENT (SIA) TOOL?

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INTRODUCTION
The character of urban communities significantly affects residents’ quality of life, while adopting sustainability practices for urban community development can improve the community’s characteristics, individuals’ welfare and the quality of the environment. A socially sustainable community must have the ability to maintain and build on its own resources and have the resilience to prevent and address problems in the future.

LEED-ND, an initiative of the U.S. Green Building Council, is a community development rating system which promotes sustainability practice by emphasizing the creation of compact, walkable, vibrant, mixed-use neighborhoods with good connections to nearby communities. On the other hand, a social impact assessment (SIA) is concerned with assessing the social and cultural consequences of any development that results in changing the lifestyle of affected people, including employment, entertainment, relations, etc.

This research focuses on analysing the possible relationship between LEED-ND and SIA with the aim of developing LEED-ND into an inclusive rating system by integrating the missing social sustainability dimension found in SIA. This would make LEED-ND a reliable rating system for assessing social impacts of any urban development at the neighbourhood level. Accordingly, the research attempts to bridge a gap in knowledge related to the integration of the social dimension of sustainability into an existing world-wide recognized rating system (LEED-ND) using the SIA as a tool to achieve socially sustainable urban development. Little research has been concerned with the issue of achieving social sustainability in neighbourhood development and almost no research has investigated integrating SIA with neighbourhood development rating systems, such as LEED-ND.

The research outcomes will support socially sustainable neighbourhood design and decision-making process through the development of the existing LEED-ND into an assessment tool that takes the social sustainability dimension into account more comprehensively.

AIMS AND METHOD
This paper analyses the social sustainability measures in the LEED-ND with reference to the possible social impacts associated with urban development as presented by the Environment and Social Development Department, the International Finance Corporation and the World Bank Group. The ultimate aim is to suggest revision of the LEED-ND to allow it to serve as a comprehensive neighbourhood development rating system that allows for a better decision-making process, through integrating SIA measures into the existing LEED-ND rating system.

The analysis will evaluate the current LEED-ND rating system and investigate the social dimension of the system to highlight strengths, weaknesses, successes, and failures and provide recommendations for future improvement.
The research employs both quantitative and qualitative methodologies. A qualitative approach, using data analytical review tools, was taken in examining the investigated social dimensions in relation to LEED-ND categories and their perception of social considerations, together with attempting to understand how credits address the relevant social issues. The paper uses quantitative methodology to identify the number of social issues considered in each credit and specify the total number of credits and points for each social issue. Using a simple three-category classification, quantitative analysis will allow us to assess how LEED-ND incorporates the social dimension into its rating framework.

IDENTIFYING SIA ISSUES AND VARIABLES
The SIA community of practitioners considers all issues affecting people, directly or indirectly, pertinent to SIA\(^4\). It is almost impossible to catalogue all dimensions of social impacts because change has a way of creating other changes\(^5\); however, a convenient way of conceptualising social impacts is as changes to one or more of the following: People’s way of life; culture; community; political systems; environment; health and well-being; personal and property rights and their fears and aspirations.\(^7\)

SIA evaluates the contribution of the planned project to equitable and sustainable development. Equitable and sustainable development is a long-term objective, which neither a single nor even several projects can achieve. Nonetheless, as an objective, it illuminates the path to social development. Equitable development includes preparing the field for future users and key stakeholders to express their thoughts and participate in the development opportunities created by a project. The foundations that are responsible for the project’s implementation should have the ability to integrate sustainable development within the socio-cultural environment and have a sense of ownership of the project’s goals.\(^8\)

Table 1 shows the social issues, as presented by Environment and Social Development Department, International Finance Corporation, World Bank Group (2003). The table provides an overview of the social issues that may be considered during the impact analysis process. Not all issues may apply to a given project, particularly in the case of small projects or those with limited impact.\(^9\)

LEED NEIGHBOURHOOD DEVELOPMENT (LEED-ND), USA
The LEED-ND Rating System is a set of performance standards for certifying the planning and development of neighborhoods. LEED-ND creates a label, as well as guidelines for both decision making and development, to provide an incentive for better location, design, and construction of new residential, commercial, and mixed-use developments. LEED-ND is designed to convey its objectives in credits. A score is awarded to the assessed development based on its achievement of particular requirements for each credit and based on the score developments are rated.

The credits are divided into three major categories: Smart Location and Linkage, Neighborhood Pattern and Design and Green Infrastructure and Buildings. Innovation is an additional category to address sustainable design and construction issues and measures that is not covered under the main three categories. Regional Priority Credits are another feature of LEED-ND. This credits acknowledge the importance of local conditions in determining the best environmental design and construction practices as well as social and health practices.\(^10\)
Table 1.

<table>
<thead>
<tr>
<th>LEED-ND Categories</th>
<th>Major Categories</th>
<th>Additional Categories</th>
<th>Number of Prerequisite Points and Possible Points</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Smart Location and Linkage</td>
<td>Neighborhood Pattern and Design</td>
<td>Green Infrastructure and Buildings</td>
</tr>
<tr>
<td>Social Issues for Consideration</td>
<td>27 5P</td>
<td>44 3P</td>
<td>29 4P</td>
</tr>
<tr>
<td>A. Population/Demographic Movement</td>
<td>12 1P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Economic Environment</td>
<td>10</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>C. Natural Resource Management and Land Use</td>
<td>23 5P</td>
<td>15 2P</td>
<td>23 3P</td>
</tr>
<tr>
<td>D. Community Organization and Local</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Social Services and Infrastructure</td>
<td>14 1P</td>
<td>33 3P</td>
<td>20 3P</td>
</tr>
<tr>
<td>F. Vulnerable Groups</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>G. Cultural Property</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>H. Employment and Labor</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I. Social Conflict</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. Lifestyle and Culture</td>
<td>9 1P</td>
<td>13 3P</td>
<td></td>
</tr>
<tr>
<td>K. Health</td>
<td>8</td>
<td>29 3P</td>
<td>19 3P</td>
</tr>
<tr>
<td>L. Equity</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M. Induced Impacts &amp; Associated Facilities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N. Cumulative Impacts</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>O. Bio-Physical Aspects</td>
<td>3 3P</td>
<td>7 1P</td>
<td>5</td>
</tr>
<tr>
<td>Q. Alternatives Analysis</td>
<td></td>
<td>2-6</td>
<td></td>
</tr>
<tr>
<td>Number of Social issues considered under each category prerequisites and credits</td>
<td>7</td>
<td>11</td>
<td>7</td>
</tr>
</tbody>
</table>

Table1: Analysis of Social Issues in relation to the value of LEED-ND possible points (X):P. Number of Prerequisite credits

**ANALYTICAL REVIEW OF LEED-ND**

In the next section, this paper reviews and analyses the social sustainability dimension in LEED-ND using SIA issues and variables as presented by the Environment and Social Development Department, the International Finance Corporation and the World Bank Group.11.

**Population and demographic movement**

In LEED-ND, to receive the Compact Development credit, it is required to design and build the project such that residential and nonresidential components achieve specific densities per acre of buildable land. Moreover, receiving the Mixed-Use Neighborhoods credit requires locating and/or designing the project such that 50% of its dwelling units are within a 1/4-mile walking distance of a number of diverse uses.

**Economic environment**

Aiming to conserve resources, reduce waste, and reduce adverse environmental effects of new buildings related to materials manufacturing and transport, LEED-ND encourages extending the life cycle of existing building stock through the Existing Building Reuse credit. The Renewable Energy Production credit promotes on-site renewable energy production to reduce impacts on the environment and economy related to fossil fuel energy production and use. Moreover, conserving natural and financial resources is part of the intention of the Preferred Locations credit, while the intention of the Local Food Production credit is to support local development that increases the...
economic value and production of farmlands and community gardens by promoting community-based food production.

On the other hand, LEED-ND promotes socially equitable and engaging communities through the Mixed-Income Diverse Communities credit, by enabling residents from a wide range of economic levels, household sizes, and age groups to live in a community.

**Natural Resource Management and Land Use**

The LEED-ND Rating System pays significant attention to the issue of natural resource management and land use. The issue is considered in most of the credits under the three major LEED-ND categories. The main intention of the Smart Location and Linkage category is to encourage development within and near existing communities and public transit infrastructure and encourage the reuse of land, avoid floodplains, and minimize erosion to protect habitat and reduce stress on natural water systems by preserving steep slopes and conserving wetlands, wildlife habitat, water bodies and native plants.

The Neighbourhood Pattern and Design category is concerned with land uses and improving public health by encouraging daily physical activity. The Green Infrastructure and Buildings category focuses on natural resource management to reduce energy use, pollution, adverse energy related environmental effects, effects on natural water resources, burdens on the community water supply and wastewater systems, and economic effects.

In addition to the main three LEED-ND categories, the optional category Regional Priority aims to encourage strategies that address geographically specific environmental, social equity and public health priorities by offering incentives for achieving related credits.

**Community Organization and Local Institutions**

The Community Outreach and Involvement credit is the only credit that addresses community organization and local institutions. The credit is intended to encourage responsiveness to community needs by involving the people who live or work in the community in the design, planning and decisions about how the community should be improved or how it should change over time.

**Social Services and Infrastructure**

Social services and infrastructure were considered in most of the LEED-ND credits aiming to improve the community’s social services and infrastructure.

The Smart Location and Linkage category focuses on the development’s location in relation to existing cities, suburbs, and towns, as well as accessibility to the public transit infrastructure and its effect on public health and daily physical activity.

The Neighbourhood Pattern and Design category concentrates on transportation efficiency and transit use, internal connectivity clusters, diverse land uses and parking design, community interaction and engagement, and providing a variety of open spaces and recreational facilities. The intention is to improve physical, mental, and public health, along with increasing social capital by encouraging daily physical activity.

The credits under the Green Infrastructure and Buildings category are mostly concerned with the sustainability of the buildings and infrastructure of community. This category assigns credits to promoting sustainable buildings, high energy efficiency and indoor water use reduction, rainwater, wastewater, solid waste management, and light pollution reduction.
Vulnerable Groups
The Visitability and Universal Design credit was the only one concerned with vulnerable groups. Its intention is to enable the widest spectrum of people, regardless of age or ability, to more easily participate in community life by increasing the proportion of usable areas by people of diverse abilities.

Cultural Property
The community’s cultural property is considered in the Historic Resource Preservation and Adaptive Use credit. This credit is intended to encourage the preservation and adaptive use of historic buildings and cultural landscapes that represent significant embodied energy and cultural value, in a manner that preserves historic materials and character-defining features.

Employment and Labor
The Housing and Jobs Proximity credit, under the Smart Location and Linkage category, is intended to encourage balanced communities with a diversity of uses and employment opportunities.

Social Conflict
The issue of social conflict was not considered in the LEED-ND rating system. Social conflicts, such as those between the local population and newcomers, can result from differences in the backgrounds (e.g., urban, educated, skilled, foreign language, expatriates, different customs, etc.) of those involved, and provide potential for misunderstanding and conflict that needs to be addressed early in the project cycle\textsuperscript{12}.

Lifestyle and Culture
Lifestyle is considered in four of the Neighborhood Pattern and Design category credits: Compact Development, Access to Civic and Public Spaces, Access to Recreation Facilities and Local Food Production. The overall intention of these credits is to promote livability, walkability, and transportation efficiency, including reduced vehicle miles travelled, and to provide a variety of open spaces and recreation facilities close to work and home to facilitate social networking, civic engagement, physical activity, and time spent outdoors, in addition to promoting community-based food production.

The community’s lifestyle is affected, indirectly, by the intentions of most of the Green Infrastructure and Buildings category credits, which aim to achieve high energy efficiency and reduce indoor water use; reduce pollution and adverse environmental effects; extend the life cycle of existing building and minimize effects on the microclimate and human and wildlife habitat.

Health
Most of the LEED-ND credits are intended to improve the health of the community, particularly by encouraging daily physical activity, reducing pollution and adverse environmental effects, and community-based food production. Health is addressed under all three of the LEED-ND’s major categories: Smart Location and Linkage, Neighborhood Pattern and Design and Green Infrastructure and Buildings. In addition, the Regional Priority Credit category encourages strategies that address geographically specific environmental, social equity, and public health priorities.
Equity
Equity is also an important objective in LEED-ND, and equity-related issues considered in the LEED-ND fall under the Neighborhood Pattern and Design and Regional Priority categories.
Social equitability is addressed through the Mixed-Income Diverse Communities Credit, which promotes socially equitable and engaging communities by enabling residents from a wide range of economic levels, household sizes, and age groups to live in a community, and designing the community to have a diversity of housing types and affordable housing. Social equitability is also addressed through the Regional Priority Credit, which encourages strategies that address geographically specific environmental, social equity, and public health priorities by offering incentives for achieving related credits.
Accessibility is addressed through the Mixed-Use Neighborhoods Credit, which requires the clustering of diverse land uses in accessible neighborhood and regional centers; the Street Network Credit, which promotes projects that have high levels of internal connectivity and are well connected to the community at large; the Access to Civic and Public Spaces Credit, which is designed to provide a variety of open spaces close to work and home; the Access to Recreation Facilities Credit, which promotes creation of a variety of recreational facilities close to work and home; the Visitability and Universal Design Credit, which promotes ease of participation in community life by the widest possible spectrum of people, regardless of age or ability, by increasing the proportion of areas usable by people of diverse abilities; the Local Food Production Credit, intended to improve nutrition through increased access to fresh produce; and the Neighborhood Schools Credit, which promotes community interaction and engagement by integrating schools into the neighborhood.

Induced Impacts and Associated Facilities
The issue of induced impacts and associated facilities was not considered in LEED-ND. Social impacts of all activities in the project’s area of influence should be considered, including associated facilities or ancillary aspects of a project such as access roads, pipelines, construction camps, etc., as well as unplanned developments induced by the project13.

Cumulative Impacts
Cumulative Impacts is the direct, indirect and secondary impacts resulting from existing projects, the proposed project and anticipated future projects.
The Long-Term Conservation Management of Habitat or Wetlands and Water Bodies credit aims to conserve native plants, wildlife habitat, wetlands, and water bodies by creating a commitment to implementing a long-term (at least ten-year) management plan, and create a guaranteed funding source for management. The Transportation Demand Management credit is intended to create and implement a comprehensive transportation demand management (TDM) program to reduces weekday peak-period motor vehicle trips by at least 20% and funds the program for a minimum of three years following build-out of the project aiming to reduce energy consumption, pollution from motor vehicles, and adverse public health effects by encouraging multimodal travel.

Bio-Physical Aspects
Bio-physical aspects were considered in the three major categories of the LEED-ND. To manage the project’s bio-physical aspects, the Smart Location and Linkage category assigned credits such as Wetland and Water Body Conservation; Agricultural Land Conservation; Floodplain Avoidance; Steep Slope Protection; Site Design for Habitat or Wetland and Water Body Conservation Restoration...
of Habitat or Wetlands and Water Bodies. While the Neighborhood Pattern and Design category includes credits such as Compact Development and Local Food Production, and the Green Infrastructure and Buildings category has Rainwater Management and Heat Island Reduction credits.

**Alternatives Analysis**

To provide a systematic analysis of alternatives and options for the proposed development in terms of their potential impacts, at least one principal member of the project team shall be an accredited professional to support the integrated planning and design and to streamline the application and certification process. Meanwhile, the Innovation category aims to develop options to encourage projects to achieve exceptional or innovative performance.

Table 1 summarizes the findings of the previous analysis and illustrates the social issues and its relevant LEED-ND categories, LEED-ND credits and points.

**CONCLUSION**

The research claims that LEED-ND could be used not only as a sustainability rating system, but also as a SIA tool that takes account of social and cultural impacts of any urban development projects. This requires that LEED-ND be further developed to integrate missing measures of social sustainability in its current rating system, which would make it a more efficient and effective social sustainability assessment tool and hence be suitable for genuinely socially sustainable neighbourhood development. Although the LEED-ND rating system considers most of the SIA social issues as presented by World Bank Group, LEED-ND gave different levels of attention to these social issues in terms of prerequisite and credit points weighting.

Social issues such as natural resource management and land use; social services and infrastructure, and health were, obviously, addressed in the LEED-ND and they were considered in a high number of prerequisites and its related credits were given a high value of credit points. Lifestyle and culture was considered in prerequisite credits and related credits were given a moderate value of credit points. Bio-physical aspects and population/demographic movement were considered in prerequisite credits; however, its related credits were given a low value in credit points. Credits identified as related to the economic environment and equity were given a moderate value in credit points, but they were not considered in prerequisite credits.

Although the remaining social issues, except for social conflict, were addressed in the LEED-ND, their related credits were given a low value in terms of credit points. Furthermore, the LEED-ND didn’t show how other important social issues should be addressed and rated as part of the design of a sustainable neighbourhood. Examples of issues not considered include: social conflicts between local population and newcomers, social cohesion and distribution (separation of families and communities), changing relationships between groups in terms of gender, age, socioeconomic status and ethnicity. In addition, LEED-ND did not consider the induced impact resulting from associated facilities required for the development of the neighbourhood. A rating scale should be developed to measure the success level in implementing the recommendation of the SIA and it should be a key Rating Credit in LEED-ND.

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APPROPRIATING THE PUBLIC PAVEMENT AS AN EXTENSION OF THE FAMILY HOME: CREATION OF UNIQUE ‘TEMPORARY’ URBAN TYPOLOGIES IN ABU DHABI

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INTRODUCTION
Until very recently, the majority of the urban city development in Abu Dhabi has mainly manifested itself on Abu Dhabi Island. Since the country’s formation, the city has rapidly grown and expanded, laterally as well as vertically. The city’s character is in continuous flux, changing shape, form and appearance with the continuous formation of new districts and the non-stopping transformation of existing ones. Neighbourhoods increased in population subsequently increasing the urban fabric density; a progress that included the high-rise towers and skyscrapers growth, along with land reclamation process causing the coastline to stretch and extend further into the sea.

The city today is a hybrid metropolis made from varied urban fabrics constructed over the past four decades. Mostly consisting out of high-rise towers, the buildings’ aesthetic and appearance is a very particular one reflecting not only their creation in time but also their spatial contribution in forming the city, defining the period’s physical materiality and construction methods. The resulted, is a diverse urban fabric made out of a combination of concrete buildings mostly masked with a regional aesthetic, high-rise glass towers of global and international style, and a number of landmarks by renowned architects or consultancy firms such as; Abdelrahman Makhlouf (Egypt), The Architects Collaborative (USA, Cultural Foundation, 1977), Rifat Chaderji (Iraq, National Theater, 1977), Henri Colboc (Franc, Zayed Sport City, 1979), Bulgar Consult (Bulgaria, Bus Terminal, 1989; Abu Dhabi Municipality, 1990), and Abad al-Radi (Iraq, Old Fish Market, 1992).¹

THEORETICAL BACKGROUND
Small-incremental interventions with a city’s urban structure is a world-wide phenomenon, with origins that trace back to the nineteenth century. Carl Smith in his study of Chicago states: “reality, city, and disorder became closely related, if not interchangeable.”², a reference to an apparent disorder that gradually emerged at the time to define the city’s urban experience. During that phase, group members from the society implemented small-scale urban improvements while refraining from any attempts to radically alter the city’s structure.³ These autonomous small-scale efforts were deemed insufficient and were overtaken by ordered municipal city planning laws, governed by urban planners and architects in the 20th century.⁴

The effectiveness of incremental change, and its correlation to the greater part has been debated in history. Jane Jacobs argued for a regulated urban change that is assessed within the context of other patterns and activities.⁵ Christopher Alexander advocated for the emergence of individual freedom
within ordered structured language. And Lewis Mumford denounced the modernist city and questioned the additive effort of individualistic approach.

In the more recent years, a number of publications documented small-scale space appropriation initiatives highlighting the direct resident involvement in the improvement of public space. Roy and Rodgers documented Portland’s Food Cart Revolution. Jonathan Lerner narrated strategies on Tactical Urbanism. And Mimi Zeiger in four series reviewed and reflected upon emerging practices of small scale interventions.

In the developing countries, the notion of unofficial public space use has a very different definition, where the unauthorized and unofficial public spaces use is a common witnessed daily phenomenon. It occurs as a direct response to the inhabitants needs in the form of irregular set-ups. It emerges with no consultation nor does it comply to any pre-set managing rules. Its attributes respond solely to their creators needs in the particular time of the creation for the needed duration of the performed activity. As such, it can be argued that these spaces are not fully understood by the visitors and the observes, who are alien to the particularities of the derived local settings. A published report by UNHABITAT in 2012, included 11 cases study narratives describing the impact of placemaking processes.

**METHODOLOGY**

The field of study is contextualized to Abu Dhabi island excluding all other parts of Abu Dhabi Emirate. The excluded areas include service oriented industrial zones in Mussafah and Mafraq along with their integrated residential sectors; both located at the outskirts of Abu Dhabi island. As such, the low to mid social group who work as service providers and generally exhibit a different notion of temporary space use were excluded from the study. Examples of eliminated typology is illustrated in Figure 1.

![Figure 1. Examples of excluded temporary urban typology](image)

In addition to the location, the following attributes were identified as common dominators to identify temporary urban typology:

- to be situated on the public street and freely viewed by public street passers.
- to be position adjacent, or in close proximity to the inhabited residence.
- to have a sense of identifiable order in the arrangement of its elements.

The authors conducted a general survey to identify a zone to conduct the study. The data was collected through direct-passive observation and content analysis, paired with a field dairy and photographic records; following an unobtrusive research methodology. The collected data was then further mapped and analyzed. The theorem and derived proposition was subsequently tested through applied project implementation.

The research presented in this this paper has three folds;
a. Defining the setting
b. Observation and content analysis
c. Implementation and reflection

DEFINING THE SETTING
Abu Dhabi today and its demographics
The city zoning developed throughout the years leading to the creation of the Abu Dhabi 2030 plan; a vision developed by Abu Dhabi Urban Plan Council for the city’s 25-year development program. The 2030 land use framework reinforces the current functional distribution; allocating the land use across the west coast for private development. This specific typology designation has had a direct impact on the adjacent urban areas, zoned to be retained at low density (Figure 2), residential in function and limited to three-floor height (Figure 3); thus, creating a buffer zone between the high-rises and the private palaces.

Figure 2. Abu Dhabi 2030, Land Use Framework\textsuperscript{12}
The UAE is a multi-cultural society characterized by a high ratio of foreign to local population; approximately 11% Emiratis to 88% expatriate - as per 2014 / 2015 statistics data, out of which 12% are from the Arab region. Majority of the Arab expatriates moved to the UAE in the late 70’s and early 80’s, attracted by the opportunity to be part of a much-needed work force. They differ from the Western and Asian expatriates by having shared customs with the local Emirati, compromised of the common language and religion. Their temporary residence has been masked by successive generations growing, working and residing in the country.

**Ephemerall organizations**

This paper sheds lights on those urban organizations that escape the defined boundaries and merges to become a dynamic part of the streetscape. (Figure 4) What is unique about today’s local residential neighborhoods is not the houses’ luxurious looks, nor the golden arches and cladded marble surfaces, but rather the spaced out, seemingly unordered, yet carefully placed elements forming different urban settings. (Figure 5) This unique urban typology illustrates an exclusive method that inhabitants seem to have devised as a way of integrating their particular social customs and cultural needs into the concrete structures that they occupy today.
Though sometimes, the construction of these elements appears permanent, their characteristics are masked by the constant shifting of need, usage, increase or decrease of space. The nomadic transitional lifestyle of the region’s past is reflected on the loose feel of the architecture of the objects. There is an ambiguity in purpose and form. The physicality of the object is not a perfect solution, but a vessel to facilitate an activity, a narrative or an occurrence to take place. It ‘yearns’ spontaneity of use and misuse.

**OBSERVATIONS AND CONTENT ANALYSIS**

**Aspects and Particularities**

Walking or driving through the surveyed zone has a very different feeling to the sections known as the city centre. This area is characterized with a lower urban density resultant from the height limitation on the surrounding built environment, and subsequently lower population. The relation of the urban surrounding to pedestrians totally changes, due to the vast variation in the height of the surrounding built environment. While the width of the roads and parking designated areas remain similar, the roads in the lower density areas are much quieter as the scale of the built environment becomes more ‘personal’ with the surrounding urban fabric being limited to three-floor height. The alteration in height to width ratio drastically changes the spatial experience, altering the overall perception and the thoroughfares scale, thus directly affecting peoples’ occupation, street usage, space perception and relation to the urban environment (Figure 6).
Houses in these areas; unlike their peer high-rise towers, have experienced a general slower pace of development and urban regeneration. Their occupants have resided in them for generations, thus appropriating and adapting them through time. In this area, it is much more enjoyable to experience the city on foot. One is able to slow down and ‘meander’ between the alleyways (known as Sikah in local Arabic language), gardens, front yards, and intimate spaces (known as Barahaat in local Arabic language) are formed from various building and structures. Every now and then, it is possible to hear the sound of children playing, cockerels crowing, parrots singing and chickens making cackling noises, something that has a very strong resonance to the past and provides a ‘warm’ content to modern living.

The less ‘polished’ feeling and layers of use radiate the notion of time passage. As one deviates from the main road to the periphery streets, a different form of urban elements starts to pop out at unequal intervals; a group of chairs, shaded structures, swings, slides, water fountains, gazebos, chairs and sofas. These elements are scattered yet somehow grouped, unrelated yet form a setting, and are arbitrary yet seem to be carefully selected and arranged (Figure 7).
The residences of these areas mainly fall into two groups: middle class Emirati population and Arab professional expatriate families, both who seem to have broken the often-perceived notion of privacy and extended their occupation to the public realm unofficially claiming it, thus masking the street with a unique character and adding to it a very particular essence. Astonishingly, these ‘unofficial occupations’ remain unnoticed to the passers on the main street, possibly due to their periphery location. Nevertheless, surrounded substreet organization seems to respectfully conform to their set boundaries.

The tectonics, materiality and object selection all suggest the ephemeral nature of these settings. Yet, majority of them have existed there for quite some time. Their ‘apparent’ transitory state responds instead to the seasonal change; not used during the extreme summer months when the temperatures can reach up to 48 degrees Celsius with 80% relative humidity\textsuperscript{15}, and utilized in the winter (Figure 8). These structures act as extended parts/spaces of the house and are treated with the same care and given equal attention. The spaces are exposed to the passing public and are occupied differently depending on the background of the residing family. If it is an Emirati family, they tend to be mostly used by the men of the household. Whereas within other Arab families who have different notions of privacy, it is possible to see different genders and ages occupying these spaces. Both groups are generous and hospitable to guests and passers, but the majority prefer to refrain from appearing in photographs. Whereas at sometimes a physical barrier; small fence, mount or bush, demark the space, in other instances a sense of an invisible barrier projects an unspoken respect of privacy, where pedestrians do not stare, jump over or walk onto these spaces, unless they are invited by the occupiers.

Figure 8. Space usage during different year seasons

The inhabited zones transition from being totally private (the space inside the house or behind the boundary fence), to semi-public space (the appropriated areas within the public realm), to public (the pavement and the street).
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Figure 9. Typical inhabitation zones. Drawing by Asma AlMukhaini.

Mapping occurrences along a defined trajectory
The surveyed zone is positioned between Street 7&13 and Streets 6&8 (in relation to the streets grid numbers of Abu Dhabi city). It was used to analyze the forms and map the occurrences of the unofficial occupancies. The path charted in Figure 10, marks the positions of the studied urban typologies of observed (un)temporary structures.

Figure 10. Urban mapping trajectory along the surveyed path

Typology A
Outdoor Majlis (a local Arabic words that means a living area); Built elements or vegetation is used to define the boundaries of this zone. It remains an outdoor area that is roofed and/or fenced, setting a clear definite none trespassing boundaries, yet maintaining the visual connection with the adjacent public street.

Figure 11. Typology A - Outdoor Majlis
Typology B
Fenced Zones; Confined boundaries clearly marking the demarcation line, either using mesh like material or linear planted vegetation. This maintains transparency, allowing visual connectivity but restricting access.

![Figure 12. Typology B – Fenced Zones](image)

Typology C
Outdoor-Indoor Majlis (a local Arabic words that means a living area); Areas constructed from traditional tent materials and are climatically controlled. Though located in the public domain, they are private zones with a clear marked separation and a defined entrance; demarcated as such to maintain the physical segregation while preserving the visual connectivity.

![Figure 13. Typology C – out(IN) Majlis](image)

Typology D
Informal Sitting Areas; Settings allowing various gatherings or get-together spaces, are conceived from various elements collation and intuitive organization. They vary from the traditional Arabic settings - carpet and cushions, to an arrangement of sofas, to an organization of chairs around a table.
Typology E
Scattered Pieces; Isolated chairs, sofas and benches in the street usually with their backs oriented to buildings walls or fences providing opportunities for observation and contemplation. This typology could be defined as interactive as although it clearly belongs to the structure it is leaning against, it is the only typology that provides a possible opportunity for the public to use without feeling they are trespassing.

Typology F
Water Sources; This links back to an old Islamic tradition where providing public water to the passers was considered a high-rewarded act of generosity. The forms by which water is provided vary from stand-alone coolers to embedded sources that form part of the fence design.
Typology G
Stocks; Cages and areas appropriated for pets and poultry.

Typology H
Children Play Areas; Slides, swings and trampolines positioned either as stand-alone elements or on an area zones that is often marked by a carpet or grass.
Typology J
Gardening; Either elements that are appropriated or areas that are hoarded for vegetation growth.

IMPLEMENTATION AND REFLECTION
Context and targeted audience
Zayed University is a federal university founded in 1998 as an all-female university based on the American liberal arts college system. It houses five colleges and over 8,000 students attending classes on two main campuses, one in Abu Dhabi and the other Dubai. The University became co-educational in 2008 with the introduction of the men’s program, but undergraduate education remains gender segregated, and 80% of the students are female Emirati.
The campus in Abu Dhabi is located adjacent to the highway leading to Abu Dhabi international airport and is designed by BRT Architekten. A formal axis divides the 80-hectare university site into male and female sections; cutting through the promenade that connects the academic buildings, the central courtyard and the administration. The campus architecture is defined mainly by a prominent iconic angulating curvilinear canopy that cascades to touch the ground. (Figure 20) Due to cultural reasons, the courtyard is accessible to the male and female students on alternate days.

Application
The authors observed how students informally occupy and use the courtyard space, and simultaneously noticed the lack of outdoor seating areas. In response, they designed and built a linear prototype out of a 6mm plywood aggregate modules. The piece was situated in the linear area between eight-planted palm trees, also partially shaded by the overhanging canopy. The prototype tectonic formed an interesting interplay of light and shadow with the surrounding site elements. (Figure 21)
In spite of the new introduce language resultant from the building geometry of the piece, it was interesting to observe how students started to use the prototype as seating areas to interact, spend time and have lunch. (Figure 22) Over time, and without any communication or coordination with the authors, additional outdoor seating purchased by the campus facilities started to appear and were positioned around and in consideration with the prototype. It was interesting to note how the tectonics of some of the added outdoor furniture arrayed the prototype materiality and make-up mechanism. (Figure 23)
CONCLUSION

Despite of the specific locality of presented case study and preceding observations – Abu Dhabi, the authors recognize that these spatial conditions are not exclusive. They have a specific aesthetic and a language that has traces encountered in other communities across different parts of the world. These traces are recognized through their unique typology derived from their form or material, arrangement or construction technology. For example:

On the road running north from the Dead Sea, there are spaces that are used as a truck drivers makeshift praying spaces. Maurice Mitchell, questioned if these spaces are “repeated (there) or in other similar locations”\(^\text{17}\). He continues, “the one-off sheltered local prayer stop might become a type well known alongside desert lorry routes”. The statement implies an architectural language recognized by the users and possibly repeated in many parts of the world.

Another example is the construction of fishing placements in Barcelona breakwater. The forming of carefully positioned structures as places to sit and rest. The uniqueness of these elements comes from the ownership demarcation process; painting the place white. In addition to protecting the metal from corrosion, the white surfaces indicate a possession and communicate a space belonging to a particular fisherman. Roman Domenech refers this action as; “This reflects a simple, effective local tradition which has been learnt.”\(^\text{18}\)

It is the rearrangement of domestic elements that has a connection to a potential use. Definition of function is by placement, recognition and familiarity of the physical presence of the objects.

The implemented experiment connotates the possible notion of space activation through the injection of human-scaled activity into a public space; a theorem on place-making person-centered design methodologies first addressed by Relph in 1976\(^\text{19}\) and Canter in 1977\(^\text{20}\). It also reaffirms the authors observations on residential unofficial occupation settings and transfers it into an alternate social-educational setting.

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CONSERVATION OF CULTURAL HERITAGE IN KATHMANDU VALLEY: A STAKEHOLDER PERSPECTIVE

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1. INTRODUCTION

Cultural heritage is of increasing significance to every society. It provides a sense of belonging and can be an anchor in a rapidly changing world. It is the result of people’s interaction with their environment and with one another. Conservation of cultural heritage is an essential part of urban planning and development. It is necessary for society both practically and in the academic sense of the historic knowledge. The Burra Charter describes conservation as “all the processes of looking after a place so as to retain its cultural significance”. It involves identifying and assessing attributes of a place that is of a value to us and society. It is also about engaging the aspirations of different stakeholders for the conservation of cultural heritage. Due to the complexity of the heritage conservation, number of stakeholders are involved with a wide range of disciplines and backgrounds. Given this complexity, engaging the aspirations of all stakeholders and managing their interactions through collaboration and coordination of activities is essential for an effective conservation process.

With this in focus, this paper attempts to gain an understanding of the stakeholders’ opinion and perception on cultural heritage conservation of Kathmandu valley. Cultural heritage of Kathmandu is comprised of exceptional architectural typologies, ensembles and urban fabric. It is closely linked to functions and activities that take place including the daily rituals, processions and festivals that dramatically change the meaning of the place and convey a sense of belonging to these places. This cultural heritage is now being threatened by rapid urbanisation and unplanned urban growth. The growing influx of migrants and booming population has led to expansion of core areas, urban sprawl, loss of open spaces, decreased liveability and rise of concrete structures different from traditional brick structures. Discussions and research on conservation of heritage in the valley has largely focused on monuments, temples and world heritage sites but failed to include the complex urban spaces where people live, work, worship, and celebrate festivals. There is a lack of holistic approach to understand the heritage first and conserve not just the tangible heritage but intangible as well. Currently in Kathmandu valley, community involvement in conservation process is rather minimal, limited to the early stages of identifying the history and background of the site. There is also the issue of several overlaps of responsibilities of key stakeholders. Thus, an appropriate strategy for the conservation process is urgent so that both tangible and intangible heritage can be conserved before we lose it all.

This paper is part of a research aiming to develop an approach to the planning of urban living heritage in Kathmandu valley. The main aim of this research is to make a contribution to the ongoing debate on urban development and heritage conservation in the historic cities of developing countries.
starts with an overview of stakeholder interaction in cultural heritage conservation with focus in the developing countries of Asia. This is followed by an explanation of the methodology and case study area. The last section presents the results, findings and draw up conclusions.

2. STAKEHOLDER INTERACTION IN CULTURAL HERITAGE CONSERVATION

Conservation of cultural heritage is increasingly becoming a contentious activity as contemporary global and local forces of production and consumption exert pressure on how heritage places are to be redefined. This is more visible in historic cities of developing countries in Asia. These historic cities are facing pressure from different areas including globalization, urbanization and accelerated efforts of socio-economic progress. The Resolution of the International Symposium on the Convention of Smaller Historic Towns states that the existing settlement structure of the developing countries is being threatened by rapid expansion of population and accelerating influx of people to the towns. The issues that the developing countries in Asia are facing is very similar but the major concern for conservation of heritage has been lack of coordination between the stakeholders. Community participation has also not been a norm in the conservation of cultural heritage in the Asian cities.

According to Amar et.al, Bott et.al and Jamal and Stronza understanding stakeholders perceptions in a conservation process is integral to the realization of sustainable decision making. Due to the different stakeholders involved in conservation process, it has to be understood that there might be different perspectives concerning cultural heritage. However, a common platform is needed for all stakeholders to engage in the conservation process through increased collaboration. Although not all stakeholders can be equally involved it is important to identify and understand the interests of all stakeholders from individuals to groups to the whole community. In the context of conservation process in Kathmandu valley, stakeholders involve all local and central government organizations, local community members, community organizations, academicians, guthis (socio-religious organization) and other religious organizations.

In order to ensure that the conflicts and misunderstandings are managed or reduced where appropriate, there needs to be a clear distinction in the stakeholder roles and responsibilities. This is often not the case when it comes to the role of communities in the conservation process. Role of community is often dismissed through token consultation rather than involve them in the decision making process. Kathmandu valley is a living heritage site and hence the role of community specially the core community is essential for the conservation process. For this research, the opinion and perception of the community was gathered through the questionnaire surveys and interviews were held with other members of stakeholder groups. It is essential to understand opinion of the stakeholders for the conservation of heritage and it is within this context that the case of Kathmandu valley is presented.

3. METHODOLOGY

From the methodological point of view, this research has taken a qualitative approach with case study as a research strategy. A case study approach was deemed suitable as it allowed the researcher to explore and investigate a contemporary phenomenon within its real-life context through detailed contextual analysis. The historic cities of Kathmandu and Lalitpur were used as the case study sites. The central objective of this paper is to understand the stakeholder opinion and perception on cultural heritage conservation of Kathmandu valley. This was done through semi structured interviews with the stakeholders. Nineteen interviews were conducted with government officials, planners, academicians, conservationists and community leaders. The questions were initially prepared in English and translated
Interviews were conducted in Nepali language and audio recorded. Participants were briefed about the research and asked to sign the consent form before starting the interview. The audio recordings then were translated and transcribed into English for the purpose of the analysis. The data from the interviews were coded using quantitative and qualitative content analysis in NVivo 10 software. This methods of analysis is the most suitable as it helps to analyse the data in a systematic way and also allows data to be manageable. Thematic analysis was used as qualitative content analysis as it provided a way to interpret the test and understand the meaning of the text. Thematic analysis involves a process of identification of themes through careful reading and re-reading of the data, and it is a form of pattern recognition within the data where emerging themes become the categories for analysis. A theme could be expressed by single word, a phrase, a sentence, a paragraph or entire document.

4. CASE STUDY: KATHMANDU VALLEY

Kathmandu valley is the administrative, economic and political centre of Nepal. With an annual growth rate of about 3.9%, it is one of the fastest growing urban areas in South Asia. Located at the crossroads of ancient civilisation of Asia, Kathmandu valley is characterised by its compact urban form, traditional planning concepts, rich built heritage and diverse socio-cultural activities. Seven out of the ten UNESCO World Heritage Sites of Nepal are located in the valley. UNESCO declared the seven monument zones collectively as a single site and called it as the Kathmandu Valley World Heritage Site. Figure 1 shows the map of Kathmandu valley.
The urban fabric of all the cities in the valley consists of two basic elements; blocks of closely built two to three stories houses clustered around courtyards and a network of streets and pedestrian lanes. There is a spatial link between private and public spaces with a gradual path leading from the public street to the semi-private area and into the inner courtyards. There are numerous temples, shrines, dance platforms, wells and public platforms in the squares and the streets. The inner courtyards were mainly used for daily activities, festivals and also used as a place to gather during an earthquake. Newars, one of the indigenous community of Nepal are the focus of the cultural heritage in the valley. Almost all neighbourhoods have a temple for its own Ganesh and a shrine for its area protector. Each divinity presides over its own particular territory and every year each deity is led out in procession. These festivals and processions attached to deities located in different neighbourhoods are able to provide an identity to the neighbourhood. Besides these processions, many other festivals, daily rituals and activities along with tangible heritage make Kathmandu valley a living heritage.

5. STAKEHOLDER PERSPECTIVE ON CULTURAL HERITAGE CONSERVATION OF KATHMANDU VALLEY

This section presents the findings of the interviews. Analysis of the interviews identified four themes based on the objectives of the research which are cultural heritage conservation, planning and development, urban quality and heritage and disaster. This paper presents only the cultural heritage conservation theme. Three sub themes were identified within the cultural heritage conservation which is shown in figure 2.

<table>
<thead>
<tr>
<th>Cultural heritage conservation</th>
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<td>Conservation process</td>
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Figure 2: Cultural heritage conservation theme and its sub themes

5.1 Conservation process – Actors involved in the cultural heritage conservation

Government authority and community represent the two main actors involved in the conservation process of Kathmandu valley. The government authorities include different levels such as central and local government. There are different organizations for heritage conservation in the valley namely Department of Archaeology under the Ministry of Culture, Tourism and Civil Aviation, local municipalities and ward offices under the Ministry of Local Development and Guthi Sansthan under Ministry of Land Reform and Management.

Department of Archaeology and the municipalities along with ward offices are responsible for the conservation of tangible heritage. The Department of Archaeology is a central government agency responsible for the conservation of temples, monuments and heritage structures. The Under Secretary of the department stated that “DOA is the only department for the conservation and protection of temples, monuments and heritage structures that are more than 100 years old. Also any residential buildings that is more than 100 years old need to take permission from this department before they can demolish or make any changes to their residential buildings. The intangible heritage does not come under the domain of DOA”. Municipalities and wards are also responsible for conservation of structures
within their jurisdiction. However, ward offices provide funds and support for only small scale heritage projects.

Guthi Sansthan is the only organization working for intangible heritage in Kathmandu valley. The Deputy Director of Guthi Sansthan mentioned “Our department provides financial and technical support for the conservation of intangible heritage. We are also trying to develop strategies to stop the encroachment of the guthi land. This is being done with the coordination of community, local government organization and ministry”. Guthi Sansthan is also the legal owner of many monuments and historic and religious buildings and is responsible for their conservation.

All of these organizations are working for the conservation of heritage. However, lack of coordination between the organizations is causing a lot of repetition of works. The lack of coordination is also because all organizations fall under different ministries creating conflict of interests. The main obstacle to conservation process in Kathmandu valley is the lack of involvement of government authorities. Local community members complain that government departments do not provide support or provide funds for the conservation of heritage. One of the local community members summed this situation up during an interview:

*Government is not proactive in conserving our heritage. Heritage is at a high risk in the cities of the valley specially Kathmandu, Lalitpur and Bhaktapur. Lack of enforcement by the government is also leading to deterioration of our heritage* (Respondent #LC7).

Another obstacle in the conservation process is the insufficient expertise and monitoring capacity of government authorities. The very definition of cultural heritage used by the government authorities focus only on tangible heritage such monuments, temples and palaces. There is no mention of intangible heritage aspects of the cultural heritage.

Another key actor for the conservation of heritage is the community. They are bearer of both tangible and intangible heritage. For a living heritage site like Kathmandu valley, community is an essential part of the conservation process. Their importance for the cultural heritage was acknowledged by all stakeholders. However, for a living heritage site there needs to be a distinction between the core community and other communities. Core community is the one that created the heritage site and have been using it for centuries. Newars, one of the indigenous community of Nepal is the core community of Kathmandu valley. They should be given the primary role of conservation of heritage. However, government does not involve them in the planning of the site and conservation of heritage. One respondent from the local community noted:

*Our heritage structures are used and the traditions continued only through the efforts of the community members. However, they are never acknowledged in any government processes be it planning or conservation processes. Community can definitely take the lead and has done so for years but support has to be provided by the government and the experts* (Respondent #LC5).

These conflicts highlight the absence of collaboration and partnership between the government authorities and local community.

5.2. Issues of cultural heritage conservation process

The issues of conservation process in Kathmandu valley are due to urban development and migration, lack of awareness amongst the community members, definition of heritage and loss of guthis.

Migration of the core community from the core to suburbs is considered as one of the main challenge for the conservation of heritage in the valley. Majority of respondents mentioned about the effects of this migration on the conservation of both tangible and intangible heritage.
The biggest issues or constraints has been the moving of people away from core area to the suburb and influx of migrants to the core. This not only destroys the physical fabric of the core but also affects the intangible heritage. Migration means that the people that have the skills and knowledge move away and there is no one to take the culture forward (Respondent #LC3).

Lack of awareness amongst the community members about the importance of the heritage is also noted as one of the challenges of the conservation process. This lack of awareness is leading to the demolition of traditional structures and replacing with modern concrete structures that is destroying the identity of the site. Another issue for conservation of heritage has been the definition of heritage. As mentioned above, the definition of heritage in the valley includes only temples and monuments. There is no mention of intangible heritage. It is important to broaden the definition of heritage by including the urban spaces and intangible heritage.

*Guthis* are the socio-religious organization through which all the community works and activities are organized. These religious organizations are also responsible for the upkeep of monasteries, temples and shrines. This is done through the administration of proceeds from lands granted as endowments to certain deities and their temples or shrines. A guthi corporation was established in 1964 to consolidate all *guthis* to a central unit and to preserve the tangible and intangible heritage. However this consolidation of *guthis* has been an issue as the Guthi Sansthan is not able to manage the land owned by the *guthis* or use the revenue generated through the lands for the conservation of heritage. One of the respondent noted:

> Initially, the maintenance of heritage structures and organization of intangible heritage was done by the guthi associated with the structures. However, 50-60 years Bhumi Sudhar Ain was formulated which resulted in most of the guthis being nationalized and the government receiving all the revenue generated from the land trust. The way of maintaining the structures by the state and the continuation of religious and cultural activities was not very effective after the nationalization of the guthis. They are still not very effective (Respondent #LC9).

### 5.3. Policies and regulation for the conservation of cultural heritage

The principal act relevant to the conservation, protection and management of cultural property is the Ancient Monument Preservation Act (1956) and its subsequent amendments. The Ancient Monument Preservation Act (AMPA) gives Department of Archaeology the legal provision to declare a monument area as Protected Monument Zone in order to protect the site through the prescription of building byelaws, approve requests for buildings permits and for any other construction activities within the zone and the authority to stop inappropriate and or illegal building activities and to request for the demolition of unauthorized construction. This act was formulated from an archaeological perspective and the focus is only on ancient monuments. The act does not take into consideration consultation with the local inhabitants and stakeholders collaboration. One of the respondents from the academic community noted that the act needs to be amended as he states:

> The Ancient Monument Preservation Act needs to be changed to include the intangible heritage, urban space and also the private traditional buildings. The act should also address the integrity of all aspects of heritage (Respondent #A3).

Another act that influences heritage conservation works is the Local Self Governance Act (LSGA). This act gives the elected local government bodies the function and duty to record, maintain and preserve the heritage within the area of jurisdiction. However, there is a lack of clear differentiation between the
works that is done by DOA through AMPA and local government authority through LSGA which is causing issues with the conservation of heritage in Kathmandu valley. Kathmandu valley needs a policy to address simultaneously both planning and conservation of living heritage. Implementation of acts and regulations also has been an issue for the conservation of heritage. Local and national government authorities have been unable to enforce the policies established for the conservation of heritage.  

6. CONCLUSION
This case study research identified a number of factors influencing Kathmandu valley’s conservation of cultural heritage from a stakeholder perspective. The major factors were rapid urban development due to migration, lack of government involvement, lack of coordination between different government organizations and failure of government authorities to include community in the conservation process. There is a conflict between the stakeholders of Kathmandu valley due to the inefficiency of government authorities to provide support to the community and enforce policies, acts and regulations. All of these issues are negatively impacting the conservation process. Understanding stakeholders’ perception for conservation of cultural heritage will enable to establish effective and efficient management and conservation of Kathmandu valley cultural heritage.

Literatures show that successful conservation of cultural heritage requires active participation of local communities specially the core community for a living heritage site. Involvement of local community members is low in Kathmandu valley due to the lack of mechanism for participation mechanism and limited communication between government authorities and local community. Rodwell argues that the cultural heritage needs to be related to the aspirations of the community. The failure of the government authorities in Kathmandu valley to include the local community specially the core community have led to the conservation process being ineffective. It is recommended that the Newar community of Kathmandu valley should be given the primary role of conservation with government authorities providing support to them. Fostering the core community’s vested interest in the cultural heritage conservation is vital to guaranteeing the sustainability of cultural heritage in the valley. Effective stakeholder collaboration can help address the opportunities and problems inherent in cultural heritage conservation. Therefore, it is important to understand the interests of all stakeholders. This paper aimed to establish stakeholder perspective on the current status of conservation of cultural heritage in Kathmandu valley. Findings from this research highlight the importance of participatory planning and conservation process that involves all key stakeholders. This can help to establish an appropriate strategy for conservation of cultural heritage in Kathmandu valley.

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VANDAL OR SCAVENGER? METAL SCRAP DEALERSHIP AND THE SURVIVAL OF URBAN FURNITURE IN OWERRI, NIGERIA

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INTRODUCTION
From the period of her Structural Adjustment Programme (SAP) in 1986 which entailed economic restructuring and number of austerity measures, many Nigerians came to survive on scavenging on urban refuse dumps. Scavenging also progressively came to be organised in the form of exclusive cartels of assertive peasantry that would not allow outsiders into their trade just as it is in most parts of the developing world, from Manila, Philippines to Eldoret, Kenya. Scavenging has created a whole sub-culture all its own. Many more people have also come into the trade to the extent that contestation for valuables on the expansive city dumpsites has become more pronounced and garnished with usual trappings of resource contests (squabbling and bickering). While this goes on and while many would-be scavenger are marginalized or excluded completely from choice dumpsites, while per capita recoverable waste declines with rising number of scavengers, the level of vandalism of urban infrastructure has also grown. It is possible that people who are excluded from mainstream scavenging are turning their agency to non-waste recoverable in the city.

Urban infrastructure failure is common as electric power supply is epileptic, communication is also interrupted at times as cables and other metal components of urban infrastructures are vandalized occasionally. The abysmal performance of these infrastructures goes a long way in compromising the liveability of the city, income potential of the residents and the overall quality of life.

This paper raises the question, has expanded scrap dealership prompted an inclination in scavengers to go beyond scavenging and vandalize urban furniture? In an ecological sense, has Owerri assembled the factors that produce facilities vandalism? Using information secured through interviews of personnel of Nigerian Security and Civil Defence Corps which has the primary mandate of tackling vandalism, Imo Security Network, Orji Vigilante and Imo Orientation Agency, the paper shows vandalism as a product of feedback from metal scraps dealerships in Owerri. It shows the ways this practice challenges social sustainability at the public level while it is seen as some form of agency in urban survival at scavengers’ personal level. The paper interrogates the seeming blurring of the line between the vandal and the scavenger in Owerri and issues surrounding such a mutation of otherwise distinct concepts.

ECOLOGICAL SETTING OF VANDALISM
Vandalism of urban infrastructure occurs within certain environmental, human and institutional constraints. Long and Burke suggest factoring cultural setting of crime in understanding vandalism. The vandal might as well be a product of the environment. In this light we may begin to look at spaces as producers of vandalism and stimulators of vandalism. Vandalism is held to occur if vandals think they can get away with it. Probability of getting away with a crime is situational and leans heavily on spatial
attributes such as proximity or otherwise to public censure and law enforcement oversight capabilities. In Owerri, the variegated spaces reflect varying vulnerability of infrastructure to vandalism. Apart from spatial effects; there are temporal dimensions registered in diurnal range of activity spectrum and intensity which switches the city to low human circulation at night opening the door to vandals. Hence the daytime scavenger in the open, well trafficked spaces can be a vandal in the confined deserted spaces and during night hours. Most cases of removal of railings on roads, metal crossings on drainage channels, and electrical installations such as armoured cables happen at night hours or in isolated areas. Civic duty is however indicated as a protective measure and perhaps government’s last line of defence for public infrastructures; the idea that concerned public present some form of restraints for would-be vandals. This would rather work well where the public perception of public facilities is not influenced by debilitating apathy towards government institutions. Where government serially proves dysfunctional and where public infrastructure show epileptic performance, the public may view acts of sabotage such as is presented by vandalism with the lens of situation ethics. This public attitude therefore compromises the watchdog roles of the public.

Samdahl and Christensen support earlier workers in the synergy of the trio of environmental conditions, people and behaviour (in an ecological sense) in the production of environmental cues that might predispose to vandalism. In this line of thought, vandalism is prompted by the physical presentation of objects. Certain objects attract the behaviour. Hence some objects are more vulnerable to vandalism than others given the nature of their assembly, human access, inherent value and functional status. The scavenger can become a vandal where the fruit hangs low enough.

A scavenger that turns to vandalism is probably driven by profit motive. Not all forms of vandalism have an economic orientation. Acharya recorded in India, a case of vandalism in protestation against poor presentation of some in a movie that was yet to be released. Vandals do go into wilful damage leaving damaged items in situ for emotional fulfilment of anger or for political points. The scavenger is however in the wings to mop up after such acts of violence and pick valuable items. Scavengers resisting the temptation to create and reap from damage on a bad day of scavenging may prove difficult. Economic motive resonates in most acts of vandalism showing that vandalism may be an extreme form of scavenging. The Nigerian Communications Commission identified vandalism in cutting of cables and destroying facilities of mobile base stations. Vandalism to the perpetrators in this context is purely an economic agency, albeit a negative one. Extreme poverty as witnessed in some urban areas which has been put at 60 percent precludes the realization of many city objectives. It is under such situations that such pedantic crimes are seen.

LEGAL AND INSTITUTIONAL CAPACITY

Vandalism in Owerri functions in a virtual institutional and legal void to the extent that special protection of critical infrastructure as it is in the United States and European Union are lacking. A total of 233 cases of electricity infrastructure vandalised in only 4 states in first nine months of 2017 amounted to a loss of half a billion naira. The Nigerian Police Anti-Electricity Vandalism Response Squad (AEVRS) set up in 2017 can be seen as an after-thought and an indication of poor capacity up to the launch year, 2017. In the years preceding first quarter of 2017, the policy environment allowed export trade in scrap metals with massive demands from China. The trade only got banned in the year 2017 and enforcement intercepted ₦100m worth of scrap metals in 2017.

Kachikwu reported for the country a continuous import cycle of 92 percent of its daily fuel consumption while spending $28b in foreign exchange importing petrol products annually. This indicates a failure of infrastructure. Oil facilities are highly subject to vandalism. The problem of vandalism is compounded by out-of-school children, that is in excess of 10.5 million and ranked highest in the world, who usually massively indulge in scavenging.
CONSTRUCTING AN URBAN FUTURE: THE SUSTAINABILITY AND RESILIENCE OF CITIES.
AMPS, Architecture_MPS; Abu Dhabi University
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PEOPLE’S SURVIVAL AND SOCIAL SUSTAINABILITY
Nigeria’s Ministry of Communications put costs of shut downs of ICT infrastructure due to vandalism in 2016, at $50 to $100 million. Some people in Owerri survive off the trade in vandalized items which are increasingly brought into the scraps metals market as scavenged items. People build critical personal structures from vandalized steel structures. Hence usage of vandalized items is multifaceted. Facilities such as outdoor advertising stands may be dismantled when once announced events are past and unfortunately such treatment is also at times extended to non-temporary structures. In slums, shanties feature such items cobbled together from diverse sources. The economics of survival on vandalized facilities is rather fudged and only meaningful at a personal level. While the vandal enjoys the benefit of his vandalism of a public facility alone in tune with the poor private attitude to Commons, he prefers to socialize the negatives of his actions as mere externalities. Thus, huge socialized public losses are not justified by scavenger’s little private gain. Social safety nets are hardly provided. The poor therefore interpret abuse of public facility as a necessary agency that stands to partially compensate for denied socio-economic justice. Many have a floating existence between the world of the scavenger and that of the vandal. Whereas scavenging is sustainable, vandalism fails to satisfy the criteria of social sustainability. There is a basket case situation in providing certain vulnerable facilities in the face of extreme poverty. The goals of progress and aesthetic appeal projected by the state and her agents willing to impress continue to run counter to the goal of survival in Owerri and other cities. It is also a major reason Owerri urban renewal efforts are highly conflicted, challenged by public outcry.

VANDALISM: INCREMENTAL ACT.
In many cases in Owerri area, vandalism takes the form of a subterfuge. Rather than a spontaneous and abrupt act, it is graduated in which case vandalized structures pass through several stages of disrepair and dysfunction up to the time the vandal-scapenger might, for removing them, be hailed as an environmental hero, saving society from hazardous nuisance. At times, a street light pole may pass through several months of tilting at progressively dangerous angles up to the point of posing a major traffic risk. In this light accidents become avenues to vandalism. Hit-and-run drivers damage infrastructure and beat their escape. Road furniture is mostly vulnerable. The failure of bodies saddled with responsibilities to replace facilities in disrepair tends to invite scavenges. Is it vandalism when the scavenger fails to leave accident debris in situ for maintenance agencies or is it a mere act of scavenging? If scavengers move in, will it not forestall maintenance efforts? This issue is involved in labels of persons involved in retrieving articles of value floating in the urban space. The absence of distinct environmental management plans, infrastructure management plans and urban management information systems does not help the building of non-existing maintenance culture. What to do with urban furniture in disrepair is not made clear to all stakeholders and governments dissonance or failure helps to lure scavengers to vandalism. Government’s response time in the event of infrastructure failure is therefore a conditioner of the scavenger-cum-vandal feedback.

VULNERABILITY OF FACILITIES TO VANDALISM AND SCAVENGING
From the experience of Owerri, vulnerability of facilities varies. It also seems to be determined by factors that include
(a) Remoteness factor: Geographical proximity of facility’s areal location. Exposed cables close to busy areas may survive.
(b) Access factor: How easily reachable the facility is, is very important. Buried cables are less prone to vandalism than surface type.
(c) Material values factor: Greater risks and efforts go into scavenging or vandalizing materials of greater value. Armoured electricity transformer cables are stolen despite the high risk involved for their great market value.

(d) Period of day/night: Night time and early dawn record higher frequency of incidents.

(e) Ownership: Government owned facilities are more vulnerable as they tend to be bereft of close oversight authorities.

(f) Portability: Objects that can be easily carried and hidden due to smallness of size are more vulnerable. For instance, generator coils.

(g) Reducibility: Facilities that can be diminished in dimensions such as area or perimeter are more vulnerable. For instance aluminium frames.

(h) Amenability to dismembering: Coupled facilities that are amenable to being dismembered are more easily carted away in bits and in repeated bouts of vandalism. For instance bolted pieces of railings.

(i) Availability of markets: Iron definitely thrives where blacksmithing is major occupation.

Government and other agencies can design facilities and make such choices as location factoring vulnerability to vandalism. From indications, facilities require varying levels of policing to survive vandalism menace according to how many of the vulnerability factors are indicated for them. In Orji, Owerri, about 40.5 percent of cases concerns electrical fittings19. A study in Osogbo, South West Nigeria showed water pipes as most visited by vandals at 40.4 percent20. This suggests spatial variance in vandalism determinants outlooks.

MANAGING SCAVENGING, TRANSITION TO VANDALISM.

The high level of informality associated with scavenging has been a problem. Whereas government admits the role played by scavengers in sustainable environmental management, governance fails to integrate them at policy level as a component of waste recovery value chain. Though co-operatives exist among scavengers, they basically serve to regulate admission of ‘outsiders’ in order to manage labour supply and retain profitability. This is similar to the observations of Asibor and Edjere in Warri in the Niger Delta21. The implication is difficulties in control and monitoring of their operations and in interfacing with them to check deviant behaviour. Under this scenario, there is likelihood of transitions to vandalism. The fluid nature of existing co-operatives naturally retards their operating on a peer review template.

Scavenging in Owerri is dominated by males who are also youthful (12 to 35 years), of very low income, generally ill-educated and lacking in social network to access better occupations. The statistics from anti-vandalism authorities in Owerri very closely reflects these characteristics. Vandals in the last 4 years are 92 percent males and 70 percent between the ages of 12 and 3522. It is evident that the vandal population is basically a subset of the scavenging community.

CONCLUDING REMARKS

The paper has relied on information from anti-vandalism vigilante groups operating in Owerri, Nigeria to attempt answers to the problem of where to draw the line between the vandal and the scavenger. The public is at a loss on the seeming blurring of the lines separating these groups to the extent that scavenging which is otherwise a sustainable enterprise is stigmatized and painted with the same brush as vandalism. It is found that the act of vandalism for profit is realized in an ecological setting of poverty, failure of civic order, failure of governance and inadequacy in facility management planning. Vandalism is part of urban survival gambit at a personal level that proves very unsustainable at the public level. It is sometimes incremental in nature and is predisposed by failure of governance in management of
scavenging through integrating it in the waste management value chain. Vandalism presents an extreme form of scavenging, one that takes advantage of negligence of facilities’ vulnerability factors in their location and in other decision choices.

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IS THE MANUAL SUB DIVISIONAL PLOT APPROVAL PROCESS LENGTHEN THE PLANNING FOR A RESILIENT CITY IN JEDDAH, KINGDOM OF SAUDI ARABIA?

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INTRODUCTION
Delineating urban resilience is a tough task, however 100 Resilient Cities Program\(^1\) defines it as, “the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience”. Saudi Arabia constitutes nearly 70 percent of the GCC population of which 80 percent are residing in cities\(^2\); apart from that country is encountering grave economic, social and environmental challenges at present that increases pertinence of urban resilience.

In above regard this paper attempts to examine efficacy of plat approval process in Jeddah in special context to- ‘planning for urban resilience’.

URBAN Resilience
Origin of the term resilience could be traced back from Ecological Sciences, where scholars debated about the ability of an ecological systems to deal with instabilities and traumas produced by the elements, from outside the system\(^3\). An earlier study advocates that resilience could be understood as the determining capacity that is prevalent into the interrelationships within the system and the strength of the system to captivate the static and dynamic changes; it could be also seen as shock absorbing capacity of the system while upholding the functions and regulatory controls\(^4,5,6\).

Recently the concept of resilience has been adopted by multiple disciplines in various forms of human systems in city regions including economic (Economic Recovery), environmental\(^7,8\) (Ecological Urban Resilience) and social\(^9,10\) (Social Resilience) among others. Out of these doctrines efforts were made to find out the possibilities to be proactive for the recovery of a city region from the disasters\(^11,12\) that are anticipated because of climate change.

Brief conceptual framework outlined above prompts the urgent need of attention to be paid by urban planners and other concerned to prioritise urban resilience components into the whole spatial planning process.

Planning for Urban Resilience
Awareness on the threats from the predicted Climate Change has been increased in recent years that is because of substantial damage to resources, assets and lives incurred from extreme weather events including heatwaves, rainstorm and droughts\(^13\). Such types of catastrophes generate a series of enormous anomalies and stress for the city systems, hence it is obvious to plan for urban resilience.
A recent study\(^4\) has suggested 4 major concepts of a resilient city framework as the followings:

(i) Analysing urban vulnerability  
(ii) Planning for the uncertainty  
(iii) Focus on good governance, and  
(iv) Taking steps for preventive measures.  
All the above-mentioned concepts are pertinent for the city resilience; however, this study exclusively deals with planning processes that are the indispensable part of a resilient city framework.

**OBJECTIVE OF THE STUDY**

The key objective of the study is to explore, how the processes affects the planning of resilient city. Attempts are made to find out whether the manual sub divisional plat approval process linger the planning process in special reference to urban resilience.

**METHODOLOGY**

Two representative residential districts in Jeddah were chosen for the observation. Additionally, the in-depth interviews with land developers and government officials together with the residents. Qualitative approach of research was preferred for the study.

**STUDY AREA**

The second largest city of Saudi Arabia, Jeddah is the gateway for the two holiest mosques of the Islamic world. Famous as the bride of Read Sea (because of its location at the coast of Red Sea), Jeddah is important in term of culture, religion, trade and commerce. Ecology of the city is resultant from marine ecology, as well as desert ecology. With a population of 3.4 million, the city is spread over a total area of 748 Square Kilometres\(^{15,16}\). As the coastal and desert city are the most vulnerable from the risk of climate change, Jeddah was deliberately chosen for the study.

**FINDINGS AND DISCUSSION**

Saudi Arabia has begun, to transpose itself, towards climate change off late, that has also affected resilience of its cities. Risk from climate change is maximum in Saudi cities because of uncertain rainfall\(^{17}\). Whilst planning procedures especially the Land Subdivision plat approval processes (LSAP) is not well streamlined, with the prevalent challenges of Climate Change, that is rather compromising for the resilience of the city.

It is noteworthy that, the city of Jeddah has encountered extreme weather event twice in past decade. The quantity of rainfall has extremely increased in both events resultant into urban floods for which the city systems were not well prepared. The city was astonishingly waterlogged on the 25\(^{th}\) date of November in the year 2009 while the residents of the city were agonised from the threats of mounting storm water in residential areas ending up with the severe loss of lives and property (Fig 1). Again, the flooding disaster was repeated in 2010.

Land subdivision is the most important instrument of urban land development in the cities of Saudi Arabia which could be defined as following:
“Subdivision of land is the method of transforming a city plan into a reality. Many elements in the overall plan are realised at the time the land is developed: highways are dedicated, streets and alleys are paved, sewer and water lines and electric power are installed, new schools are constructed, transportation lines are extended, and police and fire protection is expanded. The city plan is either realized or it is lost in the subdivision of land. The control a community retains over land subdivision is the means by which the elements of the general plan are enforced.”

Figure 2 depicts the land development process in Saudi Arabia, in which land subdivision is a vital component and a decisive factor for the urban resilience. Impact of Subdivision Regulations were investigated into two residential districts of Jeddah; finding of which shows that the developers do not offer a finished housing neighborhood, or any part thereof, that contains vital structures like playgrounds, parks, mosques and pedestrian walkways among others. As an example, The Al-Mouhamadeyah district, is a low-density area, containing villas split into four subdivision plans that have been developed over different time periods. The Al-Naseam district is medium density, which permits apartment buildings inside two subdivision plans: Al-Naseam 1 and 2. The subdivision schemes were regulated, designed, planned and developed based on a single standard local SR formulated centrally at ministry level in Riyadh. The regulations ignore the uniqueness and exclusivity of each city.
There is no sign of innovation and sustainability in both districts. While interviewing the regulators, some of them preferred to be quiet; and the others responded in a gloomy fashion. However, recognising the inefficiency Subdivision regulations, remaining respondents were hopeful and anticipated additional advancements and changes in the Land Subdivision plat approval processes, that are supplemented with the demands and perceptions of the residents. Members of the Higher Advisory Committee also expressed the similar view.

Residents perceive that they are living in an unsafe and unhealthy environment because the road layouts encourage car use instead of walking or using bicycles; the services offered are scattered and the land uses are dominantly residential rather than being mixed-use. This scenario also obstructs social relations. Both districts were developed using conventional subdivision plans by different developers.

As perceived by residents, these problems exist because of the deficiencies in current Subdivision regulations codes, which lead to gaps between the implementation of the subdivision plan and people’s actual needs; also, because the end-users (residents) are neither consulted nor involved in subdivision plan preparation, approval and implementation processes. In a few cases, developers have not implemented their project as per Subdivision regulations and regulators have failed to enforce its proper implementation, due to unsuitable monitoring and enforcement mechanisms.

The study observes that absence of comprehensive spatial analysis makes the Subdivision regulations inefficient that is because of practicing manual methods. Timely response and proactive actions are extremely important to uphold urban resilience in which manual Land Subdivision plat approval processes are a big barrier.

**CONCLUDING REMARKS**

The study concludes that Land Subdivision plat approval processes (LSAP) in Saudi cities are governed through a stereotyped unified subdivision regulation, guideline (SRG); that is set by the Ministry of Municipal and Rural Affairs, Riyadh. Evidences from two representative residential districts in Jeddah divulges that manual approval practices makes the LSAP lethargic because of knowledge and capacity gaps. It was found that current LSAP leads to improper provision of urban
infrastructure and amenities on one hand; on other hand it cheers car domination in the newly developed areas while hampering walkability and weaken urban sustainability. Of which repeated urban floods and increased carbon emission are some of the reflections.

The major negative consequences of manual LSAP could be observed as followings:

i) It delays the spatial analysis, even the analysis conducted through manual processes is not comprehensive.

ii) Due to delay it is quite difficult to amalgamate essence of sustainability in the planning process; and

iii) The manual LSAP is a hurdle in the planning of Jeddah as resilient city.

Finally, the study recommends adopting the state-of-art geospatial visualization technologies with the capacity building of the Jeddah municipality officials to build a resilient city.

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INTRODUCTION
Sustainable urban design focuses on three dimensions of environmental, economic and social pursuit of increasing the quality of life and sustainability in the environment. In each of the three components of sustainability, the human-environment relationship plays an important role.
In recent years, attention to the economic benefit of a particular group has led to the loss of local communities from the process of changing built and natural environments in cities. Socio-economic inequalities and inappropriate climate change and many kinds of hazards were only part of the outcome of these currents.
The present study, with emphasis on ethical triple approaches, has sought a model for considering the human-environment relationship in the process of environmental formation. The review of ethical theories and theories related to human behavior in a context provides a conceptual framework that can be a model for redefinition of human actions and attitudes in the sustainable urban design process.
The present study was conducted in four sections. In the first section, a review of theoretical literature leads to a conceptual framework. In the discussion section, the dimensions and components of the above framework are reviewed and the results and considerations are discussed. The final section of the research also sought to answer the research question and introduce the related fields.

2. LITERATURE REVIEW
In this study, the review of literature with an analytical approach in three areas has sought to achieve theoretical framework of research; Ethical approaches to the formation of human and built environments, the human principles associated with sustainable urban design and the human-environment relationship in terms of morality and sustainability.

2.1. Ethical approaches
Reviewing the literature in the field of ethics of the built environment could clarify and differentiate the role of different ethical approaches in the built environment. Some scholars, take a teleological view that prioritizes outcomes. For example, in the book ‘Ethics and the built environment’ edited by Warwick Fox, some contributors focus on particular issues such as energy efficiency and environmental sustainability, while others deal with social issues to improve outcome of cities. In this mentality, the development of a City’s form is based on function or its goals and results and the main focus is on outcome and benefit. In this approach, the main question is ‘What does Built environment do?’
On the other side, some scholars, like Karsten Harries in his book ‘The ethical function of architecture’, consider ethics as the character of architecture. The main question of this approach is ‘What should architecture or urban design be?’ rather than ‘What does architecture or urban design do?’

Many philosophers, from ancient Greece to the present, have proposed ethical systems based on their own intellectual and philosophical principles. Similarly, since the early years of Islam, scholars have theorised about Islamic ethics. Understanding non-Islamic ethical classifications and their differences can shed light on the specifics of Islamic ethics.

At the same time, recognition of the different approaches within Islamic ethics is important in choosing the one that is most appropriate in relation to architecture and urban development.

Three main approaches in the field of normative ethics are Consequentialism/Teleology, Duty Ethics/Deontology and Virtue ethics. Some scholars also include contract ethics in this classification (e.g. Wasserman, Sullivan, and Palermo 2000, 48-61; Fisher 2010, 10)

**Different approaches in the field of normative ethics**

Teleological ethics: Teleological ethics is a branch of normative ethics that deals with ends. The defining feature: the weight given to the consequences in evaluating the rightness and wrongness of actions.

In this view, a deed is morally right only when it, more than any other possible alternative, results in the triumph of right over wrong or is performed with the aim of providing the conditions under which right can eventually overcome wrong.

In Teleological ethics goods are often connected with pleasure and value of end. Two types of consequentialism are Ethical egoism and Utilitarianism. Ethical egoism is a theory that a human being will always pursue actions that produce the most benefit for her/himself and Utilitarianism approach focus on the final goal which is the greatest amount of good for the greatest number of people.

- **Duty ethics**

Consider coordination/harmony or lack of coordination/harmony between a work and its duty as the standard by which to measure an ethical act or human action based on free will. The measure of good and bad is based on its relationship to a rule or a series of rules. This form of ethics opposes consequentialist ethics.
Kant’s famous ethical theory is the best known version of deontological ethics. For Kant, an incentive would be ethical only when it is rooted in a person’s sense of responsibility, rather than in external elements such as praise or blame or worldly or eschatological rewards (Kant 1997; Wood 1999).

- **Virtue Ethics**

Unlike utilitarian and deontological ethics, virtue ethics focuses on the character and virtues of human beings rather than their acts at a particular point in time or specific activity. The character of a moral agent guides all his/her behaviour throughout his/her lifetime.

- **Contract Ethics**

Thomas Hobbes (1588–1679): If a person, disregarding others’ benefit, tries to enhance his personal benefit, chaos would ensue. As a result, the person may not only fail to reach his/her goal (gaining more benefit) but may also lose what he/she had before, thus creating a dark and gloomy world.

Ethical values are nothing but people’s mental demands and have no objectivity. Therefore, nothing in the world is inherently good or evil. Some scholars, take a teleological view that prioritizes outcomes. For example, in the book ‘Ethics and the built environment’ edited by Warwick Fox, some contributors focus on particular issues such as energy efficiency and environmental sustainability, while others deal with social issues to improve outcome of cities. In this mentality, the development of a City’s form is based on function or its goals and results and the main focus is on outcome and benefit. In this approach, the main question is ‘What does Built environment do?’ On the other side, some scholars, like Karsten Harries in his book ‘The ethical function of architecture’, consider ethics as the character of architecture. The main question of this approach is ‘What should architecture or urban design be?’ rather than ‘What does architecture or urban design do?’

![Fig2. The main divisions in normative ethics](image)

### 2.2. Human principles of sustainable urban design

Urban design is defined by the researcher as the process, design, and organization of urban form and uses, including the design of public space, transportation systems, and open space.
Sustainable urban design as a baseline for weighing these trade-offs and aiding in identifying where a single design decision can accomplish synergistic goals. Sustainable development Principles are (Carmona, 2009):

- **Futurity** - we owe future generations an environment at least as rich and opportunities at least as good as those available today;
- **Environmental diversity** - maintenance and enhancement of various forms of natural capital underpin notions of sustainability;
- **Carrying capacity** - by remaining within the carrying capacity of environments, activities can be accommodated in perpetuity;
- **The precautionary principle** - environmental impacts are by their nature uncertain and because prevention is better than cure;
- **Equity / quality of life** - sustainability extends to the needs of people in that environments which fail to meet human needs and in which resources are poorly shared are unlikely ever to be sustainable;
- **Local empowerment** - sustainability is a process as much as an objective, requiring the acquiescence and preferably the active involvement of communities.

### 2.3. Human and environment relation

Some people-oriented approach encourage environmentally responsible behaviors. Environmentally responsible behavior is a complex and multifaceted issue. In this new find, special attention is paid to human beings and his behaviors as one of the main elements of environmental protection and the factor of strengthening the quality of the environment. Researches have shown that encouragements and punishments can be useful in creating ERB, but lose their effect in the long run, and they may disappear if they occur at the same time.

ERB is a function of a goal that has significant positive effects for the environment. The goal, in turn, depends on the individual's attitude toward his or her behavior and the subjective norm. Attitudes toward behavior are defined to some extent based on beliefs about environmental outcomes and the assessment of the implications. The norm of the mind is a function of normative beliefs (what others need to think about environmental problems) and personal motivation.

![Environmentally responsible behaviour](image)

*Fig3. Environmentally responsible behaviour*
The interaction between personal and underlying factors activates self-regulating processes that determine analytic strategies (levels of effort and perseverance) and ultimately performance. The model demonstrates how environmental motivations play a role in interacting and activating self-regulation processes (self-efficacy, goals, and emotional state) that determine analytic strategies to achieve effective ERB. Behavior is mediated through an interpretation of a person's circumstances, past experiences, culture, etc., and analytical strategies are used to achieve change. The goals of the people are influenced by their judgment of self-efficacy and their emotional reactions to the environment with how they interpret the situation. It seems that psychosocial motivations and self-regulatory trends, responsive behavior, and more attention to environmental change are activated.

### 2.4. Theoretical framework

Key the ethical dilemmas in urban design are:

- From individual to public: sustainability is relevant at a range of scales from the individual building to the city region.
- Responsibility for future
- Environment & human

![Fig4. Trends of individual to public benefits](image)

When procedural and legal means for controlling sustainability are not efficient, this kind of theoretical framework by emphasis on human and ethical approach in related to environment can be used as a guide for shaping sustainable urban design. To achieve this aim, it is necessary to understand how people experience and appraise their goals and needs in the process of shaping built environment and its changes over time and the factors that effect on.
3. DISCUSSION
The discussion section discusses the components of the theoretical framework seeking to explain them to the principles and criteria for sustainable urban design. Based on the theory of the environmentally responsible behavior towards the environment, the human-environment environment is influenced by human goals and motives, which range from external goals to intrinsic goals. Accordingly, these goals can range from self-centered to self-centered goals. What in this theory will lead to a more responsible relationship with the environment in the process of collective formation into the built environment, is to focus on the intrinsic goals on the one hand and the goals of self-efficiency on the other. In this domain of intervention, the environment will be based on intrinsic values and for the benefit of the public. On the other hand, through the threefold ethical approaches, the virtue ethic approach that emphasizes human values and prioritizes it can reinforce the intrinsic goals associated with the formation of a sustainable urban form.

On the other hand, according to urban design literature, spatial and self-regulation adaptation and self-efficacy are key issues in sustainable urban design, which emphasizes on the human being and internalizes urban design guides as the main actor in this process.

The Prevalent ethical paradigm of our time is Teleology. So there are some questions regarding to this approach:

**Questions regarding individual / public:** To some extent teleology follows social benefit? / Is utility ethics following social benefit for the sake of individual benefit? / Is this point of view limits to geographical border?

These qualities are personal in one sense, but they are also collective manifestations of attributes that sustain and are sustained by good practice; they are Aristotelian perfectible qualities of habitude exercised in the context of communal ‘flourishing’. So ‘good’ practice engenders not only excellence of achievement but also virtuous relationships within the practice community (Collier, 2005). So Personal benefit shift to public benefit that shows the excellence of Virtue ethics to Consequentialism.

**Questions regarding Future:** Is future’s benefits effect our benefits? Or future could benefit from us? / Is respecting next generations is a kind of responsibility?
Responsibility for the future is the crystallized essence of all responsibility of any kind, always and everywhere. It is not simply about the consequences of today’s choices, it is also about the way in which we envision the future, because this will shape tomorrow’s choices allow that world to take shape in our consciousness, and so we are mobilized to fight for a positive future, for the abolition of child labour, a more human work–life balance, rights of workers in the global economy, and sustainable development (Collier, 2005).

Questions regarding Environment: Who is the center of ethics: Human/Nature/Environment/God / should we respect Nature for our benefit? Or nature deserves respect? / What are the differences between these two approaches on respecting Nature? (Green Infrastructures / Basophilic City)/ Is Environmental crisis is an outcome of deontological paradigm? If yes, could this approach be a solution or part of solution?

Our present is what it is only because of the efforts of our predecessors to bring about a future where many of their problems have found solutions. Responsibility for the future is a condition of possibility for being responsible for the present. The requirements of sustainable development expresses the need to facilitate community structures in the built environment, the need to address the dangers of climate change, global warming and the rising tide of crime against persons and property. So both environment and human qualities are important. Issues such as energy efficiency and respect for the rights of others in the process of shaping an urban form are among the components that are directly related to man, his goals and attitudes inherent to him. In this study, we can specifically study the expected quality of sustainable urban design in this process, and in each environmental field, considering the cultural and moral variables and socio-economic differences, complementary recommendations in policy maker urban design achieved.

4. CONCLUSION
This research seeks to accurately explain the range of effective components in how to apply humanistic ethical approaches in the pragmatic process associated with sustainable urban design, with emphasis on responsive and context-based participation. Accordingly, three-dimensional ethical approaches were examined. The results of the studies show that teleology and deontology focus on right action. Teleology emphasizes the results or outcomes of actions and focus on personal benefit so we can’t gain the goal of sustainability in this approach. In other hand Human qualities are personal in one sense, but they are also collective manifestations of attributes that are sustained by good practice. Also, Responsibility for the future is not simply about the consequences of today’s choices, it is also about the way in which we envision the future. Deontology focuses on the action itself and considers the degree of harmony between a work and its duty as the standard by which to measure an ethical action also virtue ethics emphasizes good character. In these approaches, the future as potential event is allowed to interpret the present, so that in a sense it is a way of seeing what is known and understood, but with new insights and in new ways. Conventional ethical theory, whether consequentialist or deontological, rests on the premise that we can know and attain the good by using our reason to apply ethical rules in any given situation. On the other hand, changing of Teleology and deontology-based views into a virtue approach that emphasizes intrinsic goals can lead to a mechanism of human spatial adaptation in the environment for the benefit of maintaining the values of the environment and human self-efficacy resulting in maximum
participation in the interest of environmental sustainability. These conditions can be expected from a process of environmentally responsible behavior to the achievement of sustainable urban design.

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RESEARCH IN FORMAL AND INFORMAL SPACES: AN INSIGHT INTO THE SOCIAL AND PHYSICAL ASPECTS OF RESIDENTS’ USAGE OF PUBLIC SPACES IN ABU DHABI ISLAND

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INTRODUCTION

In several urban literature from the previous decades, the term ‘urban landscape’ has been described in different ways by professionals from different fields. Among these different descriptions, the one that defines urban landscape as open spaces influenced by the social and physical dimensions of the surroundings could be termed as fitting for the commencement of this research. Public open spaces have been playing a vital role in the sustainable growth of a city.

After a period of development with transport and infrastructure as the main concentration, the world is now moving in the opposite direction by returning the focus to creating sustainable public spaces. Public open spaces should be thought of as systems of interdependent parts and complex connections, a way to humanize cities. Public open spaces could be the ‘lungs of the city’, where people would be able to break away from their daily busy lives in the urban environment. It offers a broad range of opportunities for the community’s social and physical recreation. We, as planners, must bear in mind that a public open space is a mean to support social life and simultaneously these spaces also contribute to a city’s identity.

In the democratic society, urban public spaces are for people to enjoy nature and provide a gathering place for a social event. It is to demonstrate the characteristics of an urban landscape and real-life scenario stages. The important role played by urban open spaces is recognized both in the character and life it brings to towns and cities around the world. Several previous researchers have noted that parks not only provide the assets of community engagement but also increase the value of properties within the community. The need for this type of spaces has long been realized and explored in different contexts over the past few decades. When cities and neighbourhoods have prospering public spaces, residents have a strong sense of community; conversely, when such places are lacking, people may feel less connected with one other. Without great public places, there would be no great cities.

In order to have effective design and management of public spaces, it is essential to understand the role that those places play in people’s lives, and why spaces are used or ignored. Places are proposed, built, and assessed with assumptions about what should be done in them. It is important that urban planners and urban designers of Abu Dhabi take into account the availability of parks and open spaces as it has been proven to fulfill the needs and expectations for the residents’ satisfaction in their living environment which should lead to a sustainable city. Since the revitalization of Abu Dhabi Downtown is a main focus of the authorities, it is necessary to understand the current satisfaction level of the residents with their blocks of living or the sector within which they reside. The outcome of this study
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is expected to influence the future decisions for revitalization and establishment of a sustainable formal public open space network. With the city’s budget for landscape construction and revitalization under scrutiny at all times of its economic crisis, there is a necessity to convey the vitality of landscape in a city’s efficient function along with the benefits of having parks or open spaces within easy access.

METHODOLOGY
The study uses a mixed methods approach. It is a combination of qualitative methods along with quantitative methods, from which several had been set forth by Jan Gehl. It primarily includes on-site passive observations, field surveys, and interviews.

For the assurance of a qualitative research, the first step taken in the approach towards this research was to locate, survey and map the existing system of formal public spaces offered across the island. The authorities that are concerned with the planning and execution of open spaces were approached for the data on the existing network of open spaces. The information obtained from these various government entities was compared and personally visited to conclude on the existing network. A quantitative study was determined upon with the superimposition of this information obtained in order to understand if there was any inconsistency of information in the authorities’ existing network, as the future decisions of planning would rely on this information.

A survey was conducted among Abu Dhabi Main Island residents belonging to different groups of ethnicity, age, gender etc. that helps to understand different lifestyles. After the survey, a mapping of the identified social spaces, collected from the study, has been compared to the existing network of formal spaces to answer the research question.

Observations were carried out to study the existing patterns of use and behaviour in a recently installed urban plaza executed by the municipality. The plaza was observed for a period of 7 days during the evenings to understand the usage. Participatory observation supported to analyse the change in lifestyle of surrounding residents in their daily lifestyle.

FINDINGS

Network of existing formal parks and open spaces
The overlapping of information obtained from different sources reflected in the shortage of formal parks and open spaces for the population residing within certain areas of the main island.

Mapping of social spaces that exist in the surveyed sectors
As the interest of this study is also an attempt at understanding casual public interactions, which supports in throwing light on the deficiency of the formal public spaces. The study area was narrowed down to a total of twenty selected sectors. The sectors were selected to study different patterns in the emergence of informal social spaces within the sectors. Depending on the existing conditions of the sector, an initial typology has been developed to categorize the surveyed sectors. Three main categories have been identified based on which all the sectors could be sorted and these categories are namely, derelict sectors, revitalized sectors and low to medium density sectors. The first category, which is the derelict sector is mainly located in the old downtown of Abu Dhabi Island. This is the Tourist Club area and the sectors within the vicinity, are the first ones to have been executed. But since then there has not been any revitalization projects carried out during the time of this study. The second type of sector is the revitalized sector, the ones that had gone revitalization in the past five years. The last type, low – medium dense sectors has been identified to study the patterns in the suburban areas with low to medium population density towards the south of the island. A map has
been developed with the accumulated information. The map indicates the location of unbuilt urban spaces acting as public spaces. There are undedicated areas utilised for play areas, sports, gathering, sitting, smoking, people-watching etc. within the sector. The most notable habits is how the peak time of ‘Karak chai’ drinking goes up after office hours, till the late hours into the night. The mapping of each sector again shows how neglected spaces or corners become active with its informal usage and indirectly adds to the holistic identity of the city.

![Map of Abu Dhabi Island showing the location of the earlier mentioned sectors within the Main Island. The initial categorisation is also included in the map.](image)

**Figure 1.** Map of Abu Dhabi Island showing the location of the earlier mentioned sectors within the Main Island. The initial categorisation is also included in the map.

**Results from satisfaction survey of residents regarding their current area of living in Main Island**

From the mapping of informal spaces, the next step continued towards finding different lifestyle patterns generated from combinations and permutations of different characteristics of participants of the survey. The survey was divided into two parts, with the first part concentrating on the lifestyle of participants along with demographics, the frequency of open space usage, preferred recreation activities etc. The demographic factors taken into consideration for the combinations included gender, age, ethnicity, marital status, employment status etc. And these combinations were studied to understand if their lifestyle was impacted with sufficient availability of public open spaces within easy reach. One such example is the difference in frequency of open space visit between residents’ with these spaces within their block of living and those without. The residents were asked about the frequency of their visit to the nearest open space or park during the week. The frequencies were coded as four categories. These four categories were namely, ‘(1) Daily’, ‘(2) 2-3 times a week’, ‘(3) Weekends only’ and ‘(4) As per wish’. The main aim behind this question was to show the effect of non-availability of a park or defined open space within the block, on the person’s visiting frequency.

The higher frequent visiting codes which are (1) and (2) was more in number for the people with defined open spaces for recreational activities within their block. The lower frequency which is (3) had a higher percentage of residents without parks or open spaces within their sector of accommodation. The code (4) which was more opted by both category residents is owing to the higher percentage of working population in Abu Dhabi. Due to the working culture of the region, a major portion of the residents did not have a well-defined routine for their evenings in visiting parks. The residents who had chosen code (4) mentioned in their interviews that this depended more on their mood for the evening after work. Looking back into the drawback of the question was including code (4) which prevented the residents from really giving their evening recreation patterns a thought.
The participant is also asked to put forward their suggestions for the preferred type of recreational facilities that they perceive to be seen in their block. The demand for play areas for babies and toddlers was high as the expatriate stay-at-home mothers for this as a way to make new friends. As these mothers are not much exposed to the outside world otherwise did not have any other sort of activities to do on their own without depending on their husbands to reach home.

![Figure 2. Graph showing the frequency of open space usage by residents with and without these spaces inside their block of living.](image)

In order to start understanding the reason behind each type of frequency, it was important to know if there was any sort of recreational facilities in the interviewee’s sector of accommodation. 61% of the people interviewed, did not have any sort of recreational activities in their sector. They said that they either had to cross the main road and go to the opposite sector or go to a park which would be approximately 10-20 mins drive by car or taxi. And, their activities also depend on the fact if they are residing in the city with their family. 67% of the people were living in the city with their family. Some are living as a member of their joint family, which was the case with second-generation residents born and brought up in Abu Dhabi. And, joint expatriate families were more seen in the case of Middle East Asian and South East Asian families. Remaining were living as nuclear families, among whom the primary sponsor of the family, would be the husband mostly, had relocated to Abu Dhabi on their first job opportunity out of their home country, and after settling down have gotten married and started his family here. The residents who were living as self were either single or married with their family settled back in their home country. The married person(s) who are living by himself in the city, were mainly from the lower income group or lower middle-income group. The lower income group are earning a salary within a range of AED 1200 to 2000. They are unable to afford to bring their family to Abu Dhabi, as the cost of living is comparatively higher. In this case, these interviewees would visit their home country once in every 2 years. But, there were some who had not visited their families for the past 3 to 4 years in order to save their ticket fare. Instead, they would send cargo with all necessities to their family. Then, they would take a vacation of 3 to 6 months at a stretch, depending on their contract. The lower middle-income group consists of people, who earn a salary of AED 3000 to 5000. This group consisted of people who visited their home country once every year. Some of the other married men that were interviewed are working CAD technicians in the construction field. They said that they did not bring their family here, not because they could not afford it but mainly because they were concerned about saving for their future. The expenses of living in Abu Dhabi has increased in so many ways like accommodation, education, consumables etc. Since they are expatriates and are aware of the fact that they would have to leave Abu Dhabi any day when they
are asked to, they have saved and built assets to secure theirs and their children’s future. Another trend similar to the earlier trend of not having families in Abu Dhabi was also seen in some at the managerial positions and are from the high-income group. Some members of this group had migrated to either North American or Canadian cities and have their families settled there. They plan to work from Abu Dhabi and buy their assets back at their new city. Some of them are here in Abu Dhabi for a certain period of time, such as a particular job contract or for research.

For an urban planner, it is very much vital to understand if the residents are satisfied with their current block or sector of living on the island. This was the intention behind the second part of the survey. In the second part, the participant is asked to do a rating using the 12 Quality Space Analysis tool. Each participant had to do the rating for two different scales, mainly for Abu Dhabi Main Island and their current block of living. The rating is done using Poor, Average and Good. This had to be done for each criterion from the 12 qualities. All of the 12 factors were put forward to the residents, with examples, so that they could easily understand from which aspect the rating was to be considered. The survey was conducted mainly through one to one interviews. It was also distributed online.

![Figure 3. Chart showing the overall rating done by the participants for Abu Dhabi Island/City, using Jan Gehl’s 12 Quality criteria. Factors of protection against crime, violence, and traffic rated highest.](image)

In Fig.3 and Fig.4, the X-axis shows the percentage of participants while the Y-axis is for the 12 qualities. After the comparison between the two ratings which is Fig.3 and Fig. 4, it is understood that the residents are happy to be living on the Main Island, however, they are not content with their living surroundings. The only factors which were highly rated at both scales were the protection of pedestrian against traffic and protection against crime/violence. As many of first established sectors within the Main Island is in need of urgent revitalization most of the criteria ended up being marked as Poor in the remaining 10 categories.

![Figure 4. Chart showing the overall rating done by the participants for their sector of accommodation, with protection against crime, violence, and traffic.](image)

The revitalized sectors show improvement in providing to pedestrians’ needs by limiting the vehicular access to a few selected roads within it. But the sector adjacent to Central Market is very highly dense,
to provide multi-functional open spaces. The neglected play area in this sector shows the result of assuming the residents’ optimum location for such uses.

Figure 5: Neglected play area in recently revitalised sector E-06. The people seen in the picture are men smoking in the area.

FUTURE OPPORTUNITIES
The survey developed for the research could be utilized to understand the lifestyle of residents in particular sectors. This will in planning for the future revitalization of sectors within the island. The same could be repeated after revitalization as well in order to understand the impact of the changes in the residents’ lives. The social mapping could also be conducted over a longer period of twelve to eighteen months, as the harsh summers of the island have a tremendous impact on the lifestyle of residents. Therefore the same areas have to be mapped at least twice during the year. During spring and winter, more active usage of the open spaces could be observed which will support in guiding the research to optimum conclusions.

CONCLUSION
Even with an admirable existing network of open spaces for a young city, there is still an insufficiency of social spaces. Spatial practices of residents in most of Abu Dhabi’s dense neighbourhood tend to show that new functions are given to unbuilt urban spaces, in order to cope with the insufficiency of a formal offer. It is important to remember that both the physical and social dimensions of a city equally contribute to sustainable open spaces. The daily routine of a resident along with variables like proximity, weekday or weekend, preferred activity, weather etc. have an influence on the usage of public space. Neighborhood parks and urban plazas could help to increase the connectivity between the city parks and make it accessible to each and every one. Connectivity could also put forward the feeling of having a variety of experiences within one’s easy reach. It is very crucial that as planners and designers of the society, we keep in mind that planning should allow for gaps, overlap, and adaptation for planned and unplanned uses. The availability of open spaces has proven to fulfill the needs and expectations of the residents in the living environment which will, in turn, lead to a socially sustainable city.

Newly designed public and semi-public spaces with modernist and control features can become important arenas for social encounters among strangers. Therefore we as urban planners and designers, need to give more thought about design through the body of users themselves as only they can tell us about the limits and opportunities of the plan. In practice, all this requires a change in mindset, since clients expect public spaces to function effectively. However, we need to argue that there are more
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gains than losses. The real vitality of a place lies in its messiness. To reject this principle is to lose faith in the possibility of a socially diverse public realm.  

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SMART CITY SMART CONSTRUCTION

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INTRODUCTION

Studies have shown that one of the main reasons BIM is not being enthusiastically adopted by the Architectural, Engineering and Construction (AEC) industry in developing countries is the lack of return and value for money in its investment\(^1\)\(^2\). This paper speculates and looks beyond BIM level 1 and 2 to BIM level 3, Smart City management and Big Data analytics to highlight the potential of investing in BIM technology. BIM level 3 is the integration of electronic information with full automated connectivity and web storage. BIM Level 3 proposes a construction industry that is smarter and more digitally-enabled than BIM level 2\(^3\). At present information in a BIM is supplied by professionals during building production processes. It is not often that large, varied and unstructured information is used in a BIM. It is argued that BIM will in time take advantage of Big Data generated by the Internet of Things, drone imagery, mobile devices and sensors that provide real-time digital information. Ismail\(^4\) refers to the so-called “5V” in Big Data: volume, variety, velocity, veracity, and value with an emphasis on volume, variety and velocity. Volume, variety and velocity indicate huge amounts of data acquired constantly which become very difficult to store and process. At present a single BIM model used for design, evaluation and planning does not use unstructured information and Big Data infrastructure. However if BIM is expanded from a single building model to include buildings and infrastructure in an entire city where geo-referenced buildings and real-time information are linked then BIM models can become future Smart City models. Due to the volume, variety and velocity of information generated by a Smart City model Big Data analytics becomes essential. A BIM model is traditionally centred on information while a Smart City model is centred on the flow of information. The extension of the BIM model to a Smart City model will require young construction managers who have grown up with digital technologies to take advantage of this new wave of innovation and its evolving markets. In the following sections of this paper, the role of BIM in the digital revolution, the Internet of Things, Big Data and Smart Cities are highlighted. Next, BIM implementation in China and South Africa is reviewed using three recent surveys. Big Data and Smart City infrastructure is presented as a catalyst for BIM implementation and motivation for construction firms to start investing in BIM in the long term. It concludes with the proposition that BIM can benefit from Big Data infrastructure and suggests that BIM will probably expand from a single model that focuses only on one building to multiple building models in an entire city.

LITERATURE REVIEW

Ismail\(^4\) (2016:1) refers to Big Data as being information that cannot be analysed using traditional tools and processes. The advancement in communication technology and decreasing cost of data storage allows organisations to record almost every activity, however are not able to derive value and analyse it sufficiently. Being able to drill down information to enable better decision making is key to
competitive advantage. According to Jin Big Data is the overall term that refers to the explosion in the quantity and diversity of high frequency digital data. Ismail states that the volume and detail of data is being generated through the Internet of Things. The internet of things is the connecting and integrating of space (physical and informational). With the integration of such advanced information techniques and the spatial monitoring tools, e.g. GPS and GIS, it is possible to record the spatiality of human behaviours as big data. Ismail refers to the Internet of Things as intelligent devises such as sensors, actuators, data processors and relay nodes. Isikdag explains further that the Internet of Things includes the communication between devices. Wearable technologies such as wristwatches contribute to the enormous amounts of information generated. Variety refers to various types of organised and formless data generated continuously through emails and social media, Instagram photographs, Tumbler posts and Skype calls to mention a few. Velocity of data refers to the demand for real-time streaming of information for example on a cell phone. Pattern recognition and clustering has become an important tool for business in analysing their client’s needs and behaviour and recognising trends.

A Smart City’s functionality is enhanced through Big Data analogous, cloud computing and the Internet of Things. Ismail identifies the city economy, mobility, environment, people, living, and governance as the six dimensions that need to be enhanced for it to be considered a Smart City. Wu refers to a Smart City as an idea born with intimate relationship with data. It’s a city that uses techniques to improve urban services, civilian, business, transportation, communication, water, sources and other urban core systems.

Isikdag refers to BIM as a methodology related to sharing of information in real-time over the internet. BIM can be used as a Space Linker that links macro and micro urban spaces. The function of BIM is not only sharing building information but to also providing virtual simulation of construction processes. BIM based construction management provides crucial information for facilities such as airports, shopping malls etc. that need to be integrated with city information for Smart City monitoring and management. At present BIM is the design and construction of the buildings and does not place the building in the wider city context. The reality is that at present architects are the main users of BIM with the seamless integration and handover between the various phases still in the development stage.

Two data platforms that have been develop to exchange data between different modelling software applications include CityGML designed to store digital 3D models of cities and the Industry Foundation Classes (IFC) to describe building and construction data. The IFC format can be transformed so that BIM can be imported into a city model.

BIM is certainly part of the digital revolution which has resulted from the rise of the Internet of Things, Big Data and Smart Cities. BIM Level 3 will include post-construction data where data is captured to ensure more efficient building production processes. Level 3 will also offer real-time information using sensors that will be processed through Big Data analytics. At present the use of drones and Unmanned Aerial Vehicles (UAV), Point clouds provide significant value when it comes to BIM workflows. With this technology in mind BIM will potentially provide updated information about the expanding built environment in a city both inside and outside. Not only will BIM provide detailed information about a building design and construction but also its impact in the city. In understanding a buildings asset, the impact of building’s can be determined and how it interacts with external factors such as infrastructure demands, green spaces and pollution. A variety of 3D models currently being used in city planning generate a vast amount of information used for the management of Smart Cities. Conceptual 3D modelling, using Computer Aided Design (CAD) provides high levels of precision and accuracy while BIM displays building geometry, light analysis, and the quantity and semantics of buildings. The City Engine, created by ETH Zürich, allows automatic generation of
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buildings in an urban matrix based on predefined aesthetic and architectural rules. Bentley’s 3D City GIS creation of Smart City models analyses and simulate specific processes. The Digital City produced by Autodesk provides visualization, analysis and simulation of future interventions in a city.

BIM IMPLEMENTATION IN CHINA AND SOUTH AFRICA
A study done by Jin\textsuperscript{12} ‘BIM Investment, Returns, and Risks in China’s AEC Industries’ focused on respondents perceptions of the risk and returns of BIM implementation and how these risks can be mitigated and what measures can be introduced to enhance returns. The survey sample included architects, engineers, academics and software developers. The survey consisted of 81 respondents. Results show that BIM is becoming the driving innovation in China’s construction industry however respondents identified collaboration amongst project participants as one of the main risk factors. The reason given for this is insufficient standardisation of BIM within the Chinese AEC industry. It is suggested that stakeholders should all develop BIM-based collaboration procedures in order to mitigate this risk. The survey revealed other major risks as being limited functions within existing BIM software tools, high cost of short-term investment, adjustments needed in business procedures and lack of BIM-skilled employees. Despite these risks it was revealed that AEC practitioners felt the most valuable aspect of BIM is its ability to improve collaboration amongst stakeholders through visualization. One of the concerns highlighted is that construction firms are not investing in their own BIM capacities instead utilising subcontracted BIM services. This trend results in construction firms lacking in BIM-skilled employees, incapacity of BIM software and high cost of short-term investment. According to Jin\textsuperscript{12} marketing the firms BIM capability is crucial in ensuring the desired returns and viability.

The BIM Survey conducted by the South African BIM institute (2016)\textsuperscript{13} revealed a poor response from ten of the largest construction firms in South Africa. Harris\textsuperscript{13} believes construction firms are following trends rather than taking the lead in BIM implementation. The survey sample consisted of 125 respondents consisting of 1 from Government, 1 Asset Manager, 4 Contractors, 4 Planners, 4 Contracts Managers, 4 IT Services, 9 Draughtsman, 11 Engineers, 11 Project Managers, 15 Technical experts, 17 Quantity Surveyors, 22 BIM Managers and 22 Architects. The respondents came mainly from three provinces in South Africa: Gauteng (45%), Western Cape (31%), Kwa-Zulu Natal (8%) and ‘other’ (15%). According to Harris\textsuperscript{2} construction firms who have adopted BIM technology strategy have done so using a silo approach. The 2016 survey revealed that most construction firms were using cloud based document management systems that were not BIM specific, not secure and hindered by internet connectivity. It was revealed that construction firms felt there is the lack of internationally certified BIM training programs available for construction personnel in South Africa. It was also revealed that the lack of interest in South Africa from international software vendors is a reason for stunted interest in BIM. A large percentage of respondents (81%) were concerned that there is no local mandate by National Department of Public Works concerning BIM standards. Harris\textsuperscript{13} believes that the construction industry needs to change its industry structures as well as technology used in order to facilitate BIM implementation.

A study done by Pinfold\textsuperscript{14} was conducted in Cape Town, South Africa investigated the use of innovative technologies during the five building construction processes. These technologies included BIM, point cloud scanners, remote sensing imagery obtained from a drone, location awareness technology, bar code scanning and CCTV monitoring. The perceived advantage of these technologies during the five stages of construction being initiating, planning, executing, monitoring and closing was explored. The focus of the survey was on congested construction sites in the central business district of
Cape Town where 130 questionnaires from 1 Contracts Manager, 1 Laboratory Technician, 1 Junior Contracts Manager, 1 Site Supervisor, 2 Architects, 2 Facilities Managers, 2 Junior Engineers, 4 Technicians, 6 Consultants, 7 Forman, 7 Site Agents, 7 Surveyors, 12 Project Managers, 16 Junior Quantity Surveyors, 28 Engineers and 33 Quantity Surveyors were obtained. BIM was perceived to be potentially the most useful technology across all five building production processes. Although construction personnel believed that BIM significantly enhances building production processes only a few believed BIM was a good investment for the firm they worked in. Respondents blamed the lack of BIM standards in the construction industry as a major stumbling block for BIM implementation. Respondents agreed that the construction industry needs to be encouraged to convert from paper documentation to digital information systems.

The three surveys indicate that despite the risks and low uptake BIM is perceived as important in today’s construction industry and has the potential to become the information backbone of the industry however the lack of industry standards in both South Africa and China is hampering the commitment of construction firms to make far reaching changes needed to implement BIM. The surveys indicate that construction manager’s acknowledge the potential of design-driven BIM however underestimate the potential of data-driven BIM. A large amount of useful unstructured data is being generated in the construction industry that is not machine readable or interoperable. Big Data infrastructure is needed to make sense of the large amounts of data being produced in the construction industry. Big data is vastly under-utilised in Africa and hampered by lack of big data infrastructure and software, human capital, regulatory frameworks and finance.

BIM, BIG DATA AND SMART CITY’S IN CHINA

In September 2013, Guiyang city in the Southwest Guizhou province initiated the Chinese equivalent of Silicon Valley. The ‘Guian New Area’ with cutting-edge Big Data technology is intended to build the country’s “top tier” cloud computing hub by 2020. Furthermore Shanghai’s Pudong New Area’s data engineering centre and BIM & 3DGIS public service platform in China was launched in July 2017 and is the latest achievements of the area’s Smart City construction. Aiping believes the integration of BIM and 3DGIS in China will greatly contribute to Smart City construction. The centre will focus on the integration of data resources, data application, the establishment of Big Data industrial standards, and the optimisation of the industrial environment. The BIM & 3DGIS platform is the first of its kind in China and functions as the information infrastructure of a Smart City and forms an important part of Smart City operation and management and will concentrate on uniting the area’s BIM data resources and promoting BIM & 3DGIS innovation and application. It will also work on building a Cloud Pudong featuring 3D visualization, real-time sensing, and data-driven smart operation. Jin points out that governmental policy has indicated the government’s commitment to BIM as the mainstream innovation in China’s construction industry. According to Rogers the Chinese government has set a target of the end of 2020 for the big construction and design companies to be BIM ready. However Rogers reveals that the whole structure, hierarchy and supply chain in China differs vastly from Western countries like United Kingdom.

Cheng believes that Big Data has high relevance in developing countries however are generally less developed in terms of IT infrastructure. Evidence has shown that the digital divide between developed and less developed countries can be bridged by adopting the Big Data approach. Recent reports indicate that China’s economy has shifted in favour of tech companies and has become home to more technology firms than the United States. Chinese government has made massive financial investments in research and development thus attracted both domestic and international companies. Cheng
believes there is considerable potential for Big Data in the development sector in China. It is believed that China’s investment in Big Data infrastructure will generate significant financial value across sectors.

FINDINGS
BIM implementation in developing countries is lagging behind compared with developed countries such as the United Kingdom. This is due to the lack of enforced BIM standards which results in the reluctance of construction firms to invest in the BIM concept. In South Africa and China BIM implementation has been successful in some prestigious projects in the capital cities however is not yet an industry standard. The evidence presented in this paper suggests the future of BIM is not in a single model but in a model that incorporates multiple BIM models that represents a Smart City model. Smart City model rather than BIM models can take advantage of Big Data analytics. Big Data infrastructure is needed to manage the volume, variety and velocity of data generated in the construction industry. The Chinese government has invested heavily in Big Data infrastructure in Guiyang city in the Southwest Guizhou province with the development of the ‘Guian New Area’ which is intended to build the country’s “top tier” cloud computing hub and cutting-edge Big Data technology. Shanghai’s Pudong New Area’s data engineering centre and BIM & 3DGIS public service platform is the latest achievements of the area’s Smart City construction. It is suggested that these Big Data, Smart City infrastructure developments will be the catalyst needed to encourage construction firms to invest in BIM in the long term and to contribute to its trajectory from its predominantly building-focused models to models that encompass an entire city. The South African government needs to follow this trend and invest more in Big Data infrastructure if it is to keep up with this the digital revolution.

CONCLUSION
BIM technology refers to the management of information on a single building project however can also include multiple buildings with infrastructure linked to an entire city. The delivery of functional, maintainable, safe and secure buildings with easy access to information in real time provides the infrastructure needed of a Smart City. Smart Cities can be seen as a collection of individual buildings (BIM) and infrastructure that are associated geographically in physical space linked to the Internet of Things and Big Data. Cities in developing countries like China are becoming smarter with the government investing more in Big Data-infrastructure and the Internet of Things. Smart Cities will demand smart buildings and smart construction. The building construction industry is typically slow to adapt to change and needs to embrace BIM processes and raise the quality of the industry to a much higher and sophisticated level. Construction firms need to realise that the high upfront costs relating to software and hardware setup and BIM user training, combined with the difficulties of incorporating BIM into existing workflow operations and management systems will be compensated when BIM expands from a single building models to multiple building that include infrastructure in an entire city.

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INTRODUCTION

At a global level, the critical importance of the built environment generally and the city specifically as the focus of sustainable planning, design, and development considerations was emphatically announced in the 1987 United Nations’ study Report of the World Commission on Environment and Development: Our Common Future.¹ In the three decades since Our Common Future, efforts at policy formulation and implementation – whether in higher education, government, or industry and following the two general themes of natural and built ecologies and economies -, have moved into discipline-specific initiatives at a national and regional level.

To take one example at a national level, perhaps the most visible and immediate consequence of the 1987 United Nations’ report in Australia was the establishment of the Prime Minister’s Urban Design Task Force. The Task Force’s final 1994 Report recommended, in addition to near and long-term proposals for government and industry, that training in urban design become part of all university programs in architecture and those associated disciplines contributing to the development or renewal of the built environment. The adoption of a multidisciplinary approach was also called for, the Report stating that: ‘Programs are needed to incorporate multi-disciplinary problem solving at an advanced level… [including] knowledge of urban theory, administration, culture, and history.’² The Report goes on to state that in addition to ‘broadly based urban design education appropriate to undergraduate teaching… there needs to be specialist graduate education in urban design...’³

More recently, momentum for a carefully framed approach to university urban design curricula has been called for in international studies commissioned and published by public and private entities such as The Rockefeller Foundation.⁴ In this ‘century of the city’, one assumes that if settlement patterns follow ‘urban revolution’ trends as suggested in Our Common Future, then urbanisation will create increasingly pressing challenges in coming decades. The training of future generations of urban design professionals will as a consequence be a mounting priority for universities around the globe.

Urban design as a distinctive university concentration or program emerged in the 1960s as a reaction in part to the urbanistic shortcomings of town planning. Judged especially disastrous in terms of the city were the effects of segregated land use and continuous open space planning.⁵ What emerged as a largely architect-led and discipline-specific response to post World War Two reconstruction efforts in Western Europe in particular, and massive urban renewal projects undertaken in the 1950s and 1960s globally, a review of university urban design programs has more recently received further importance. Approaches to urban design curricula, whether urban planning biased or urban design biased, assume that good city form can contribute to the health and well being of communities. Such traditional
approaches to urban design curriculum have however been severely challenged by the new scale and complexity of intertwined forces and values at work in contemporary cities. In particular, the growing recognition of episteme-changing conditions supports the timeliness of revisiting the content and structure of university programs. Though other factors exist, those impacting conditions that seem most urgent now are a rise in environmental consciousness accompanying increasingly sharp climate change science, an unprecedented and increasingly fast-paced global surge in urbanization, and revolutionary advances in digital technologies which include evolving capacities in data capture and modelling.

Despite the clear need, there appears to have been no general, considered examination of the overall structure and key elements of urban design curricula whether at a national or a regional scale. Within Australia, for example, a search under the key words urban design, urban planning, city design, and city planning result in only one hit on the website of the Office of Learning and Teaching, the Australian Government agency responsible for advancing university-level education. Of research and policy papers listed under architecture that might potentially address aspects of urban design curricula, only Ostwald refers to urban design and only in the context of a discussion of other design disciplines.

Within this context, it is more than timely for a sustained and coherent examination of a contemporary urban design curriculum and this paper is a preliminary step in that investigation.

Key Questions

To begin to develop an urban design curriculum to meet local, regional, and global challenges and educate future generations of urban designers and other built environment professionals, this paper surveys four approaches to, and identifies key elements of, a university urban design curriculum for contemporary cities. The following questions underlay the paper:

- **Question 1.** What general direction should an urban design curriculum for 21st century cities take? Should it be more focused on urban design practice, more biased to historical and theoretical aspects, or more research-led and future policy focused?
- **Question 2.** Should the urban design studio remain the core of the curriculum? If so, what kinds of studio problems are most effective and relevant today: should the focus be on normative institutions and urban scale problems (infill, grid completion, extension) or more focused on future infrastructures, transportation, open space planning, and regulatory controls and policy?
- **Question 3.** In addition to the studio, which other core courses might make up the balance of the curriculum? Alongside traditional topics such as history of city form, visualisation and modelling, methods of urban design practice, public policy, and urban economics, what other topics should be considered? Should they be delivered via case study or practice-based learning?
- **Question 4.** In order to best prepare students to move into a wide range of urban scale built environment industries, which kinds of collaborative, interdisciplinary models might be adopted in the delivery of a contemporary urban design curriculum to ensure content-focused discipline developments are included? Alongside architects, planners, engineers, developers, urban economists, and government agencies, what other disciplines or stakeholders should be included?
- **Question 5.** How best to deploy contemporary modelling, sustainability science, visualisation and communication technologies in the delivery of an urban design curriculum to ensure the highest standard of teaching and learning?
A comparative analysis of four postgraduate programs will serve as case studies, providing base materials for this initial phase of research. The programs are Columbia University’s Master of Science in Architecture and Urban Design, the European Postgraduate Masters in Urbanism, Harvard University’s Master of Architecture in Urban Design, and Melbourne University’s Master of Urban Design. At the time of base data capture (mid 2017), these four were selected from a short list of some three-dozen postgraduate urban design programs and will serve to identify differences and similarities in orientation, core studio focus, and degree structure. While other programs could have been added, given the relative brevity of this paper it was decided a more selective examination of a limited number of university programs, presenting diverse attributes, was the most productive and efficient approach at this stage.

A comment on program or degree types not considered at this phase is worth making to further highlight the paper’s focus. I did not include programs more traditionally associated with urban planning, the emphasis of the research on postgraduate design-led degrees in what might appropriately be characterised as a sub-speciality within university architecture departments. So, for example, I did not consider including MIT’s Master in City Planning program as the program is clearly within the discipline of planning and not architecture. This is not to say there is not much of the degree content that would not productively overlap with a course in urban design nor that in a broader study the interrogation of the differences between urban ‘design’ versus urban ‘planning’ would not be a necessary and constructive question. Nor did I consider programs that are more clearly built around future policy and regulatory professionals as opposed to designers. Of the many strong programs in this strand, The New School’s Master of Art in Theories of Urban Practice can serve as a placeholder to be included in a future larger study.

ANALYSIS

Based on a review of the structure and key study areas of some two-dozen programs, five factors have been identified and are used in the analysis of each of the programs. This limited set of factors, I believe, provide a matrix of terms sufficiently broad to allow one to identify important characteristics within each urban design program and allow for comparisons among the larger set. The five factors are:

- General pedagogical orientation, whether toward practice, history, policy, or theory
- Program structure and duration
- Studio thematics
- Other core study areas
- Scale of curriculum focus, whether the street, the block, the city, or the territory

Though terminologies vary nationally and regionally, for simplicity’s sake in what follows I use the term program to refer to the overall degree-granting framework; unit or course interchangeably to refer to the sub elements within the degree program; and points to designate the relative value of any one unit toward course or degree completion.
Columbia University, Master of Science in Architecture and Urban Design (MSA&UD)

Columbia’s MSA&UD is a three semester program with a strong focus, according to program descriptors, on ‘the pedagogical potential of the design studio as a site of research, visionary speculation and critical inquiry.’ See Table 1. The idea of urban gradients at multiple scales is one way to characterise the program both organisationally and in terms of pedagogical ambition. Gradient is a way to describe the program’s focus on ‘networks’ as a set of ‘landscapes’, landscapes in the program’s terms that are inclusive of food, energy, resources, culture, transportation and culture.

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
<th>Semester 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Design Studio I (New York) (9 pts)</td>
<td>Urban Design Studio II (New York Region) (9 pts)</td>
<td>Urban Design Studio III (Global conditions) (9 pts)</td>
</tr>
<tr>
<td>Urban Design Seminar IA (3 pts)</td>
<td>Urban Design Seminar II (3 pts)</td>
<td>Urban Design Seminar III (3 pts)</td>
</tr>
<tr>
<td>Seminar IB (3 pts)</td>
<td>Elective (3 pts)</td>
<td>Elective (3 pts)</td>
</tr>
<tr>
<td>Digital Techniques for Urban Design (3 pts)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The studio sequence moves from using the city of New York as a laboratory for experimentation, to New York’s region - currently focusing on the Hudson Valley according to the program website - to global cities and regions. Accompanying the general studio descriptions, the thematics of layering and flows is present. Studio I is about processes characterised as ‘biophysical infrastructures… and ongoing socio-spatial change.’ Studio II is about ‘interdependencies and interactions… [and] shifting … conditions’ – whether ecological, topographical, infrastructural or democratic, and taking the region as its field of experimentation. Studio III looks beyond the region into other settings of global urbanisation.

Balancing the studio stream is a cycle of core units that bridge the histories of urban form and urban design movements, to urban analysis, to digital modelling and representation. Distinctly, there is a pairing of a specific seminar with each studio. Thus the second design studio (Urban Design Studio II on the city-region) is paired with Urban Design Seminar II with its focus on regional scale issues such as zoning and changing constructs that attempt to provisionally frame contemporary complexities, such constructs including bio-urbanism, junk space, and chaos theory. Columbia’s emphasis on design over planning is further revealed in program loading the first semester with a dedicated unit in digital techniques.

Different from other programs as discussed below, MSA&UD only allocates 7% of the program to electives, the remaining 93% being program core. The program structure and core elements, with course names and topics is set out in Table 1. As in most programs, studio units are weighted three times the credit point value of other seminar or elective units toward degree completion. Thus a studio unit is worth 9 points in Columbia University’s MSA&UD, and an elective unit 3 points. Consistent with other programs, studio constitutes 50% of the program. In terms of scale, MSA&UD is emphatic about the city as its field of investigation, with the ability to scale up to the territory and back. The program’s specific city – as ‘an agent of resilient change’ – may be taken as shorthand for the underlying approach.
European Postgraduate Masters in Urbanism (EMU)
The EMU is distinguished by a geographical and institutional hybridity overlain by a strong thematic focus. Four EU universities have joined in a consortium to deliver the degree with students having a home university at which they must complete 50% to 75% of the four-semester degree – including the final thesis semester –, with the remaining percentage completed at one of the other host universities. The four universities are Universitat Politecnica de Catalunya, Barcelona, Spain; Delft University of Technology, Delft, The Netherlands; Katholieke Universiteit Leuven, Leuven, Belgium; and Universita IUAV di Venezia, Venezia, Italy.

In the EMU program launch brochure, a clear orientation along specific urban challenges translated as studio problems is set out.9 The EMU organises itself around a set of local urban scale challenges confronting the European city and territory, with discursive frameworks in theory, method and technique of a more generalizable and global nature. The key challenges appear to be aligned more or less with the four university settings at the time of forming the consortium and were synthesized in the following themes: territories of dispersion, or extended settlement types; post-industrial sites, including marginal or peripheral urban areas or obsolete industrial sites; mobility and network cities, such as new kinds of urban agglomerations and airport cities; cultural landscapes, including urban-scale heritage and conservation issues.

In order to minimise the complexities of possible study plan combinations, in what follows I briefly focus on the program as currently delivered at Delft University of Technology.10 Table 2 sets out the typical study plan.

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
<th>Semester 3 - Exchange</th>
<th>Semester 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Studio: Urban Regional Networks (15 points)</td>
<td>Studio: Constructing the Sustainable Delta City (15 points)</td>
<td>Courses taken at one of the other consortium host universities (30 points)</td>
<td>Graduation Thesis (30 points)</td>
</tr>
<tr>
<td>Theory: Theories of Urbanisation, Regionalisation and Networks (5 points)</td>
<td>Theory: The Sustainable City (5 points)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methodology: Regional Strategies and Territorial Governance (5 points)</td>
<td>Methodology: Research and Design (5 points)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology: Design and Planning Support Tools (5 points)</td>
<td>Technology: Urban Design and Engineering (5 points)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In terms of studio thematics, Delft’s EMU program is organized around a set of key issues that are intended, according to program information, to ‘reflect contemporary challenges within cities and territories.’ Within the Delft program, there is a studio that explicitly addresses a local condition characterised as the Delta City. The program balances this specific urban-scale problem with a
semester taken at one of the other consortium universities – Barcelona, Venezia or Leuven - and a systematic coverage of theory, methodology, and technology sub areas. These core program units appear to provide a broad conceptual and technical grounding, with content ranging from urban form theories, governance at regional and territorial levels, research methodologies, infrastructure technologies, and representation and modelling tools. A full semester or 25% of the program is devoted to individual student-led research topics.

**Harvard University, Master of Architecture in Urban Design (MAUD)**

Harvard’s MAUD describes itself as a ‘post-professional studio based program… [for those] who have a strong interest in engaging the practice and theory of contemporary urbanism.’ This four-semester program shares a core of units with students pursuing a Master of Landscape Architecture in Urban Design degree. The program allows a high degree of individualisation as compared to other programs considered in this brief study. It has built-in cross-disciplinary capabilities, allowing students to align individual study plans with any one of three departments within the Graduate School of Design – architecture, landscape architecture, urban design and planning – and within that track further stream more toward a studio-based program or one concluding with a more traditional thesis.

**Table 3. Harvard University, Master of Architecture in Urban Design (MAUD), simplified program plan**

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elements of Urban Design – Core Studio (8 pts)</td>
<td>Urban Planning Option Studio (8 pts)</td>
<td>Option Studio (8 pts)</td>
<td>Option Studio or Thesis (8 pts)</td>
</tr>
<tr>
<td>Cities by Design I (4 pts)</td>
<td>Cities by Design II (4 pts)</td>
<td>Preparation of Thesis Proposal (4 pts)</td>
<td>Elective (4 pts)</td>
</tr>
<tr>
<td>Defining Urban Design (4 pts)</td>
<td>Required subject area course (4 pts)</td>
<td>Required subject area course (4 pts)</td>
<td>Elective (4 pts)</td>
</tr>
<tr>
<td>Required subject area course (4 pts)</td>
<td>Elective (4 pts)</td>
<td>Elective (4 pts)</td>
<td>Elective (4 pts)</td>
</tr>
</tbody>
</table>

A review of the MAUD program plan (Table 3) reveals a relatively balanced relation of studio subjects to other subjects as compared to other programs. 40% of the program content is devoted to studio units, 35% to core topics in the discipline, and 25% to electives. One can thus generalise the program character as almost equally divided between design-based units, applied research and technical units, and advanced units in urban history and theory following a student’s preferred study or future professional focus.

The analysis of MAUD is constrained by not having full access to detailed unit descriptions especially of the Option Studios and would benefit from further expansion in future studies. What can be observed, however, is that core topics include 3 units from what are called required subject area option lists. These are drawn from clusters of units organised in over-arching categories named Models of Development and Urban Systems and Form. A review of these can provide a sense of the program character and reveal a focus on housing. Topics in the category Models of Development stream include clear strengths in real estate and development including units in finance, housing, public/private development, urban politics and planning. Topics in the Urban Systems and Form track
include units on East Asian urbanisation patterns, housing and urbanisation in global cities, housing markets, urban regulatory policies.

Melbourne University, Master of Urban Design (MUD)
In Melbourne University’s MUD, students learn ‘the art of making places’ according to the program web page. This seemingly narrow, opening remark is quickly expanded to reveal a broad and clear pedagogical approach to the curriculum. Analysis of the program structure and detailed unit content reveals a focus within the degree on framing urban design as a distinct discipline – with specific urban design issues, concepts, models, and design approaches – from the scale of the street up to the multiple-block city precinct or larger building group. See Table 4 for the program study plan.

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaping Urban Design (12.5 pts)</td>
<td>Strategic Plan Making (12.5 pts)</td>
<td>The Economics of Cities and Regions (12.5 pts)</td>
<td>Elective (12.5 pts)</td>
</tr>
<tr>
<td>Defining Urban Design (12.5 pts)</td>
<td>Elective (12.5 pts)</td>
<td>Planning Law &amp; Statutory Planning (12.5 pts)</td>
<td>Elective (12.5 pts)</td>
</tr>
</tbody>
</table>

In terms of other core study areas, the MUD program is distinguished by specific topics delivered in core study areas that might in other programs be offered as electives. One such topic is urban economics, with students taking a unit ‘investigating the economic drivers, activities, and interrelationships… [and] the competing demands of economic development and social needs’ in specific urban contexts. Another strand is governance. Two core units are devoted to built environment governance, and to planning and development law with a focus on the local jurisdiction – in this case the Australian state of Victoria - as a foil for comparative discussions/analysis of other jurisdictions.

CONCLUSION
Having briefly surveyed four postgraduate urban design programs, it is now possible, first, to make some comparative observations on similarities and differences between programs, second, to form preliminary responses to the questions underlying the paper, and, third, to propose key future lines of the next phase of research.

Observations
Table 5 sets out the specific elements and characteristics of each program against the study factors. Perhaps not surprisingly, the pedagogical orientations of the programs considered reveal a mix of priorities. Programs swing variously from history of urban form, to theories of urban form, to governance to a more or less systematic engagement with practice through increasingly diverse studios, conceptually, geographically, and technically. The studio-based structure is similar among the four, with studios
claiming 50% of content other than in Harvard’s MAUD where studios claim 40% of the program. Duration ranges from 3 semesters in the case of Columbia University’s MSA&UD to 4 semesters for EMU, Harvard, and Melbourne. Studio thematics provide the most visible key to differentiating program character. In all cases constituting the largest percentage of program content, it is not surprising that in interrogating the studio focus more than in other areas can one distinguish significant program differences. Scale – and no doubt a wider survey with greater access to unit details at the syllabus and assessment item level would have addressed this – tends to logically track multiple scales from the street to the block, from the city to the territory and back. Melbourne’s MUD, at least according to available program descriptions and unit outlines, is perhaps the most focused, generally not going beyond a multi-block or building group scale. For other programs, the primary object of focus is the city – though which form of city needs to be clarified – with studios expanding to include the region or territory.

Table 5. Comparison of urban design programs and key factors

<table>
<thead>
<tr>
<th>Pedagogical bias</th>
<th>Program structure and duration</th>
<th>Studio thematics</th>
<th>Other core study areas</th>
<th>Scale of major focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory, practice: Systems and conditions</td>
<td>Studio based, 3 semesters</td>
<td>City, region, global settings</td>
<td>Digital techniques, history and theory of urbanism</td>
<td>Systems: ecological, topographical, infrastructural, demographic</td>
</tr>
<tr>
<td>City precincts: practice, technology</td>
<td>3 semesters of studio and core units, 1 semester thesis</td>
<td>European city and territory; post-industrial precincts; local urban problems</td>
<td>Methods, techniques, theories</td>
<td>Urban precinct: post-industrial, historic-cultural core, territory</td>
</tr>
<tr>
<td>Design-led problem solving, history and theory, research</td>
<td>Balance of studio, research, history and theory</td>
<td>Flexible options models with practice bias; some emphasis on the American city</td>
<td>Landscape, real estate, development, policy</td>
<td>City and region</td>
</tr>
<tr>
<td>Practice, methodology</td>
<td>Studio based, 4 semesters</td>
<td>Urban design practice: problem and propositions</td>
<td>Urban design as a disciplines, economics, governance</td>
<td>Street, urban place, building group</td>
</tr>
</tbody>
</table>

Opening Questions

In what follows, I return to the questions underlying the study and provide preliminary responses.

•  **Question 1**: What general direction should an urban design curriculum for 21st century cities take?
Reply: The above survey suggests that the complexities and challenges confronting urban design professionals are so vast that university programs must address several overlapping study strands including history of urban form, theory, modes of practice, modes of data and design representation, analysis and communication. The open ended, research-driven nature of urban design agendas has a necessary plurality: a both/and emphasis.

- **Question 2: Should the urban design studio remain the core of the curriculum and if so which studio problems are called for?**

  Reply: From the programs surveyed, it is clear the studio continues to be the most appropriate vehicle for organizing and delivering a large part of program content. Even more, the studio platform functions as means to speculate and drive design-based research forward in a collaborative environment.

- **Question 3: In addition to the studio, which other core courses might make up the balance of the curriculum?**

  Reply: There is no single answer to this question but certain differences are now more clearly visible. In programs like Melbourne’s MUD, urban economics and governance have a visible role; in Delft’s EMU overlapping units in theory, method, and technology – whether infrastructural or digital – are clear protagonists in the debate. Of equal relevance to the ideas and tools bias, there is the nature of specific local urban-scale problems – for example the heritage/conservation debate – or post-industrial site question.

- **Question 4: In order to best prepare students to move into a wide range of built environment industries, which kinds of collaborative, multi-disciplinary models might be adopted in the delivery of a contemporary urban design curriculum?**

  Reply: This question is harder to address from the brief survey, in part due to insufficient detail on unit or course specifics. One would need to drill down to studio problem types, client models, and studio deliverables to fully answer. That said, there is evidence that in general the traditional discipline triad of architecture, landscape architecture, and urban planning provide a core base from which students can add either on specific competencies – regulatory, urban finance, data modelling – or on condition-specific cases: social, infrastructural, technical for specific sites whether urban, rural, coastal, water front, or post-industrial.

- **Question 5: How best to deploy contemporary modelling, analysis, visualisation and communication technologies to ensure the highest standard of teaching and learning and inclusivity?**

  Reply: This question was not treated in the present study and should be considered in the next phases of research as discussed below.

**Next Steps**

In terms of next steps, the research should be extended and two future lines among many stand out as having greatest immediate benefit. First, the survey base should be expanded to include additional postgraduate urban design programs. Greater regional diversity should be pursued. And as suggested in the opening comments, a review of programs located in near or adjacent academic disciplines such
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as landscape architecture and planning included to see if there are lessons or trends or even specific study areas that might be added to the curriculum models. Second, samples of teaching materials and student work – especially student materials resulting from studio units - should be included in the analysis. This will allow for more fine-grained and concrete illustration of differences and similarities as well as limits – conceptual and technical - in orientation and outcome.
The urgency announced thirty-one years ago in Our Common Future is increasingly palpable: ayond in this ‘century of the city’, it is timely for an in-depth consideration of urban design education to progress.

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SMART LIGHTING SYSTEM AS THE SUSTAINABLE INTEGRATOR OF THE SMART CITY

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INTRODUCTION
The smart lighting system is an essential part of the implementation of the Smart City agenda, as it is the general basis for all Smart City and social progress index services, without which the Smart City agenda cannot be realised. The primary drivers of mass implementation are energy savings for the higher return on investment that are sufficient for the interest of investors, who prefer investments with low-risk and long-term returns. However, economic logic alone is insufficient in this case; in addition to investors' interests, the interests of users and the public must also be taken into consideration. Therefore, in addition to the low cost of implementation, such systems must provide various services for its users. Next to the best economic utility, the system has to provide a multitude of useful services for the benefit of public users, addressing the so-called social progress index (parking detection system, snow detection system, street damage detection, environmental data harvesting, future drone post services, support for driverless vehicles, charging services for electric vehicles, visual communication services, etc.) for services that improve the lives of citizens.

The implementation of the smart lighting system must reduce the ecological footprint. In the R&D process, the selection of low carbon impact components is an essential priority. The presented system is continuously adapted in its implementation: nothing is definitive, and development is the constant of this smart lighting system. The disadvantages of the smart lighting system are the disadvantages of the Internet of Things and SmartCity agenda in general. According to one of the best experts in this field, Natalie Allen, “cybersecurity weaknesses threaten to make smart cities costlier and more dangerous than their analogue predecessors.”¹

The goal of this paper is to present the smart lighting system as an approach to providing the massive deployment of Smart City services to compete with existing solutions.

The remainder of this paper is structured as follows: Chapter 2 reviews the background of the smart cities, Chapter 3 displays the importance of the smart streetlights for the smart city sustainability and conclusion (Chapter 4).

Energy efficiency
“Energy efficiency is at the heart of the EU’s transition to a resource-efficient economy and the realisation of its 2020 strategy for smart, sustainable and inclusive growth. These processes include three complementary energy and climate headline targets by 2020: to lower greenhouse gas emissions
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by 20% relative to 1990 levels, to generate 20% of primary energy from renewable sources, and to achieve 20% primary energy projections for 2020.”

“One key area for investment in energy efficiency is street lighting, for which there are not only meaningful opportunities to significantly reduce electricity consumption but also additional benefits associated with phasing out environmentally harmful technologies, reducing maintenance costs, and achieving much better overall control of the street lighting environment.”

Street lighting
“Street lighting is a key public service provided by public authorities at the local and municipal level. A quality lighting system is essential for road safety, personal safety, and urban ambience. Street lighting ensures visibility in the dark for motorists, cyclists, and pedestrians, thereby reducing road accidents. Street lighting also indirectly facilitates crime prevention by increasing the sense of personal safety, as well as the security of adjacent public and private properties.”

“Street lighting can also boost the appeal of cities, towns, and communities as commercial and cultural centres by highlighting attractive local landmarks or accentuating the atmosphere during public events.”

“However, many street lighting facilities are outdated and therefore highly inefficient. This leads to higher energy requirements and levels of maintenance. For some municipalities that have outdated systems, street lighting can account for as much as 30-50% of their entire power consumption.”

Currently, throughout the world, enormous amounts of electric energy are consumed by streetlights. This huge waste of energy should be changed.

The main aim of smart street light systems is that the lights turn automatically on when needed and off when it becomes bright. Moreover, the smart street light system behaves like usual streetlights. Whenever people see the streetlights, they turn on; whenever no one sees them, they turn off. The smart street light system consists of LED lights, brightness sensors, motion sensors, and short-distance communication networks. The lights turn on before vehicles and pedestrians come and turn off or reduce brightness when no one is present. It will be difficult for pedestrians and drivers of vehicles to distinguish smart streetlights from conventional streetlights in the smart streetlight system because the lights turn on before pedestrians and drivers arrive.

BACKGROUND OF SMART CITIES
In the second half of the 20th century, the development of information and communication technology accelerated the transformation of the industrial economy into the technological developmental-oriented economy. Urban development further influenced migration to cities. According to the United Nations, more than half of the world's population lives in cities and, in the coming decades, this proportion will continue to increase. It is expected that more than 65% of human beings will live in cities in 2050. Currently, the proportion of urban population is the highest in North America (close to 82%) and the smallest in Africa (40%). In Slovenia, around 50% of people live in urban areas, while 73% of the population in Europe does.

Urbanisation, the technological innovations, the rapid adoption of change in public and private sector organisations, climate change, and the diversity of natural resources require a different model of the city.

Recent years have seen the emergence of the discourse about the strategies of urban development that include the technological solutions of organisations that have become significant stakeholders in cities’ smart urban strategies. In particular, IBM, Cisco, and Siemens are crucial players in cooperation
with municipalities in providing new solutions for smart city initiatives. They offer municipalities proposals for creating smart models of urban management with the goal of solving the problems of sustainability in urban environments, which are expected to be resolved in the long run (e.g. the city strategies are prepared with a view to the year 2050).

In 21st century Europe, there are different concepts and theories about smart cities (e.g. sustainable cities). The practice and theory of smart cities remain in the formation phase. The literature is divided into two main categories. The first group of studies focuses on the technological issues, especially on energy efficiency, carbon emissions, etc. The second group analyses the importance of information and communication infrastructure, e-government, mobile applications (public transport), e-health, and e-drive mobility. These articles aim at increasing administrative efficiency, competitiveness, and social inclusion (e.g. applications and portals for senior citizens). It is the question of how the processes of smart urbanisation are essential for the further development of cities and citizens’ quality of life. The critical literature after 2011 reviews the phenomenon from different views: socio-economic, ecological, political, technology, and governmental studies, and ideological critics.

From the municipalities strategies, it can be determined that infrastructure plays a vital role in enabling urbanisation and facilitating growth and development. The smart city is understood as a complex mechanism, in which we begin to realise the often-unintended human, environmental, social, and economic consequences of technological- and engineering-led processes. The latest thinking and smart urban projects are aimed at comprehending the smart and/or sustainable infrastructure as a networker of places and people in order to create a more sustainable, healthy and resilient future for citizens (e.g. project of the Vienna suburb Aspern). They need to address the global socio-economic factors, processes of the innovation of new technology, constantly adapting in public and private sector organisations, and the diversity of qualified resources. The development of the Internet of Things, Internet of Services, artificial technologies, blockchain technologies, new sustainable materials, new economic models (sharing economy, cycling economy), smart processes (e-mobility, e-health, e-governance), etc. leads to the continuous development and semantic features of the smart city. Complexity theory helps us to understand the urban transformation predicated on cutting-edge technology and, on their basis, prepare strategies for providing the smart sustainable city.

**IMPORTANCE OF THE SMART STREET LIGHTS FOR THE SMART CITY SUSTAINABILITY**

The sustainability has significance in the holistic approach to setup networked knowledge – innovation activities in the smart city R&D and entrepreneurship environment. Such holistic models include the promotion of sustainable development and applying the term sustainable beyond its environmental dimensions.

The most important Smart Street Lighting stakeholders are:

1. Municipal authority

Local authority is becoming aware of the service possibilities offered by smart street lighting. However, there are knowledge and information gaps as well as a lack of standards and aligned specifications available to municipal authority. It is important, for the municipal authority, that street light poles are likely to become valuable real estate as the space used and data collected can be leased or on-sold to service providers. In future the light pole may be considered as part of a new eco system
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providing improved lighting, increased service efficiencies, data collection, additional service provisioning and energy saving.

2. Road authority

Road authorities have to become interested in how smart street lighting works and the possible improvements to safety, efficiencies, productivity, measuring traffic congestions and other benefits. They must become an active participant in this discussion and the development of smart street lighting systems.

The increased asset management capabilities of smart street lighting systems are of interest to road authorities, as faulty luminaires can be detected immediately upon failure.

In addition, the data logging capabilities of smart street lighting enables efficient maintenance planning, thereby reducing the incidence of failures. As well, the relatively long lifetimes of LED luminaires compared to traditional lighting are now reducing maintenance costs.

Cost reductions over time due to decreased energy usage from more efficient and dimmable luminaires are being explored now by road authorities.

3. Providers of the Electricity utilities

Electricity utilities own the majority of street and road lighting infrastructure and are moving to LED street and road lighting. Electricity utility customers are the roads authorities and local authorities. The key question to which it can be given a solution are: how smart street lighting will affect the grid of the future and whether smart street lighting will be a distributed energy resource need to be considered as part of the electricity network transformation roadmap. The incorporation of control and communication systems currently used within the grid and used by smart street lighting systems needs to be considered along with variable load prediction.

Drivers of the future grid include regulation; tariffs; standards; grid design and operation including transformation; technology development and innovation.

4. Energy Market Operators

Energy market operators operates the electric energy distribution by maintaining the market operating principles, coordinating electricity dispatch instructions, overseeing responsible parties and arranging energy settlements/financial contracts/settlement payments. The responsible parties within the electric distribution include generators, retailers, local network service providers, responsible persons, metering and data providers.

Metering Service Providers must comply with the accreditation and quality management requirements of the National Electricity Rules.

Different installation types require accuracy of metering to range from 0.5% to 1.5%. An appropriate accuracy needs to be determined for street lighting if it becomes metered. Discrete control of adaptive street lighting (e.g. lighting levels adjusted to a particular level at the same time each night) is easier to accommodate within the current arrangements. The load has to be predictable and reasonably calculated.
Full adaptive control (e.g., a range of dimmed lighting levels, no specific times for dimmed operation, and no specific duration of dimmed operation, not able to reasonable calculate metering data) will require metering of the street lighting.

Under the National Electricity Rules, metering requires the following five components measurement element, clock, energy data storage, display, communications device (to enable the collection of metering data). If smart street lighting requires full adaptive control, the required metering installation components and their arrangement/placement have to be determined and agreed.

Smart street lighting systems including adaptive lighting controls can be installed now by installing systems behind a pattern-approved meter.

### Smart lighting systems and IoT

The information and communication technologies (ICT) which are based on the Internet of Things (IoT) and the Internet of Services (IoS) represent a new wave of computing for urban sustainability as a structure of science and technology (S&T) within the concept of a smart, sustainable city. A fundamental concept in the integration of all smart devices is represented by IoT. The Internet is accessible to “more than a billion people through personal computers, tablets, and smartphones. It is predicted that in the future, they will be linked through small devices that can be simple or complex sensors and microcomputers, which will have the possibility of autonomous operation without the need for an additional power supply for several years or decades, and, most importantly, the devices will connect (mostly wirelessly) to the Internet.” The IoT enables smart lighting systems to become more than a light system. It is expected that in lighting will be just one urban subsystem. All systems will be open to new Smart City services and concepts and will provide rich sensor data to urban subsystems (Figure 1). As can be seen from Figure 1, as smart city urban infrastructure, a smart lighting system offers energy efficient street lighting control systems with the function of data collection and IoT services, which enables parking management, traffic management and social progress index services.
The smart lighting system will support simple energy savings applications, and extensive, complex energy services build together with energy service companies, and other urban service providers (security, waste, mobility, maintenance), depending on the smartness level of the city. Adaptive coloured dimming will be applied to save even more energy, extend the system’s lifetime and provide additional new services of guidance and signalling. Smart lighting systems’ future technologies will move from situations of users adapting to input devices towards solutions in which the technology adapts to human ways (figure 2).
**Impact of legislation on Smart City innovations**

If new technologies are to be implemented in the urban environment, governments will have to change the relevant regulations. Such changes can also be an essential factor for smart governance to enable supporting innovation. In practice, it can be seen that legislation increases the costs of development, and is unfriendly to research and development. However, the leading regions have discovered that they have to support investors by setting up new businesses. Regions are changing their legislation and preparing development strategies. They involve local companies in development projects (e.g. rural development projects that promote the emergence of the smart villages) and develop an R&D infrastructure that includes science and technological parks, research laboratories, and further education institutions.22

In the case of smart lights, “local or regional governments as street owners have a legal duty to ensure road safety and must ensure that their lighting systems comply with various technical norms and standards (including a number of EU directives). Therefore, the imperative for compliance with current and forthcoming legislation within the lighting sector at the European level represents a key incentive for municipalities to renew their lighting stock.” 23 In addition, it should be noted that the smart lighting system is also a system that is capturing, processing, and storing many different types of data, which must be secured according to legislation.

**CONCLUDING REMARKS**

The Internet of Things has an important impact on the development of the new smart cities concepts that include urban renewal and development with the goal of enabling the sustainability-oriented infrastructure that will ensure residents’ quality of life.
In the context of the development of Smart Street lighting systems, this article focuses on concepts related to the smart city, new systems in the development of products and services, smart products, adaptation to people needs, digital sustainability and cyber-physical systems. The advent of the Internet of Things (IoT) technology and initiatives taken by the governments throughout the world to develop smart cities are instrumental in driving demand for smart lighting solutions worldwide. Smart lighting systems are becoming a platform sustained by superior LED solutions and perfectly intelligent solutions. They provide technological smart lighting solutions, which have become one of the key components for developing smart cities because of their ability to save energy and curb operational costs. Smart lighting solutions have strong growth potential in residential and commercial spaces. In contrast, the high upfront cost coupled with the lack of awareness regarding the payback period has somewhat inhibited the adoption of these solutions.

The lighting industry is focused on finding solutions that will provide the lowest possible power consumption while simultaneously providing higher brightness and smart lighting demand in connection with driving digitalisation.

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BOUNCING BACK TOGETHER: MAPPING THE STORY OF POST-HAIYAN REBUILDING IN A COASTAL COMMUNITY

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INTRODUCTION
Disaster experience have taught us that the limitations and the need of the households to recover from the disaster greatly impacts on how the individual households and the community in general act on their situation. Often ‘the limitations of outside assistance have fostered self-reliance and self-recovery among households’¹. With the increasing prevalence of disasters and the knowledge that the government, especially in developing countries, have limited resources cities should not only consider the structural measures that can mitigate or adapt to disasters but rather increase the capacities of communities to respond to disasters.
This 2018 marks Typhoon Haiyan’s fifth year anniversary. In the five years after the super typhoon many communities have gone back to their normal life. The aim of this paper is to map the story of rebuilding in a coastal community in Tacloban City. It aims to explore how some communities rebuild faster than other communities. In mapping the story of rebuilding, social factors can be visualized against the rebuilding timeline. This can help in strengthening the cause to increase social awareness, capacity building, and community networks in disaster risk management.

Typhoon Haiyan history and timeline
Typhoon Haiyan (locally named Yolanda) made landfall in the southeastern islands in the Philippines on November 8, 2013. It started as a low pressure in the West Pacific Ocean and quickly escalated to a tropical storm and typhoon upon entering the Philippine Area of Responsibility (PAR). By 4:40 AM local time, it made landfall in Guiuan, Eastern Samar crossing the Visayan region heading towards the West Philippine Sea.²
With no early warning systems in place, a 600 km-diameter typhoon with 315 km/h sustained winds made a total of six landfalls across 4 regions in the Philippines. A 5.9 meter storm surge hit the municipalities of Tacloban, Palo, and Tanauan, and parts of Eastern Samar. This has resulted to catastrophic damage and destruction that took many lives and properties. It was the strongest tropical cyclone and the deadliest typhoon in the history of the Philippines, a country hit on average by more than 20 tropical storms a year.

Disaster experience in Tacloban City

The extent of the damage caused by Typhoon Haiyan rendered many residents without homes and livelihoods. The estimated number of deaths due to Typhoon Haiyan is at 6,300 and the economic damages was estimated at PhP40 billion\(^\text{iv}\) (US$400 million). Tacloban City was one of the hardest hit municipalities across the 46 provinces affected with around 220,000 of its population severely hit. The city suffered the most number of deaths at 2,671\(^\text{v}\) which accounts for 40% of the total deaths due to the powerful typhoon. The Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) predicted that a storm surge will hit the country days in advance and issued a list of areas that will be affected\(^\text{vi}\). PAGASA warned that Typhoon Haiyan is extremely strong with a very distinct eye\(^\text{vi}\) even before the typhoon reached the PAR. As a tropical country that regularly experience typhoons residents of coastal communities such as those living in Leyte and Samar are used to tropical storms. People know what to do and have often experienced evacuating and relocating.

However, if such is the case, then how come the amount of deaths and damage incurred was so high? Based on the results of the Philippine Typhoon Appeal study, disaster affected households were found to have no knowledge of the terminology “storm surge” prior to the typhoon\(^\text{vii}\). Therefore, the warning signals issued by PAGASA were not fully understood and people delayed evacuating thinking that it is just any ordinary storm. The study further revealed that the information relayed to the communities should have been in the language or explained in a manner that would easily be understood\(^\text{viii}\).
Rebuilding process
In 2014, Catholic Relief Services (CRS), implemented the Typhoon Haiyan Recovery Program funded by the US Agency for International Development - Office of U.S. Foreign Disaster Assistance. The 12-month project supported the self-recovery of 17 vulnerable coastal barangays in Old Sagkahan, Tacloban City. CRS undertook participatory integrated shelter and settlements, water, sanitation, and hygiene, disaster risk reduction, and protection projects. The aim was to help 3,000 households affected by the super typhoon to live in resilient communities which included the transitional shelter program. The transitional shelter program required households to form teams composed of 10 households per team to support and monitor each other’s house construction.

Households also received “Build Back Safer” trainings to educate and improve their construction techniques. The trainings also include hygiene promotion, protection issues, housing, land and property rights. In addition, CRS supported the repair of household latrines and bathing cubicles, rain and surface water drainage systems improvements, municipal water systems installation, household water taps reconnection, solid waste management, and implementation of Barangay Infrastructure Projects (BIPs). Approved BIPs led to the construction of playgrounds, rehabilitation of seawall, basketball courts, drainage canals, barangay halls and other aesthetic and protective projects to make safe use of the no dwell zone.
Throughout the process CRS coordinated with the local government, barangay officials, and households in ensuring that they rebuild their homes altogether.

**THE CONCEPT OF COLLECTIVE ENGAGEMENT AND DISASTER RESILIENCE**

Collective engagement refers to the “active collaboration of citizens in general on societal or communal issues affecting their community (town or city), developing active relationships with different actors in the community, and engaging in debate and finding solutions to these issues”\(^x\). Collective engagement is the combination of all sectors that help in the functioning of the city working together on issues affecting the city as a whole such as disasters. In Esteban’s paper, collective engagement is redefined as, ‘the awareness of all actors (government, citizens, private, and public sector, civil society) that the city is driven by human, social, economic, institutional, and environmental capitals’\(^xxi\). This definition suggests that the five capitals drives collective engagement and in turn the balanced strength of these five capitals builds resilience.

People in disaster situations tend to cooperate in order to overcome the situation. In the Philippine Typhoon appeal study disaster affected households were found to show different coping strategies to recover from the disaster\(^x\). In the same study community involvement has shown faster progress in rebuilding and improving the communities’ well-being. This collective engagement of the disaster affected communities contributed to the general attainment of their communities’ rebuilding goals. However, as Esteban suggested, collective engagement will only make an impact to the community if there are strong stakeholders that are tied to the community, an understanding of the need for a cohesive community in order to address disasters, and an understanding that change is a long-term process\(^xxii\).

A community’s resilience depends on their capacity to cope with or adapt to disasters. This capacity is anchored on the five capitals. Resilience has a ‘degree of planned preparation undertaken in the light of a potential hazard, and of spontaneous or premeditated adjustments made in response to felt hazard, including relief and rescue’\(^x\). Having a strong set of capitals contribute to the communities’ ability to plan for and adjust to disturbances.

**Capitals and assets as tools in building resiliency**

Capacity is the combination of all the strengths, attributes and resources available within an organization, community or society to manage and reduce disaster risks and strengthen resilience. This combination of strengths, attributes and resources can be translated to capitals.

Similarly, these combined attributes make a community more disaster resilient. A study\(^x\) on social capital and collective efficacy indicate that the community’s interaction and capacity to respond, adapt, learn and effectively reorganize after a disaster are important considerations in becoming disaster resilient. And for the community to respond, adapt and reorganize the community must have a certain level of human, social, economic, institutional and physical capitals.

In this paper, the aim is to build the discussion on the need to strengthen these five capitals of a community to become disaster resilient. Human capital refers to the skills and knowledge of a population that contributes to its productivity. Mayunga has indicated that education, skills, information and knowledge helps in the ability to cope with, adapt to, and recover from disasters\(^x\). Social capital refers to the networks that the people within the community. Economic capital refers to the community’s productive and financial strength. Institutional capital refers to leadership and policies that help in building community resilience. Physical capital refers to both the built and natural environments. This means that the communities level of human, social, economic, institutional, and physical capitals are instrumental in collectively addressing resiliency.
CAPITALS AND ASSETS MAPS
In May 2014, six months after the typhoon, CRS conducted a random survey of 1,125 households to assess the socio-economic conditions of the target beneficiaries in the Old Sagkahan area. Data derived from the survey formed the CRS Urban Shelter Survey Database. From this database the indicators under each of the human, social and economic capitals were extracted for this paper are as follows:

- Human capital - age and gender of household head;
- Social capital - livelihood organizations and religious organizations;
- Economic capital - income source;
- Institutional capital - government policy on recovery and rebuilding; and
- Physical capital - locations of the households vis-à-vis risks and vulnerabilities

The indicators religious organization, government policy, and locations, were determined through the review of literature and actual observations from the field.

Age and gender of household head
The head of household is defined as the member of the family recognized by everyone as the head of the family unit xvii. Philippine Statistics Authority, however, define household heads as the person who generally provides the chief source of income for the household unit xviii. Survey data indicate a predominantly male headed household (57.8%), in the Philippines the culture is relatively patriarchal and the father figure is most often considered the household head. Figure 3 provides a good indication of the gender of the household heads in the area.

Figure 3: Head of Household Gender Clustering Map
The age composition of the household heads in the Old Sagkahan area likewise vary. Based on the database 32.4% of the household heads are between 20 to 35, 24.1% between 46 to 55, 21.6% between 36 to 45, 13.4% between 56 to 65 and 8.5% are 66 and above (Figure 4). The southern side of the Old Sagkahan area show a clustering of household heads between 25-45 years of age. This age range is within the working age population or the productive age. The northern side show a clustering of household heads in their late 40s above. The clusters further reveal that most household heads in the north are 50 above which is nearing the dependency age of 65.

**Figure 4: Head of Household Age Clustering Map**

**Livelihood organizations and religious organizations**

Social capital is honed among people sharing the same values and beliefs. Bonding social capital often refer to religion and faith as a factor, while bridging social capital indicate people having similar occupations or professions. Figure 5 indicate the concentration of households with similar occupation or livelihoods. The southern portion of the Old Sagkahan area showcase high concentrations of household heads working as fishermen and vendors. This is understandable since the southern area is also where the fishing port is located. This clustering indicate the presence of livelihood organizations within the area based on occupation.

While the Philippines is predominantly Catholic, the influence of religion at the community level can be affirmed in terms of the location, proximity, and number of establishments within a community. There are three main churches located in the area of Old Sagkahan, Christ Lutheran Church in the north, Redemptorist Church in the middle, and Seventh Day Adventist Church in the South. Apart from the main churches there are seven community chapels located in barangays 31, 35-A, 54-A, 56, 56-A and 60 (Figure 6). The average walking distance is at 400 meters (5 minute walk)\textsuperscript{10}, given this fact Figure 6 outlined the 400-meter radius from the churches. It can be observed that the main churches are within close walking distance from the community that the community chapels appear to be a redundant use. However, the
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religious institutions often place community chapels in areas where there are a lot of parishioners forming an ecclesial community within a specified area. Further, most community chapels are also used for other purposes aside for worship, bible study or any religious activity but also for social services initiated by the ecclesial community such as seminars, medical missions, community meetings.
Income source
Since the survey was done six months after Typhoon Haiyan, most of the household heads surveyed indicated no income source. Income sources, however, vary in the area as shown in Figure 7. Vendors, fishermen, and sari-sari (mini grocery) store owners make up the most occupation owing to the existence of the fish port and commercial area in the south. This provides a stable source of income (Figure 5). The south of Old Sagkahan is also well-known as the area where roast pig restaurants abound. Aside from this, it can also be related to the working age population of household heads (Figure 4) where the south has the most clustering.

Government mandate: No dwell zone vis-a-vis physical location of risks and vulnerabilities
A few weeks after Typhoon Haiyan the national government announced a blanket 40-meter buffer zone along the coastline, which it designated a NDZ\textsuperscript{15}. Within the one year period after the typhoon the government extended the NDZ to Esperas Avenue (Figure 8). The declaration was eventually lifted but the principle of the NDZ is not to locate residents in an area with high vulnerability. The map shown in Figure 8 indicate the areas declared as NDZ, however, to compare this map to Figures 9 and 10 it can be observed that the entire Old Sagkahan is highly vulnerable.

Figure 9 shows the storm surge only at 2-3 meters covering approximately 70% of the Old Sagkahan area but Typhoon Haiyan reached 5.9 meters such that it inundated the entire area. If the storm surge will not be taken into account but rather other risks such as flooding and liquefaction Figure 10 shows that 100% of the area is still at high risk.
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Figure 8: 40-meter No Dwell Zone and Esperas Ave. No Dwell Zone

Figure 9: 2-3-meter Storm Surge Model

Figure 10: NOAH – Multi-Hazard Map zoomed in Old Sagkahan Area
Source: Philippine Geoportal by National Mapping and Resource Information Authority
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REBUILDING STORY MAP

The shelter progress maps shown in Figures 11 to 14 shows the rebuilding progress from July 2014 to 2015. The data for the shelter progress is based on the households who applied for CRS Transitional Shelter Program grant. The legend shows green as those households that have completed the rebuilding works, orange as on-going, yellow planned, red is ineligible (households that lack the requirements for the grant), and gray not interested in the grant.

The first month of the shelter rebuilding program (Figure 11) show 90% of the households were still in the planning stage with the exception of one cluster of households in Barangay 60 who have already completed the rebuilding works. Four months after (Figure 12) show Barangay 48 and 48-A in the north, and Barangays 58, 60 and 61 in the south have clusters of households that have completed the rebuilding works. On the eighth month (Figure 13) more progress can be seen in the south. More households have completed the rebuilding in the south but also in the north it can be seen that more households have on-going rebuilding work. Finally, at the end of the project (Figure 14) household beneficiaries of the grant have completed rebuilding.

Figure 11: Shelter Progress as of July 2014
Figure 12: Shelter Progress as of November
CONCLUSIONS AND RECOMMENDATIONS

The CRS Transitional Shelter Program can be surmised as a successful project in terms of having provided 3,000 households in the Old Sagkahan area access to a grant to help rebuild their housing units. Esteban have noted the restoration and rebuilding of houses after the Typhoon Haiyan disaster improved the general well-being of households and the community. This study underscores that the communities collective engagement which are influenced by their human, social, economic, institutional and physical capitals significantly affects the quick recovery of the community. The story maps reveal that the areas in the south with the higher human, social, and economic capitals also progress faster than the rest of the Old Sagkahan area in terms of rebuilding.

This study was mostly dependent on the data derived from the survey done in May 2014. These were mostly data used for the human, social, and economic capitals. Improvements in these aspects will be worthwhile to study to compare if these has changed after the typhoon and after the rebuilding works. As an exploratory study to test the framework of collective engagement, the indicators outlined in the study can be further improved to include other demographic data (household income), locations of livelihood organizations and composition, barangay disaster risk reduction management offices and volunteers, among others.

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SIMPILIFYING URBAN DATA FUSION WITH BIGSUR

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INTRODUCTION
Scanning urban environments typically uses sensors attached to a vehicle (e.g. an aeroplane or car). The sensors capture a large number of 2D snapshots of the city from different angles - e.g. if the sensors are cameras on an aeroplane we might capture hundreds of photographs of one area of a city from different angles and heights. To understand this data, we typically convert these flat, 2D, snapshots into 3D meshes (photogrammetric reconstruction; e.g. what we might see on Google Earth). However, this conversion is not perfect. Even the most advanced techniques are prone to noise and error – e.g. the recorded position of the aeroplane is not accurate (global position system (GPS) error), the snapshots are blurred (a sudden motion by the pilot), objects may move (e.g. cars or trees), and repeated objects may be mistaken for one another (e.g. windows). In this paper we are interested in taking these noisy 3D meshes and, by understanding their content, removing such noise. Our theory is that by understanding the semantic details (which areas of a mesh are a wall) it will help us remove errors (walls are typically flat and vertical). We implement this theory by reducing the amount of data (parameters or numbers) required to describe our 3D model. We take the 3D mesh, encoded as thousands of 3D triangles, and fit a simpler model, described by a 2D plan and profiles. The mathematical model (Procedural Extrusions) uses an existing technique (BigSUR) to perform the fitting. We will do this with the help of maps (GIS building footprints). An overview of the process can be found in the accompanying video.

Procedural Extrusions
We aim to fit a semantically meaningful parameterized model to real world mesh and cartographic data. In the process, we remove the noise from the mesh, creating a simplified “clean” model. To achieve this, we decompose a building to a horizontal 2D footprint, and a profile associated with every edge. BigSUR used such a parameterization - procedural extrusions (PEs). This decomposition results in a model which can label the 2D extent of the building over the floorplan, and identify the walls and roofs from the profiles.

PEs are mathematically elegant roofs – they are built using a variant of the straight skeleton, a geometric construct which has the property that wherever a raindrop lands on the roof, if it continues downhill, it will always reach a gutter at the edge of the roof. The issue when modeling with PEs is to determine where the gutters should be. To do this is a reliable way, such that the accompanying profiles can accurately represent the roof geometry, is a challenge – the top of the roof crest may be a long distance from the gutter above the building boundary.

The BigSUR algorithm performs such a decomposition for PEs, with the aid of street-level photography to determine locations for joins between buildings – likely locations for gutters. However, such
photographs are expensive to collect or label, and it may not be possible to photograph all façades of a building (i.e. interior courtyards). Here we wish to simplify the BigSUR method, and demonstrate how it can work without such images.

**Related Work**

Urban reconstruction is a large subject area spread between subjects as diverse as geomatics, computer graphics, and geometry. For a more complete survey of the work, we refer the reader to the reports by Wang et al.\(^3\) and Musialski et al.\(^4\) However, here we will satisfy ourselves with a short tour between two extremes of reconstruction – *mesh modeling* and *primitive modeling*.

*Mesh modeling* involves creating vertices and faces of an arbitrary mesh in such a way to model the target data. These approaches are very flexible, and can construct arbitrary data. However, they often lack prior knowledge of the urban environment, and so their worst-case results do not resemble architectural structures. A classic example is *Screen Poisson Surface Reconstruction*\(^5\), which can operate on a wide variety of data but often results in “blobby” artefacts which are better suited to organic objects than the built environment. Another technique is *dual contouring*, a technique which has been modified for urban reconstruction by using the method in 2.5 dimensions to create only building roofs\(^6\). However, because the roofs can take arbitrary shapes the worst-case quality can be poor. Salinas et al.\(^7\) use detected faces and edges to regularise a mesh. The work is able to elegantly simplify manifold meshes. However, because they do attempt to understand the semantics of the geometry, they are unable to apply urban priors such as ensuring walls are vertical.

*Primitive modeling* involves arranging pre-existing objects to reconstruct the urban environment. Working at this higher level results in systems that can perform can create very convincing urban outputs from very noisy data. However, they are only able to model objects that exist in their libraries. A classic example is presented by Vanegas et al.\(^8\); they reconstruct environments using only cuboids, this guarantees that the results are well formed and manifold, but cannot represent sloped roofs. Verma et al.\(^9\) use a larger set of parameterised primitives which contains structures with sloped and flat roofs. Finally, Edelsbrunner introduce a solid roof primitive\(^10\) that is able to create impressively complex roofs. However, the choice of primitive limits the results, for example flat roofs, or buildings with arbitrary footprints cannot be represented.

Procedural extrusions lie between these extremes of mesh and primitive modeling, offering many of the advantages of both approaches. As we hope to show in the following PEs, such as mesh modeling systems, can be quickly parameterised to real world data, and are not limited to a set of known primitives. In addition, they have many of the advantages of primitive modeling – PEs are easy to edit, are guaranteed to create watertight geometry, and contain semantically valuable information. Finally, PEs have an excellent worst case reconstruction, as given a strong urban profile prior, their result is usually resembles *architecture*.

**METHOD**

To the above ends, we simplify the method of BigSUR by modifying the central optimization problem. Broadly, we achieve this by removing the complications that come with photographic data (the *building-façades*) and profile assignment. This removes terms \(O_3, O_4, O_5,\) and \(O_6\) from the previously published optimization and adds an additional post-processing step to assign profiles. We continue to describe how we find the inputs to the optimization, the way in which the optimization is formulated, the profile postprocessing, and finally how we create the mass model.
Computing the optimization inputs
The inputs to our system are 2D GIS building footprints, and a noisy 3D photogrammetric mesh. Here we describe how these are processed to create the input to the optimization - a set of sweep-edges. Sweep-edges are 2D lines in the ground-plane giving the approximate locations of the vertical walls.

To compute the sweep-edges, we take the input GIS footprints and 3D mesh (Figure 1, a). At vertical intervals of 0.2m we slice the mesh horizontally to create a large number of horizontal lines (b). These lines are aligned to nearby edges in the GIS footprint. We continue to cluster these lines into different prominent directions (c), each representing a side of the building with a single profile. We discard any clusters with an associated mesh area below a certain limit, $\gamma$, typically 10m$^2$. The base of these profiles is projected onto the ground plane to create the final sweep-edges. These sweep-edges should follow the gutters of the roof over the structure.

The sweep-edges are the result of heavy processing over noisy data. Because of this, they do not form closed footprints. Some may be missing, others may interpenetrate each other, or they may not intersect where we expect them to (i.e. the corners of buildings). For these reasons we perform an optimization to reconstruct plausible footprints from the sweep-edges.

Optimization Terms
Given the set of sweep-edges we describe here how we find a set of watertight building footprints for the block from the sweep-edges. We first fracture the ground-plane into a large number of polygons, then formulate an optimization which assigns a footprint-label each polygon.

The sweep-edges are used to fracture the ground-plane. Starting with the longest, each sweep-edge is inserted into the plane, fracturing the plane into polygons (Figure 2 a-d). To remove further complexity from the following optimization, we can perform an inside-outside segmentation using the GIS footprint and mesh-height to discard those areas outside of the building (Figure 2 e-f).
We now wish to label polygons which belong to the same footprint. Typically, there will be many more polygons than desirable footprints, and we must find which polygons we might combine to a single footprint. Following BigSUR, we define error terms $O_1$, $O_2$, and $O_7$:

$$O_1 = \sum_{e_k} \alpha \|e_k\| (\neg s_k \land \text{isSweepEdge}(e_k)) + \beta \|e_k\| (s_k \land \neg \text{isSweepEdge}(e_k))$$

$$O_2 = \sum_{e_k} \|e_k\| \text{heightDiff}(e_k) \neg s_k$$

$$O_7 = \sum_{e_k, e_j} \phi . s_j \land s_k$$
Where:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$e_k$</td>
<td>Each edge in each polygon</td>
</tr>
<tr>
<td>$|e_k|$</td>
<td>The length of edge $e_k$</td>
</tr>
<tr>
<td>$\alpha$, $\beta$</td>
<td>Weights that control the balance between over and under segmentation</td>
</tr>
<tr>
<td>$s_k$</td>
<td>Binary value, 1 if $e_k$ is part of an output footprint, otherwise 0</td>
</tr>
<tr>
<td>$\text{isSweepEdge}(e_k)$</td>
<td>Binary value, 1 if $e_k$ is a sweep edge or continuation edge (see Figure 2)</td>
</tr>
<tr>
<td>$\text{heightDiff}(e_k)$</td>
<td>The height difference of the noisy mesh across $e_k$</td>
</tr>
<tr>
<td>$\varphi$</td>
<td>A large penalty term: $0.5 \sum_{e_k} |e_k|$</td>
</tr>
<tr>
<td>$e_i$, $e_j$</td>
<td>Pairs of polygon edges that are closer than 2m, or are adjacent and form and angle of less than 30 degrees. Such geometry is undesirable.</td>
</tr>
</tbody>
</table>

We search for a labelling such that $O_1 + O_2 + O_3$ is minimized. In the above, this means searching the valid values of $s_k$ for the most desirable solution.

We represent the problem as a binary integer programming (BIP) task and solve using the Gurobi library to assign a footprint-index to each face. Given the resulting indices we can join adjacent polygons with the same index to create our set of footprints. The resulting footprints can be quite complex, and may contain holes.

**Assigning Profiles as a Postprocess**

*Figure 3. Left: the output of the optimization is a set of building footprints. Center: profiles are assigned as part of our post processing. Right: Using procedural extrusions we combine the profiles and the footprints.*

Given the output footprints from the optimization (Figure 3, left), here we describe how we assign profiles to each edge (Figure 3, centre). As illustrated in Figure 4, we take every edge of the footprints, and traverse the input mesh to find a set of noisy profiles (a). By starting at sampled points along the edge, we slice the mesh perpendicular to the edge, and climb the slice until we cannot find a higher point (b). We can then use standard techniques to clean and merge these polylines into a single clean profile (c). At this point we apply our strong urban prior to the shape of the profiles – we expect a vertical wall bellow one or more sloped roof pitches.
Creating the Mass Model
Give the footprints from the optimization, and the found profiles (Figure 3, centre) we can continue to compute the final building masses. We use the campskeleton implementation of the procedural extrusion system to achieve this. The right-hand panel of Figure 3 shows an example of such a mass model. PEs vertically extrude a building’s 2D footprint along the given profiles. PEs can be subject to geometry run-away; for example, when only vertical profiles are found the footprint is extruded to infinity. To avoid this, we use a maximum extrusion limit computed from the input mesh.

Implementation
We have released an implementation of this method, chordatlas. In particular, the modifications in this paper can be activated by using the “use greedy profiles” option in the settings menu. The system allows the above optimization to be run, results may be exported, and the resulting footprint and profile representation may be edited. The source code contains details on the many hundreds of practical details required to replicate this work.

Figure 5. Our chordatlas urban data fusion platform. The 3D view on the left shows a photogrammetric mesh (blue), GIS footprints (orange), and the output model (grey). On the right
we see an editor for the plan and profile of one footprint.

PARAMETER EXPLORATION
In the above we introduced several parameters, such as $\alpha, \beta, \gamma$. Here we explore the effect of these parameters on our output models.

Over- or Under-Segmentation
The constants $\alpha$ and $\beta$ control the under- and over-segmentation in the system. $\alpha$ controls the penalty associated with a sweep edge that is not part of a footprint, while $\beta$ controls the penalty given to lengths of a footprint which are not associated with a sweep edge.

We explored 4 different combinations of these values, and the results are shown in Figure 6. We observe that a high $\beta$ leads to an under-segmentation (top), while a high $\alpha$ leads to over segmentation (bottom). We present a vertical error plot, and average mean-squared error for several parameter combinations. Given these results we use $\alpha = 40$ and $\beta = 60$ for further experiments.

Profile Quality
We found it instructive to explore the consequence of more or less detailed profiles. By tweaking our profile simplification algorithm, we could quickly change the visual complexity of a block. Our results are shown in Figure 7. Simple (a single vertical line) profiles, create a bounding-volume-like representation. High complexity profiles created very realistic buildings. Moderately complex profiles significantly reduced the polygon count of our models while retaining a good visual quality. We used the high profiles for all other results presented.

Sweep-edge Area Threshold
The final parameter we investigated was the minimum-area threshold for a sweep-edge to be used, $\gamma$. We varied this parameter between 10 and 90m$^2$. The results are shown in Figure 8; the first result, a, shows very high error because the boundaries between the terraced houses are not detected. As these edges are progressively introduced, the quality of the result increases.

We note that as the number of sweep-edges increases, the error falls, the visual realism increases and the optimisation run-time increases. For the results in this paper, we used a value of $\gamma = 10$ m$^2$ with the exception of the very large New-York block, for which we used a threshold of $\gamma = 50$ m$^2$. 
Figure 6. Rows: effects of $\alpha$ and $\beta$ the resulting segmentation. Input mesh as Figure 7. Left: output mesh. Middle: optimized segmentation. Right: Linear error plot.
RESULTS

Using the parameters found in the previous section, we now present the application of simplified system to 6 real-world datasets. The inputs are a GIS footprint (either from OS\textsuperscript{15} for Glasgow and London results, otherwise OpenStreetMap\textsuperscript{16}), and a photogrammetric mesh. We did not use the presented tools to edit any of the results – they are the results of our fully automated reconstruction procedure. The results and accompanying statistics for these datasets are shown in Figure 9 and Table 1. We observe that the mean squared error varied between 0.3 and 6.0m, with the larger blocks typically having large errors due to accumulated inaccuracies as each procedural extrusion is evaluated.

![Image](image_url)

*Figure 8. The effect of the area-threshold on selecting sweep-edges. purple: the input mesh. Rows a-c) illustrate decreasing thresholds result in more accurate results (center), with lower errors (right) when compared the input meshes.*
Our simplifications have been successful in reducing the runtime. For example, the time to process the London dataset has been reduced from 4 hours in the BigSUR paper to 13 minutes. In other experiments on single-family homes or detached houses the optimization time was less than 0.5 seconds, allowing results at an interactive speed.

*Figure 9. Results for datasets. Green: GIS footprints. Purple: input 3D meshes. Blue: output clean meshes.*
We note that the higher, more semantic representation we construct causes errors to be expressed at this higher semantic level. For example, when a roof pitch is given an inaccurate angle, it affects the entire roof, and the roof-line of the building. Another limitation is that our polygonal representation is unable to model curves in either the footprint or the profile.

Table 1. Accompanying data for Figure 9 and 10

<table>
<thead>
<tr>
<th>Name</th>
<th>Label</th>
<th>Sweep-edges</th>
<th>Variables</th>
<th>Time (sec)</th>
<th>Error (°m)</th>
<th>Lat</th>
<th>Long</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copenhagen</td>
<td>a</td>
<td>37</td>
<td>2739</td>
<td>1.64</td>
<td>2.605</td>
<td>55.6616</td>
<td>12.5992</td>
</tr>
<tr>
<td>Glasgow</td>
<td>b</td>
<td>46</td>
<td>3290</td>
<td>11.2</td>
<td>1.360</td>
<td>55.8615</td>
<td>-4.2011</td>
</tr>
<tr>
<td>Glasgow-small</td>
<td>c</td>
<td>10</td>
<td>466</td>
<td>0.04</td>
<td>0.348</td>
<td>55.8608</td>
<td>-4.2004</td>
</tr>
<tr>
<td>Madrid</td>
<td>d</td>
<td>28</td>
<td>2832</td>
<td>6.18</td>
<td>2.075</td>
<td>40.4114</td>
<td>-3.7037</td>
</tr>
<tr>
<td>New York</td>
<td>e</td>
<td>28</td>
<td>19754</td>
<td>455</td>
<td>6.05</td>
<td>40.7222</td>
<td>-74.0022</td>
</tr>
<tr>
<td>London</td>
<td>F</td>
<td>70</td>
<td>12385</td>
<td>795</td>
<td>3.68</td>
<td>51.5173</td>
<td>-0.1420</td>
</tr>
</tbody>
</table>

Characteristic Profiles

As an aside, we find it informative to characterise the different datasets by their profiles. Figure 10 shows the all the profiles for each dataset in a single plot. We can instantly observe the rectilinear profiles in New York, the mansard roofs of London’s Regent street, and the similarities between the two buildings in Glasgow.

Figure 10. Profiles for Figure 9. a) Copenhagen, b) Glasgow, c) Glasgow-small, d) Madrid, e) New York, and f) London. Not to scale.
CONCLUSIONS
In this project we have simplified the BigSUR system, reducing the requirements for photo data, and
reducing the complexity of the central optimization problem. We have searched the parameter space to
gain an understanding of the possible system outputs, and used the parameters that we identified to
process 6 datasets from a variety of cities.
The output models have a very high visual quality, with single walls typically presented by a single
polygon, and corners of walls remaining sharp throughout processing. Further, all output models are
watertight and well tessellated. Because we have decomposed the building to a footprint and a profile,
we are able identify which portions of the model are wall (those with vertical profiles), and which are
roofs (those with sloped profiles).

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INVESTIGATING THE POSSIBILITY OF USING THE PRINCIPLES OF THE SMART GROWTH APPROACH IN THE EMPOWERMENT OF SPONTANEOUS SETTLEMENTS (CASE STUDY: KHAKSEFID DISTRICT OF TEHRAN, IRAN)

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INTRODUCTION
In 2001, 45 million people or 6 percent of all those living in and around cities in the developed countries were settled in slums. In the developing world, however, the slums housed more than 860 million people or 43 percent of all urban residents in those countries. For the Middle East, 35 percent of all people living in cities were slum residents. By 2020, it is estimated that 1,355 million and 75 million people will be living in spontaneous settlements in the developing countries and in the Middle East, respectively1.

KhakSefid neighborhood in Tehran is one such settlement that was formed after the Iran Revolution. This area has been the focus of attention among the central government officials, the City’s managers, as well as academics and researchers. In the 1980s, most officials believed that the vices and ills of this neighborhood could be wiped away by its complete physical elimination of its core area. Several attempts toward this end faced major resistance and protests by the residents, even leading to deaths and injuries. Although bulldozing some sections of KhakSefid led to renewal and the consequent reduction in criminal activities, much of the neighborhood’s problems remain intact today. Poor public health, lack of formal employment and low wages, high population density, social segregation, insufficient educational and recreational facilities, low quality and substandard housing, and unpleasant urban spaces are among problems associated with the neighborhood. A number of consequences are observed on a daily basis in the area: environmental degradation; lack of investment; drug addiction; adverse psychological behaviors; and social unrest.
LITERATURE REVIEW

Empowerment and Smart Growth

Today, those familiar with this neighborhood do not recommend the physical, bulldozer-type offensive against the area. “Empowerment”, as a solution for making spontaneous settlements more livable and as a class of intellectual proposition most discussed among urban planning researchers in the area of “capacity building” in the post-modern era, is also favored among the Iranian officials and academics alike. None, however, have succeeded in putting forth any strategy or policy to bring the concepts of empowerment and capacity building to play their respective roles in KhakSefid’s improvement. On the other hand, approaches such as New Urbanism, smart growth, and urban-village deal with overlapping principles which could have some merit in empowerment and capacity building efforts in settlements such as KhakSefid. In the following, the smart growth approach is discussed with the view as a process enabler in empowerment in spontaneous settlements.

There are three objectives set in the concept of “empowerment”: 

- Providing a basis for sustainable and comprehensive enrichment of an environment toward superior health, safety, sanguinity, providence and human dignity in spontaneous settlements;
- Providing foresight and prudence toward predicting the spread of future spontaneous settlements and taking appropriate action toward development of standard housing, basic services, and infrastructure, affordable to low-income groups;
- Capacity building for broad participation of residents of spontaneous settlements in decision making and local actions.

Character of Spontaneous settlements in Iran and other Countries

Spontaneous settlements have been defined and interpreted in different countries in different ways. Marginalized areas, in general, refer to seemingly forgotten sections of cities characterized with low standards of living. They are defined as unplanned, overcrowded neighborhoods with poor housing conditions, services and infrastructure. Such environments could materialize within the older inner cities or at the periphery. People living in margins and at the periphery have struggled to live within a city’s socio-economic hinterland without really becoming absorbed into its formal sector. Not being considered as legitimate citizens, they are also at the periphery of public services, facilities, and amenities which are by and large available to other members of the society. Thus, the marginalized residents are distinguished from others in their physical settings (as in substandard housing) or social settings (as being unemployed or employed within informal sector with low wages). In many cases, residents of such settlements are low-income migrants from villages which are content to find housing in substandard structures built on illegally occupied land at the periphery of cities. Many remain there until they can save enough to afford a house in the city and move. Thus, sometimes these settlements act as transition points from where the migrants move to within the cities’ borders when they can afford the costs.

Although some squatter settlements occupy illegal land within cities, they are similar in many negative traits to those which are located outside. The report by the United Nations Department of Economic and Social Affairs (2014) points to some of these traits: inefficient use of land, meager infrastructure, poor aesthetics, low environmental quality, lack of sufficient security, and concentration of similar ethical backgrounds.
Smart Growth (S.G)
The American Planning Association has defined smart growth as being a collection of planning experience, regulations, and development which use the Earth’s resources in more efficient way through greater building density, infill development, with rational accessibility. One of the objectives has been to reduce horizontal city growth, protection of land in environmental terms and creation of neighborhood units with a sense of community.

Smart growth is defined by National Association of Home Builders as an approach to meet the demand in housing for the growing population and economics through a public political consensus and market-oriented land use. Here, “smart methods” are introduced to achieve the housing demand including planning for dense development while protecting desirable open spaces.

In all, S.G suggests solutions for three interrelated issues: 1- development, 2- land use, and 3- transportation modes. On the first planning issue, dense development is proposed in order to limit horizontal growth of city. On the second and third issues, mixed land use and creation of public spaces for desirable and adequate spaces for pedestrians are proposed.

S.G approach, similar to the New Urbanism Movement, seeks to connect development with quality of life. It includes a number of different forms of development through which, from market’s viewpoint, more effective models of land use are created. The assumption is that this improves the spatial quality of settlements through a people-oriented, rational regional administration along with greater responsibility for the private sector. In this sense, government and related organizations must facilitate spatial development and not take over the task of development.

Thus, S.G refers to a type of land use and development method that helps to increase quality of life in society, protection of the environment, and reduction in costs. The goal is to limit urban sprawl, appropriate use of taxes and building a more livable society. S.G answers the “where” question, i.e. “which place” costs less for the public now and in the future while having the most compatibility with the environment. Also it deals with the “how” question, i.e. how could community development lead to alternatives and choices in places which have been overlooked in the past (e.g. vacant land within neighborhoods). A set of the parameters, therefore, work within the concepts of appropriate pedestrian paths and public transportation. Other parameters deal with neighborhoods’ meeting places in which a lively public space could facilitate greater public participation in urban management. These are translated in the following principles:

- Mixed land use
- Building density
- Housing alternatives
- Walkability
- Community Cooperation

METHODOLOGY AND THEORETICAL FRAMEWORKS
Spontaneous settlement can be defined from different social, cultural, psychological, physical and political dimensions. Principles of S.G also deal with all these dimensions. Those principles can be utilized to upgrade the environment of these settlements. Thus, they form the theoretical framework in this research to tie the S.G with the KhakSefid neighborhood in Tehran. These include: mix of functionality and variety of land use, building density, housing alternatives, walkability and community cooperation.
This research was based on survey and content analysis. The literature is reviewed in order to study the different aspects of spontaneous and informal settlements and the context and principles of S.G approach in regard to spontaneous settlements are defined.

Using documents and analysis of existing data as in secondary analysis includes direct interviews with the neighborhood’s residents and summarizing their views and suggestions for selecting the best alternative, collecting the minutes of meetings on the subject of planning for the region from responsible organizations and summing up the expert views in the meeting, and analyzing the principles in the case study. Finally, by drawing up a matrix, the interrelated effects of patterns of S.G on the issues of Khake-sefid neighborhood, the findings are presented.

APPLICATIONS OF S.G PRINCIPLES IN KHAKSEFID

Mixed use

The neighborhood’s functional and activity characteristics can be seen on the map below. The study of the strategic plan of District 4 of the Municipality of Tehran shows that over 16.5 percent of all activity land use are mixed. Most of the mixed use can be found at the northeast of the neighborhood along the main streets. In some locations, the mixed use has permeated deeper into the neighborhood. In general, however, the permeability is reduced as we leave the edges and move into the area. Thus, the mixed land use is at the northeast and to lesser extent at the southwest core of the area.

Spaces which have some public character, such as the Rahbar Plaza, have changed the area’s residential feel in favor of other activities. In graph 1, the relative proportion of mixed use in two cores along the surrounding streets and the main street within the boundary are shown. The study of land use map and the distribution of activities within the area and the periphery points to the fact that existing streets and areas within the neighborhood have attracted activities with different methods. Zahedi Street (between Rahbar Square and Shariati intersection) have had the highest desirability for functions. This higher desirability in intersection with lack of sufficient supply (due to unsuitable low density) has led to the fact that many nonresidential activities to infiltrate the neighborhood such that areas of mixed use can be seen along Zahedi Street. Also, on the secondary level, Taleghani and Shariati Streets have attracted most volume of activities.

Patterns of distributing activities in status quo shows that functions tend to be located more along the streets and in contrast, activities inside the residential area with certain centers is less observed. Therefore, it could e said that the potential for mixed land use within the neighborhood is high and this can be used as opportunity. However, the area of study and the surrounding areas are filled with functions such as automobile service and repair which along with scale further e from the area has a good opportunity to attract the value to the neighborhood. Of course, location of auto repair shops within a residential neighborhood is unsuitable and for this reason, it seems there is a need to organize these activities on one hand, with the aim of better conditions for the residence and on the other hand, a more appropriated development basis for these activities is provided.
Another important point is that in regards to the activity structure within the area, there is a high number of units without any activity (12.2 percent of all shops) which means there is a capacity for more new commercial activities. This capacity is a new opportunity for the neighborhood which by lubricating the economic activities more value is added. Therefore, and by considering socio-economic characteristics of the area, one can define service-related cultural activities in a scale larger than the neighborhood in order to give life to the units without activity. Existence of a cultural center within the neighborhood can help this.

**Compact building**
Currently, half of all existing plots have density less than 120 percent. The average building density is only 125 percent.
Density is one of the three major principles of the S.G approach. The other two principles, i.e., spatial separation of land use and transportation modes, are defined by density. Using current data within a GIS environment and using (AHP) weighted criteria model, were search for suitable sites which can house higher densities. This was achieved using criteria such as light, number of stories, age of buildings, access to urban open spaces, water drainage and swerves, accessibility, employment rate, education rate, current density, household size, nearness to functional and activity nodes, slope, street width, existence of signs, the ability of streets and areas to attract functions and activities, entrances, the price and total area of lands. This site selection endeavor, 80 percent of the neighborhood still don’t have the sufficient infrastructure and capacity for higher density.

<table>
<thead>
<tr>
<th>Building density within the neighborhood</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 80 %</td>
<td>535</td>
<td>32.1</td>
<td>32.1</td>
</tr>
<tr>
<td>80-120 %</td>
<td>380</td>
<td>22.8</td>
<td>54.9</td>
</tr>
<tr>
<td>120-180 %</td>
<td>358</td>
<td>21.4</td>
<td>76.4</td>
</tr>
<tr>
<td>180-240 %</td>
<td>304</td>
<td>18.3</td>
<td>94.7</td>
</tr>
<tr>
<td>More than 240 %</td>
<td>89</td>
<td>5.3</td>
<td>100</td>
</tr>
</tbody>
</table>

Housing alternatives
Currently, the number of households in each dwelling unit is 1.06 which is relative in line with the country’s average. This number for a spontaneous settlement seems natural. The passage of time and the end of first generation and beginning of second generation has balanced this situation but the major problem currently is the average number of people per parcel which leads to a problem of lack of space for residence. Currently, average person per parcel is 6.6 which relation to existing spaces which usually, 2 or 3 rooms per household may seem very high and destroys the privacy, creating social problems. This situation points to creating housing patterns that have more room and less...
public spaces such as dens and living rooms. Rooms with smaller dimensions that can create more privacy for more populated houses.
There needs to be modifications to parcel sizes which means readjusting that number of persons per parcel is reduced and create a more normal giving pattern.
In a study of the renewal of the socio-physical in the cultural axis of KhakSefid\(^6\). This was used in the KhakSefid urban landscape study\(^5\) has been updated. The pattern, in general, the trend of creating balance between qualities within housing pattern and the economic capacity and ability of the neighborhood with focus on subdivision issues and density increase.
Based on this pattern, population increase and number of laborers in the neighborhood leads to increase in demand, and in turn, to higher land prices. The concept that the need for more limited use of land as good with limited supply has resulted. Also, since the demand is from lower-income people and low capacity for paying housing cost exists- the importance of this issue considering that 90.25 percent of residence have an income lower than US$500\(^7\). Thus, it was necessary to bring to same level the housing pattern with quality and quantity of space with the residence economic strength. The solution from past to present, the subdivision and in return, higher density by increasing the floor area ration. Herein, the tendency to reduce the risk from a sound ownership has again increased the process of subdividing land and smaller parcels.

**Walkability**

Based on studies, 37.7 percent of existing land use area is for street networks, this can be an opportunity

Currently, the highest volume in pedestrian is the sidewalk along Zahedin Street. The Soltani and Vaseghi streets also have high volume of pedestrian movement in peak hours. The width of Zahedi Street is 2.5 meters and in the other two streets is 3 meters.

Currently, only at the Zahedi and Shariati intersection there is pedestrian crosswalk and other intersection don’t have any. Thus, the pedestrian corridors are incomplete. More attention should be given to quality of pedestrian walkways.

We are faced with issues below from urban studies perspective:

- Adjacency to transportation terminals
- Adjacency to environmental sensitive areas (Sorkehesar)
- Adjacency to major industrial area (Hakeimiye)
- Spread of land use with moving in unsuitable functions from periphery.
Community Cooperation

In study of community cooperation, there are two factors involved: 1- creating common goals, 2- providing social interactions as a supplement of the first function. However, other functions can be effective in this regard (e.g. one can point to the role of women in participation in different aspects of community building)

There are following points to be considered:
- bonding social capital: if social capital have three aspects, namely trust, cooperation and social anticipation, then the residents of KhakSefid have all three. The major reason for having the social capital in this neighborhood, has been the common origin of migration from which the resident migrated from.

The social homogeneity (Turkish-Azeri speaking population) has caused them even after changing their residence can strengthen this relationships with high correlation (they are mainly from Tabriz and Ardebil in northwest of Iran) which have led them to find each other and come together and support each other. Social support is not limited to common traditions, and cover assisting each other in times of need such as creating funds to help out the poor.

The residents trusting the government organizations is low. Only 14 percent of residents are satisfied while 86 percent are not satisfied due to lack of security, youth addiction, unemployment and etc. They sense they are forgotten. Their problems are forgotten by government organizations and not having formal ownership. Thus, organizations first should gain trust of residence. In turn, the trust among the residence themselves is very high due to tribal and family ties. The inner trust has cooperation and strong conclusion between different groups. Thus, social participation is high among residences. Trust, cooperation, and social participation has led the residence to have high level of social capital.

- the most important mechanism for creating public institutions within the neighborhood is to have suitable space for coming together and being face to face. Such pace does not exist. On the other hand, preparing people for participation is also important which in this regard, using influential individuals and having meeting with them and informing people through them can lead to greater
participation with least cost. This can lead to strengthening the current cooperation and building places for public gatherings.
The need the following formal places which can increase social interaction include neighborhood council, skill’s houses, socio-cultural house and mosques.

CONCLUSION
The need to change the perspective on phenomenon of squatter settlement is unavoidable. Different aspects and factors such as social, population, economic, physical, and environmental factors in the process of solving this issue are effective. In terms of social tools, they have important impacts on cultural, security, sense of place, social participation. All these factors together on place development are impacted. In terms of economic tools, change in land prices and variety of area and price of housing, using the suitable density, using mixed land use are useful. Physical and environmental tools for spatial quality are important and in turn their effect on economic development, pedestrian accessibility, sense of place, sense of attachment, variety of transportation modes, can lead to greater human dignity.

In this research, the physical and spatial principles of neighborhood including social interaction, mixed land use, pedestrian oriented, sense of place, level of open spaces, and relationship between many centers, transportation modes and social participation in KhakSefid was discussed. The hypothesis was that using S.G principles can elevate the KhakSefid environment which is a spontaneous settlement

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TRAFFIC LESSONS FROM GERMANY - RECENT TRENDS AND A LONG TROUBLED HISTORY OF POSSIBLE FUTURES

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INTRODUCTION
Our mobility patterns are evolving over time, based on cultural developments and technological innovations. In societies like Germany, technological transformation is an integral part of everyday life that constantly challenges the status quo of how we move and communicate in our cities. With the advent of a new consciousness about the future of our planet, sustainability became the central topic of all aspects of our culture, and specifically future concepts of mobility. Sustainable mobility aims to cater to the needs of our time and to provide the capacities for future developments, especially when it comes to defining “sustainable mobility” in the XXI century.

In Germany, the approach to a sustainable mobility already evolved some decades ago in the 1980s, as alternative modes of counter culture such as the “Mitfahrzentrale” that organized travel in private cars of and with other people, and in innovation labs of big car companies towards digitalization and selfdriving cars. Some decades later and due to social media related sharing economies, car sharing, vehicle’s digital and technological evolution and a growing environmental consciousness are the driving forces for a radical rethinking of mobility in our cities, and the question of ownership of cars versus consumption on demand.

Sharing economy
Collaborative or sharing consumption is challenging the economy because it induces a two-sided consumer role which goes beyond the traditional notion of a buyer/consumer relationship. Until recently, companies have sold products and services to consumers, they now start pulling on their resources too through co-creation or prosumption (result of combining production + consumption). According to Scaraboto, this means that individuals are able to “switch roles, engage in embedded entrepreneurship and collaborate to produce and access resources”. Collaborative consumption is characterized by consumers’ capacity of being both “providers” and “obtainers” of resources, in a given “resource circulation system”. A collaborative consumption systems means therefore a resource circulation system in which the individual is not only a mere “consumer” but also an obtainer who has the opportunity to endorse, if wanted or needed, a “provider” role.

Supported by information technology and the popularization of the smart phones and other connected devices, now equipped with sophisticated geolocation technology, the collaboration could not be easier. Companies like AirBnB (apartments), Craigslist (online marketplace) or Uber (city transportation)
flourish in the last years, but it is the mobility sector where innovation has been most evident. Since the 1980s and even more so in recent years, collaborative options appeared for single trip car sharing between cities (Blablacar, Mitfahrgemeinschaft or Mitfahrzentrale) and different fleet of shared car (DriveNow, Car2Go, Flinkster) motorbikes (Coup, emmy) and bikes (Nextbike, Lidl-bikes, oBike, Mobike)\. Also public transportation companies started offering not only the schedules but real time information about the location of their fleet online and allowing an electronic ticket purchase from mobile devices, shortening the waiting time for users. Comfort in public transportation and reduction of individual costs are driving forces behind these new concepts of individual mobility.

Environmental consciousness

However, the discussions about environmental concerns is overshadowing all other arguments. The human impact on our environment has never been so evident and there are different indicators that point that out. Increasing atmospheric carbon dioxide (CO$_2$) content, partially a consequence of deforestation and the use of the combustion of fossil fuels such as coal, oil and gas for human activities, have reached an alarming level. The plastic production (roughly 300m metric tonnes of plastic annually) $^*$, and the extended use of concrete in construction is changing our environment. We know about the presence of isotopes from nuclear weapons testing in the 1950s and 60s as recognizable fingerprint of the human activity. And noise pollution is the second biggest environmental health threat in Europe and road traffic is by far the largest source, according to assessments published by the European Environment Agency (EEA) in 2017 $^{vi}$. The Anthropocene is the term proposed to name an epoch that acknowledge the increasing power and effect of humanity on the Earth’s systems\textsuperscript{vii}. Accelerating technological change, and a growth in population and consumption can be traced in all aspects of our natural environment.

All transformations discussed today have to be seen against this argument. The technological advances in the automobile industry are to produce more efficient vehicles, consuming less resources, and provide more security than ever before. The development of large capacity electric traction batteries started to change the current dominant petroleum oriented energy model. The introduction of the hybrid technology in cars combining fuel and electric motors has been a big success and is leading the way to a more environmental-friendly vehicles, pointing to a near future scenario where electric cars will be the main option for private mobility. However the production of batteries might cause other ecological side effects that are hardly discussed.

The hopes of a sustainable mobility relies on the application of technological implications in telecommunication, energy supply, digital devices and electric vehicles in order to update the current multimodal transport system.

MOBILITY TOPICS LEADING THE GERMAN & GLOBAL DISCUSSION

So what are the current topics in Germany’s discussion on future mobility? Germany has been one of the pioneer countries in the automobile industry since the 2nd part of the 19th century and companies like Mercedes-Benz (Daimler) (1886), BMW (1916) or Volkswagen (1937) are international leaders. With the third highest car production in the world and the fourth highest total motor vehicle production, the importance of the automobile industry can be appreciated in the labour force working in the industry (747000 in 2009) and in the exports (234 Mrd. sells in 2017)$^{viii}$. Currently, 3 German companies dominate the automotive industry in the country: Volkswagen AG (VW, Audi and Porsche), BMW AG (BMW, Mini), Daimler AG (Mercedes-Benz, Smart). Nearly six million vehicles are produced in Germany each year, and approximately 5.5 million are produced overseas by German brands$^x$. The country is specifically sensitive to changes that the sector is already experiencing and is looking carefully to foresee the future predictions. This awareness bring up different topics that are generally
discussed in different disciplines related to mobility.

**Air pollution and diesel car ban in the cities**

In the last few months, air pollution and the Diesel ban in cities is dominating the news. Missing the EU air pollution directive of 2010 might lead this year to economic sanction for Germany and other nine members states, which have now to propose additional measures to keep the air quality (NO2 and particulate matter 10 (PM10) among others) under supervision. The control of emissions from mobile sources, improving fuel quality and promoting and integrating environmental protection requirements into the transport and energy sector are part of these aims. Germany’s ban against diesel cars accelerated since carmaker Volkswagen admitted in 2015 cheating US exhaust tests. Paris, Madrid and Athens say they plan to ban diesel vehicles from their city centres by 2025, Rome a year earlier. Copenhagen’s mayor wants to begin restrictions as earlier as next year. France and the UK will ban new petrol and diesel cars by 2040. A consequence of the dieselgate is the new Real Drive Emission (RDE) measurements, that started in September 2017 and allow to check the air pollutant emissions of cars on the road with the help of portable measuring systems.

Last February, the Federal Administrative Court in Leipzig ruled that cities are allowed to impose driving bans on the most polluting diesel cars (a former federal Government competence). Judges said the cities can include diesel bans in their clean air plans, but have to ensure that any measures are proportionate to the goal of reducing emissions to the legal limit. The German Environmental Aid Association (Deutsche Umwelthilfe or DUH in German) calls in addition to RDE measurements, the introduction of a new environmental zones billboard, which is to mark particularly low-emission cars. Even those who have a green sticker (the green one certifies that a vehicle meets the current highest environmental standards) should not drive into certain environmental zones. It's all about nitrogen oxide, PM10 and CO2 emissions. The requirements for a new blue sticker would be met by many (even older) gasoline vehicles, but not by many diesel vehicles - not even by all cars that already meet the current highest Euro 6 standard.

**Free public transportation**

One major proposal to reduce air pollution is the introduction of free public transportation. Germany, in a letter to the Commission said it was considering plans to make public transport free in cities suffering from air quality problems. It also outlined measures to be tested by the end of this year at the latest, such as low emissions zones and supporting the extension of car-sharing schemes. As a consequence of that report, the Federal Government proposed 5 cities to try additional measurements to be concreted to improve the situation: Bonn, Essen, Herrenberg, Reutlingen and Mannheim. City administrations warned that more planning is going to be needed if free travel implementation is going to succeed. Also the funding system is to be discussed. The problem is to establish the financial support for more carriages, more personnel and maybe even more tracks and lines that would be needed. Public transport is highly popular in Germany, where the systems are usually regional and a ticket for the metro is also valid for trams and buses. Most German cities use a zone system to determine the price of the ticket and there is no physical barrier to access the trains so platforms feels like the extension of the public space. The number of journeys has been increasing regularly over the past 20 years reaching 10.3 billion in 2017.

**Zonification and cars**

Another proposal focuses on zonification and cars in relationship to car sharing, and electric and autonomous cars. The existing price zone system have been used by carsharing companies to start
operating in cities with extended public infrastructure like Berlin and Munich. Daimler launched Car2Go in 2008 \(^{xiv}\) in Ulm where it was developed by one of its internal business innovation units and was first tested exclusively by Daimler employees before going open to all citizens \(^{xv}\). The company is now in Berlin, Düsseldorf, Frankfurt, Hamburg, Munich and Stuttgart and other 20 cities in Europe, USA and China, using 14000 vehicles for 2.5 Million customers worldwide. BMW in collaboration with car rental Sixt, introduced DriveNow in Munich in 2011 and expanded rapidly to Berlin, Düsseldorf, Cologne and Hamburg in the following years and to other european cities. The system offer Gasoline, diesel and Electric cars to be rented for city trips. With more than 1 million clients and 7000 vehicles only in Germany, in cities like Berlin around 10% of their fleet are electric cars, a remarkable statistic knowing that market share of electric cars was 1,58% in 2017 \(^{xvi}\). The implementation of the charger infrastructure for the electric cars across the country is still a problem for the expansion of the electric car, as in many other countries. A massive plan has been announced to more than double the current electric car charging infrastructure by converting 12000 electric distribution boxes. With around 10,800 public charge points in Germany at the moment, the plan alone would double the current charging infrastructure in the country by 2020. Installing EV charging stations inside street lamp posts is also been discussed, but the technology has not been ready until recently. Berlin-based technology company, ubitricity, is working on technology that allows electric vehicles to be connected to the power grid wherever they park. The aim is to replace battery charging stations with ‘intelligent socket systems’ that can easily be used by drivers. They won a contract with the energy company OVO to install charging stations using their system in some streets of Kensington and Chelsea Council in London \(^{xvii}\). The implementation begins by converting existing street lamps to energy-efficient LED. This frees up some of the available power, which can then be used for an EV charging socket installed at the base of the lamp column – without having to dig up the road to install new cables \(^{xviii}\). The next generation of cars will make it possible to eliminate the driver. Different companies are testing autonomous cars. Olli, for example, is the driverless bus proposal sponsored by the Deutsche Bahn to update the public transport vehicles and it’s been tested in the Euref Campus in Berlin. But this technology is not only tested within the city, since regional governments like Baden-Württemberg, Niedersachsen and Nordrhein-Westfallen already defined areas on highways where autonomous cars can be tested \(^{xx}\). More test zones have been proposed in other parts of the country and will be in use during this year.

**Bike highways**

Another powerfull project is the implementation of Bike Lane Highways, that other European cities like Copenhagen already tested very successfully. Germany was the first nation to create a high-speed highway network for cars and now it’s joining the vanguard of countries doing the same for bikes like highways for cars. The bike *Autobahn* is designed to have flat surfaces and straight distances without crossroads, together with illumination and winter-weather maintenance. It includes a larger separation between pedestrians and cyclists, which should insure better safety, especially for wide loads such as cargo bikes. The potential of the idea are medium-length journeys for frequent daily bike users that travel from the suburbs to the inner cities. Munich is already planning a network of bike highways, which will stretch from the historic center out along 14 protected two-lane paths through the suburbs into the surrounding lake land. Also Berlin Government has foreseen 13 long-distance bike routes that will require cyclists to stop for no more than 30 seconds to accommodate intersections or lights. Even Germany’s fourth biggest city, Cologne, has a smaller plan for a similar bike highway out into its western periphery \(^{xx}\).
CONCLUDING REMARKS

How is architecture part of that transformation and what are the potentials for new building innovations? Every new technology like trains, cars or the telephone that get introduced into our city fabric changes the typology and urban network. The advent of digital technologies and mobility is just starting to make a big impact. We see new models of car ownership and individual mobility, changing commuter profiles and emerging local modes of transporation, new innovation for high speed connections like Hyperloop and drone networks that conquer our airspace. These innovations are critically discussed every day on a local and international level with the understanding of urgency as well as uncertainty about necessary changes in order to survive. And there is a vague understanding what this will mean for architects, engineers and urban planners. Infrastructure buildings for public transportation will become more diversified and the idea of Intermodal Hubs that connect between public transportations and individual mobility services is one big topic. The unique potential for architects is the speculation of a new building type that hasn’t existed before, and how the process of transformation and implementation towards these new forms of mobilities can be orchestrated, mostly around the implementation of electric and autonomours cars.

The major companies are scheduling the presentation of new electric vehicles (EV) that will increase their market share in the next years. At the same time, new clean zones are going to exclude the most noisy and polluting cars from the cities and the autonomous cars will start circulating in delimited private areas until a common standard technology be established. The public charging dock infrastructure will be the result of updating the existing electric points in the streets and the autonomy of the battery will increase with the time. The new housing projects already foresee the installation of private use chargers for EVs. The german company “urban standards” is developing business models to offer “mobility as a service” included in new real estate projects: concierge, gardener and an EVs fleet to service the inhabitants. Sharing cars and other smart technologies applied to achieve a more efficient mobility means that less private cars will be needed in the future. Some studies points out a reduction of 2/3 of private cars, liberating space on the streets, that might be the real winner of the new mobility: the re-qualification of the public space. That leads to an urban approach more than an architectural approach in the city centers but not in the suburbs, where big parking surfaces might not be needed and can become key areas to relieve the lack of housing and the sprawl problem. Since density is also a key factor to develop public transportation, this consequences might lead to better connections in that way. Public transport systems in the city are often organized radially, and cross-connections do not work. That can be an opportunity to fill these gaps with alternative, complementary lines, that will connect to the idea of free public transport system, in discussion recently. If more people are going to use it, the infrastructure needs to be resized: more frequency, more capacity or more carriages, more personnel at the stations and maybe more tracks and lines will be needed.

If the stations are going to be updated to host more capacity and transform into Intermodal hubs, new flow studies for a better integration in the surrounding urban context might be needed. Such projects already started in city hubs with mixed-use program, also called Transport Oriented Developments (TOD), like the main stations in Berlin, Stuttgart and Munich. Not only the station itself, but the real estate around it has an added value that attract investors. Putting existing lines underground has become a lucrative operation that many cities are implementing.

The architectural innovation to transportation hubs will then be linked to the generated land plots as a result of the creation of space on top of underground infrastructure. But sofar, in Germany, convential reality also sets in here as well: New mobility, yes, but just basic real estate business on top of it.
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