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Replacing Land-Use Planning with Localized Form-Based Codes in the United Arab Emirates: A Proposed Method

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Abstract: Abu Dhabi, the capital city of the United Arab Emirates (UAE), is one of the pioneering cities in the Middle East and North Africa (MENA) region that have recently prepared urban sustainability agendas for their cities. Nonetheless, the recently developed urban neighborhoods in Abu Dhabi mostly rely on Land Use planning and their urban forms are still missing essential sustainability qualities. The Form-Based Code (FBC), a sustainable planning tool that helps realize sustainable urban forms, is suggested in this research as an alternative for the conventional Land Use planning currently applied for new urban neighborhoods in Abu Dhabi. The research adopted a method for ‘localizing’ the global tenets and initiation processes of FBCs that outfit the local urban conditions. The investigation of the locally applied form-related regulations and guidelines revealed that they could be transformed into a localized FBC, but still lack some essential components of the FBC’s principles while the community involvement in initiating them was fairly limited. The research examined the applicability of this localized FBC model through interviewing the concerned stakeholders to identify the challenges that might face the adoption of it. The research concluded with recommending a set of actions for implementing the model in Abu Dhabi and other cities sharing similar urban circumstances.

Keywords: Form-Based Code (FBC); sustainable urban form; neighborhood design; MENA; Abu Dhabi; UAE

1. Introduction

Sustainable urban form is widely perceived as an essential pillar for realizing sustainable urban development. In literature, common criteria of sustainable urban form have been identified, including compactness, high density, mixed land use, diversification of housing types, interconnected street layouts, efficient public transport networks, walkability and cycling, green urban areas, security, environmental control, and high standards of urban management [1–4]. In addition, community involvement in the design decision-making process is considered an essential measure for attaining sustainable communities [5–8].

In any urban context, achieving sustainable urban form is significantly reliant on to the applied urban codes and regulations. In the 1980s, a group of planners and architects in the USA rejected the conventional zoning by which land uses are controlled and buildings are disconnected from each other and from the street. Instead, they worked on developing a Form-Based Code (FBC) that could efficiently define and enhance walkable, mixed-use, and sustainable communities through the principles of Smart Growth and the Charter of the New Urbanism. Since then, FBCs have been adopted in highly accelerated rates as highlighted by the study undertaken by Borys and Talen in 2013 [9].

Form-Based Codes could be essentially considered as representations of code-driven comprehensive planning/zoning tools for realizing sustainable urban forms. Unlike conventional land use planning, FBCs have the ability to control the form and the layout of urban development utilizing various components including building typologies, intensity and arrangement of buildings, public space standards, and the control of architectural elements. Such an approach enables land or building functions to adapt to environmental, social, and economic changes over time [10–14]. In FBCs the priority is given to the building form rather than its use. This is because the building form, which affects the public realm, is relatively constant but its use tends to change over time [15]. Form-Based Codes usually depend on graphics, illustrations, and perspectives for defining their main concepts and requirements to help the community recognize the rationale and tangible benefits of them [10,16].

Recent research works have proven the positive impacts of applying FBCs in achieving sustainable urban forms [12,15]. It is argued that because FBCs encourage compactness, mixing the uses, and creating more socially, viable, and walkable public realm, they would help aging residents live independently [11]. FBCs also support developing various affordable types of housing that could meet the different requirements of the community [16]. In addition, FBCs tend to control building types and architectural details, thus, preserving community aesthetics and character [15]. From an economic point of view, FBCs benefit real estate developers through offering diverse project sizes and uses with different allowable civic, commercial, and residential spaces. Therefore, the private sector can manage any sudden change in the market with minimum costs and can thus predict any possible problems experienced during the process of change [17].

Owing to its claimed success in the USA, FBCs have been recently attempted in different regions in the world. For example, in Scotland, the Grandhome community development was one of the projects developed under the Sustainable Communities Initiative with the aim of creating seven pedestrian-oriented neighborhoods based on the calibration of the Transect FBC system [18]. In another example from developing countries, FBC has been attempted in developing the Angondje phase II community plan in Gabon in 2012. The project was developed based on the adoption of a calibrated SmartCode that represented the tropical climate of Gabon [19]. A more relevant example in the MENA region, is the development of Dahiyah Al Muntazah urban community in Makkah, Kingdom of Saudi Arabia. The calibrated SmartCode for Dahiyah Al Muntazah aimed to achieve a sustainable community that is compact, walkable, and has a human urban scale, while responding to the local natural context, climate, and heritage. The involvement of local communities in developing the FBCs was strongly present in the cases of Scotland and Gabon, but it was absent in the case of Makkah where only professionals from several municipalities were invited in the SmartCode initiation workshops.

2. Background about Urban Form and Sustainability in the United Arab Emirates (UAE)

Many of the sustainable urban form principles were achieved in the traditional urbanism in the UAE and the Middle East and North Africa (MENA) region as a whole, where the influence of harsh climatic conditions was appropriately mitigated through the wise use of natural resources and the appropriate building and urban forms. For example, the central courtyard '*housh*' helped regulate the temperature within the buildings and the appropriate building orientation was a commonly utilized technique for passive energy saving. Buildings were typically located close to each other in order to create shading over the narrow paths '*sikkas*' separating them. The winding alleys enabled wind to increase in speed as it passes through, creating natural ventilation and helping cool down the streets [20].

On the other hand, the traditionally shared socio-cultural values of the local residents had a major impact on housing formation. This formation, as highlighted by Bianca [21], reflected the community-related socio-cultural customs, patterns of use, and corresponding structuring principles. For example, the windows were located high to maintain the privacy of the families. The courtyard was a private family space in which female members could conduct their daily and occasional social activities. The bent entrance of the house helped achieve privacy as it prevented people outside from

looking inside the house [22]. Public spaces were usually provided amidst each cluster of houses and functioned as the milieu for the tribal social gathering and activities. Mosques were moderate in size and were located close to houses and farms. The compact urban form made relationships with neighbors cohesive and interactive. Inspired by their values and beliefs, people sharing the same territory were expected to have mutual care, respect, and interdependence [23].

After the discovery of oil in the 1970s, the economy of the UAE has thrived and living standards of the people have significantly risen. Since then, the urban morphologies of the cities in the UAE, and the Arabian Gulf region as a whole, have witnessed profound changes due to the successive shifts from endogenous to exogenous types of urban growth [24]. Modern imported construction techniques and materials have been used in developing public buildings and houses. Architects and planners from all over the world have been hired to satisfy the needs generated by the rapid urbanization. As they applied Modern design and planning theories learnt in their countries, those practitioners contributed to the production of Modern architecture and urbanism with almost a unified, one-for-all, international style. Most of the public and residential buildings in many cities in the UAE have witnessed this rift with 'locality' due to the rush towards being 'Modern'. The several constructed social housing neighborhoods have been distinguished with their sprawling urban forms with wide streets and open spaces that made the reliance on private cars the norm for commuting. The unified and modern design of these houses has not been fully consistent with the local socio-cultural norms of the Emirati families. As a result, several informal amendments and extensions have been carried out by the residents to satisfy their either missing or changing needs [23].

As Abu-Lughod mentioned [25], traditional cities cannot be presently reconstructed, simply because almost none of the conditions which would permit doing so still exist. However, she believes, we still could learn from the values that the traditional urbanism often achieved including community, privacy, and beauty. Therefore, the aim should be developing neighborhoods that are supportive, foster privacy for households, and guard the rights of neighbors while still applying laws consistently.

In the recent decade, the UAE in general, and Abu Dhabi Emirate in specific, have strongly committed themselves to sustainability agendas with various initiatives in all types of development including an ambitious sustainable urban development agenda. Besides adopting the main principles of sustainability, as globally defined, the lessons that could be learnt from the traditional urbanism have inspired these initiatives as well. For example, Masdar City, launched in 2008, is meant to be developed as the world's most sustainable city combining both state-of-the-art technology with design features inspired from traditional local Emirati/Arabic architecture such as narrow shaded alleys and wind towers [22]. The locally-tailored building and urban codes in Abu Dhabi such as *Estidama* (sustainability) rating systems and Abu Dhabi International Building Codes have been initiated to help develop sustainable architecture and urbanism. The Urban Planning Council in Abu Dhabi issued a series of important sustainable urban design guidelines for public realms, streetscape, and neighborhood design, that are reliant on contemporary sustainable urbanism theories but are also tailored to the local context of Abu Dhabi and the UAE. Most of the standards and guidelines that regulate urban development in the Emirate of Abu Dhabi are currently issued based on the concepts enclosed within Abu Dhabi 2030 Vision and Plan Abu Dhabi 2030 [26].

3. Research Problem, Questions, and Methods

Despite all these initiatives, the mostly prevailing urban form of the recently developed neighborhoods in Abu Dhabi city have been limited to low density developments composed of single-family houses surrounded by high solid fences (Figure 1) and supported by some central services and facilities.



Figure 1. (a) Watani Community, Abu Dhabi; (b) Yas Community, Abu Dhabi.

Beside the recent research studies that focused on enhancing environmental sustainability in these neighborhoods [27,28], one study concluded that social sustainability was poorly achieved in local neighborhoods mainly due to the lack of safe and pleasant pedestrian/cycling facilities and housing diversity [29]. On the other hand, recent research indicated that the ownership of cars in Abu Dhabi is rapidly growing at a rate of 24% annually with a high dependency on cars for most journeys. High dependency on private cars has been justified by the urban sprawl, the social habits, and the climatic constraints in the region [30]. These urban-related unsustainability symptoms have stimulated this research to explore adopting the FBC as an approach for a solution while bearing in mind that FBCs cannot be blindly ‘imported’ to Abu Dhabi urbanism due to the different social and urban contexts in different regions in the world. Therefore, a ‘localized’ FBC is needed in which urban planners and designers could have the chance to develop proposals based on the local community’s vision that aim to realize sustainable urban forms [30–33].

To investigate the research problem, the following questions were addressed: First, how close are the locally-applied urban form-related regulations and guidelines in Abu Dhabi’s new urban neighborhoods to the main components of FBCs? Second, what needs to be changed/added/omitted to these locally-applied urban form-related regulations and guidelines to create a proposed localized FBC for Abu Dhabi? Third, what are the opportunities and obstacles facing the applicability of this proposed localized FBC, as perceived by the stakeholders in Abu Dhabi? To answer these main questions, the research adopted a qualitative approach as it helps provide a holistic overview of the context under study [34,35]. To answer the first research question, the components of FBCs in new urban neighborhoods and their application in some case studies were explored. Then, the research studied the form-related regulations and guidelines locally applied in Abu Dhabi’s new urban neighborhoods and compared them with the components and the processes followed in the development of FBCs. For addressing the second question, the conducted comparative analysis revealed the similarity and variance between the locally applied form-related regulations and guidelines on the one hand, and the components of FBCs on the other hand. For answering the third question, some interviews were conducted with stakeholders including the central and local authority representatives, planners, and community members to discuss the challenges that may face the application of the proposed localized FBC model for Abu Dhabi.

For the interviewed central authority representative, the Abu Dhabi Urban Planning Council (ADUPC) assigned a planning director in the Research and Development Feasibility, who is aware of all applied regulations, to answer all queries. For the local authority, Abu Dhabi Municipality (ADM), five representatives were met including two chief engineers, one senior engineer working in the Urban Planning Department and two Chief engineers from the Construction Permits Department. Two professional planners were also interviewed based on their involvement in designing new urban neighborhoods in Abu Dhabi. Finally, all the community members who were interviewed were Emiratis as the main context of this research is new urban neighborhoods allocated for Emirati citizens. The selected sampling method is the purposive sampling which relies on discovering useful patterns of information about particular groups or subsets of the population [36]. For a research that mainly relies on individual interviews, it is recommended that the sample size could be around 50 [37]. The actual sample in the research included 24 female and 22 male residents with an age range between 20 and 50 years. Some of them are married and all of them are educated. However, it should be noted here that the results of this research are linked to the local context of Abu Dhabi and are limited to its new urban neighborhoods. Also, the limited sampling size was affected by the limitation of the available time and resources allocated for the study, as well as the fact that getting access to the related information and to Emirati citizens was difficult during this research.

The semi-structured interview method, which uses open and closed ended questions with no specific order for the questions [38], was selected as an investigation tool because it is more manageable and provides flexibility in asking subsidiary questions or employing modes of exploration if necessary, depending on the interviewee's responses [34,39]. On the other hand, one of the strengths of the semi-structured interview lies in its high validity because it allows the interviewee to answer questions and justify their answers in sufficient detail and depth with a slight direction from interviewer, if needed [40]. This research adopted the face-to-face interview style even though it takes more time, but it actually allows for moving from one topic to the other and ensures the certainty about respondents' answers [41].

4. Form-Based Codes: A Global Practice

4.1. Main Components of Form-Based Codes

While the accurate identification of the main components of FBCs depend significantly on each project's specific needs, it could be claimed that the FBC is usually comprised of the following eight main components. First is the Regulating Plan, a detailed plan that usually illustrates the lots, blocks, building types for a specific area, the layout of the surrounding elements, and public realm elements including streets and public open spaces [42,43]. Second is Public Spaces Standards which provide specifications for each element within the public realm in terms of design and location [15]. They are distributed among two main groups of standards: Thoroughfares and Civic Spaces. A thoroughfare is a road used by vehicular and pedestrian traffic and provides access to lots and open spaces [44]. Civic space types are either open space or public areas including parks, squares, plazas, pocket parks, playgrounds, and playing fields [45]. Third is Block Standards that define the maximum dimensions of blocks and the streets patterns [14]. These standards are usually applicable on the project site that is two acres or larger. They usually include maximum block length (122–274 m) and maximum block perimeter (487–732 m) [43]. Fourth is Building Type Standards which define specific building types and how they are arranged in relation to the surrounding context [16]. Fifth is Building Form Standards including all standards related to building form dimensions and location in addition to car parking regulations, usually using three-dimensional illustrations with explanatory text [46]. Sixth is Frontage Type Standards that determine the interface between the buildings and the streets/spaces through providing measurements and standards for sidewalk layouts, tree lawns, stoops, porches, arcades, building height, street façade, and side lot setbacks. Depth, width, and height are typically regulated for different frontage types. Shading is considered as well when the frontage is facing a

walkway [43]. Seventh is Architectural Standards that vary from one community to another depending on the architectural style in the targeted area. Basically, architectural standards regulate the massing, windows and doors, details, color palette and combinations of materials. Also, they regulate the external architectural materials, composition, and quality [9]. Eighth is Glossary, in which all terms used in the FBC are defined [16].

Based on the above exploration, it could be claimed that the components of FBCs are considerably interrelated. For example, the allowed Frontage Types are included in Building Type Standards and they should be considered, as well, in the Public Space Standards to depict the relationship between the buildings and the street. In addition to these eight components, other optional ones such as green building standards could be included within the code based on the community requirements.

4.2. Developing Processes of Form-Based Codes

Form-Based Codes can be generally developed through two approaches: first is developing a community-wide FBC such as in the City of Cincinnati, USA, in which the Transect-Based FBC for all new urban neighborhoods was developed and adopted [47]. The second approach is developing a customized FBC for a specific area such as in Hampstead, London, England, which represents an example of developing a new neighborhood based on the adoption of SmartCode with some modifications [43]. In both approaches, five main stages for developing the FBCs were identified including: scoping, documenting, initial-consultation, design charrette, architectural charrette as well as, in some cases, post-charrette stages. The charrette process usually includes interviews, workshops and presentations conducted with the participation of local residents, developers and relevant agencies [48,49]. However, as mentioned by the Congress for the New Urbanism (CNU) in Michigan [46], in some communities the charrette process is not applicable for different reasons. For example, the community may not be ready for this kind of meetings in which some or all of the stakeholders cannot participate. There maybe also some political issues that could hinder charrette meetings, or the available budget might not be enough to support the charrette process. In these cases, two alternative strategies could be suggested. The first alternative is a Visual Preference Survey in which the community members select the preferable styles and forms among different pictures. The second alternative is a focus group of people attends a meeting controlled by a moderator to discuss various planning issues related to the community and thus helps depict a clearer image about the residents' behaviors and feelings [50]. Still, in other cases, the FBCs could be developed as 'By-right' standards without public hearing to accelerate and achieve a specific form of development [15]. Figure 2 illustrates the two different processes of developing the FBC.



Figure 2. The different development processes of Form-Based Code (FBC).

5. A Proposed Localized Form-Based Code for the New Urban Neighborhoods in Abu Dhabi

In order to establish a localized FBC for new urban neighborhoods in Abu Dhabi, the following steps were applied in this research. First, the locally applied urban form-related regulations and guidelines in Abu Dhabi were defined. Second, these defined regulations and guidelines were compared with the main FBC components as defined in Section 4.1. Third, the processes of developing these local urban form-related regulations and guidelines in Abu Dhabi were defined and compared with the globally adopted processes for developing FBCs presented in Section 4.2. Such comparison helped define the gaps that should be bridged to ultimately reach to a localized FBC for new urban neighborhoods in Abu Dhabi.

5.1. Locally Applied Urban Form-Related Regulations and Guidelines in Abu Dhabi's New Urban Neighborhoods

This section reviews the locally applied urban form-related regulations and guidelines that regulate and/or guide the development of the new urban neighborhoods in Abu Dhabi. These regulations and guidelines were actually developed by local authorities in Abu Dhabi in which various relevant traditional local features have been considered as detailed below. The aim is to study the extent to which these local regulations and guidelines can be considered as a base for a localized FBC in terms of components and process of development. Based on the results of this investigation, a proposed conceptual model for a localized FBC, following the same 8 point structure of the FBCs, was developed including recommended additions and/or modifications to the current Abu Dhabi's form-related regulations and guidelines.

There are three governmental authorities issuing various sets of urban form-related regulations and guidelines in Abu Dhabi; ADUPC, ADM, and Department of Transportation (DoT). The ADUPC is the central authority that is responsible for devising most of the regulations and guidelines for all new urban development projects within the Emirate of Abu Dhabi. The ADUPC has issued several documents including: Urban Structure Framework Plan for Abu Dhabi Vision 2030 [26], Master Plan Detailed Submission Requirements that include land use, densities, building mass, and site layout [51], Abu Dhabi Public Realm Design Manual (PRDM) for parks, streetscape, waterfronts, and public spaces [52], Abu Dhabi Urban Street Design Manual (USDm) for bicycle, pedestrian, and travel lanes [53], Pearl Community Rating System (PCRS) for evaluating design and construction sustainability of new urban communities [54], Pearl Villa Rating System (PVRS), and the 1 Pearl Villa Guide for evaluating the sustainability of the design and construction of new single-family houses [55,56]. Other documents issued by the ADUPC include the Commercial Signage Regulations (CSR) [57], Abu Dhabi Mosque Development Regulations [58,59], Abu Dhabi Utility Corridors Design Manual (UCDM) [60], and Abu Dhabi Community Facility Planning Standards (CFPS) [61].

Meanwhile, ADM issued the Guidelines for the Approval of Entrances for Residential Plots and Villas that regulate the vehicles' entrances and parking in terms of dimensions and location [62], the Unified Executive Regulations for Law No. (4) 1983 for Organizing the Construction Work, the Neighborhood Planning (NP) that puts up a depiction for the design of the *fareej* (traditional housing block) [63]. The DoT issued several documents including, the Executive Regulations for Law No. (18) 2009 and the Standards and Specifications for Parking Design identifying the technical requirements for car parking [64,65], Road Lighting Manual (RLM) [66] and Roadside Advertising Manual (RAM) [67].

All these documents, as summarized in Table 1, indicate that the urban form-related regulations and guidelines for new urban neighborhood in Abu Dhabi are quite scattered and were issued by several authorities in a timeframe ranges between 2007 and 2014.

Table 1. Local urban form-related regulations and guidelines for new urban neighborhood in Abu Dhabi. ADUPC: Abu Dhabi Urban Planning Council; DoT: Department of Transportation; ADM: Abu Dhabi Municipality.

Name of Standards and Guidelines	Issuing Authority	Legislation Type	Date of Issuing
Plan Abu Dhabi 2030-Urban Structure Framework Plan	ADUPC	Guidelines	2007
Master Plan Detailed Submission Requirements	ADUPC	Standards	2013
Executive Regulations for Law number (18) 2009 for Organizing Vehicles Parking in Abu Dhabi Emirate.	DoT	Standards	2010
Abu Dhabi Public Realm Design Manual (PRDM)	ADUPC	Standards, Guidelines	2010
Neighborhood Planning	ADUPC	Guidelines	2010
Pearl Community Rating System (PCRS)	ADUPC	Standards	2010
Pearl Villa Rating System (PVRS)	ADUPC	Standards	2010
1 Pearl Villa-Guide for consultants	ADUPC	Standards, guidelines	2010
Abu Dhabi Urban Street Design Manual (USDM)	ADUPC	Standards, guidelines	2012
Commercial Signage Regulations (CSR)	ADUPC	Standards, guidelines	2012
Master Plan Detailed Submission Requirements	ADUPC	Standards	2013
Road Lighting Manual (RLM)	DoT	Standards, guidelines	2013
Roadside Advertising Manual (RAM)	DoT	Standards, guidelines	2013
Abu Dhabi Mosque Development Regulations	ADUPC	Standards, guidelines	2013
Abu Dhabi Community Facility Planning Standards (CFPS)	ADUPC	Standards, guidelines	2014
Abu Dhabi Utility Corridors Design Manual (UCDM)	ADUPC	Standards, guidelines	2014
Guidelines for approval of entrances for residential plots and villas	ADM	Standards	2014
The Unified Executive Regulation for Law number (4) 1983 for Organizing the Construction Work in Abu Dhabi Emirate	ADM	Standards	2014
Standards and Specifications for Parking Design	DoT	Standards	2014

5.2. The Process of Developing Locally-Applied Urban Form-Related Regulations and Guidelines in Abu Dhabi

The development of the above regulations and guidelines were undertaken mainly by specialized teams from ADUPC, DoT, ADM, and other hired consultants. For example, the USDM was developed by ADUPC with the contribution of DoT, DMA, ADM, AAM, and Western Region Municipality (WRM), Abu Dhabi Police (ADP) and Abu Dhabi Civil Defense (ADCD), as well as the Health Authority of Abu Dhabi (HAAD), in addition to an international consultant team with technical advisors [57]. On the other hand, the community participation was only considered in preparing the PRDM document through a public survey administered with 10,882 households to determine the availability and use of parks, streetscape, waterfronts, and public places [52]. Currently, the development of new urban neighborhoods in Abu Dhabi is supervised by ADUPC in collaboration with local municipalities such as Abu Dhabi and Al Ain municipalities. Table 2 summarizes the development process of some of the form-related regulations and guidelines.

Table 2. The process and participants for developing some of urban form-related regulations and guidelines of the new urban neighborhoods in Abu Dhabi.

Abu Dhabi Form-Related Regulations/Guidelines	The Adopted Development Process	Participants
Plan Abu Dhabi 2030	Design workshops	Urban planning and community development experts. Representatives from Abu Dhabi's authorities
PRDM	Stakeholder meetings. Public survey was distributed households to determine the availability and use of civic spaces	ADUPC, DMA, ADM, AAM, DoT, TDIC, ADACH. Community members
NP	Based on the awareness of the needs of local communities	ADUPC
CSR	Based on best standards and specifications applicable worldwide	ADUPC and DED
RAM	According to other documents	DoT, DMA and ADUPC
UCDM	Based on the requirements of stakeholders. Bench marking study	ADUPC

5.3. Comparing Local Urban Form-Related Regulations and Guidelines in Abu Dhabi with the Components of Form-Based Codes

In this section, the locally applied urban form-related regulations and guidelines in Abu Dhabi's new neighborhoods are briefly compared to the eight generic components of FBCs as defined in Section 4. This qualitative comparison indicated the existing components, the partially missing components and the missing ones. The aim here is to define the gaps when the scattered local urban form-related regulations and guidelines are formulated into a proposed localized FBC for the new urban neighborhoods in Abu Dhabi.

5.3.1. Regulating Plan

While the Regulating Plan in FBCs provides a depiction for building types and forms as well as their relationship to the public realm in addition to the permitted uses in each area, Land Use Plans for the new urban neighborhood in Abu Dhabi have been developed based on conventional zoning which led to segregating them from each other and ignoring the frontage of street (see for example, Figure 3). Still, these Land Use Plans have partially utilized the ADUPC issued manuals including CFPS, USDM, and PRDM where several elements such as site details, development design and delivery, development control regulations, and community facilities have been illustrated.

5.3.2. Public Space Standards

Thoroughfare Standards: In Abu Dhabi, the USDM and PRDM are the main manuals that regulate public spaces elements. The street design measures define the pedestrian realm zones, transit users, cyclists, and motor vehicles according to the street categories (boulevard, avenue, street or access lane). Additionally, the standards of the Right-of-Way (R.O.W.) are distributed among the pedestrian realm, the frontage lane, and the traveled way standards. On the other hand, there are special street types including *mushtarak* (a space shared by both pedestrians and vehicles) and *sikka* (a pedestrian passageway between houses where cyclists may share it) [53]. The junction design measures define junction types, spacing, and layout design considerations, and traffic signs [53]. The streetscape design measures include different standards and guidelines that regulate shading, landscape, materials, street furnishing, and lighting [53,66]. Shading is an essential local strategy especially in the hot climate of Abu Dhabi. According to these manuals, any new street should be designed with respect to orientation and size to get the advantage of shading from adjacent buildings where possible. If shade could not be provided by the buildings within a development, different architectural options including freestanding

structures, canopies and arcades in adjacent buildings, should be incorporated. However, these are just optional guidelines [53] (Figure 4).

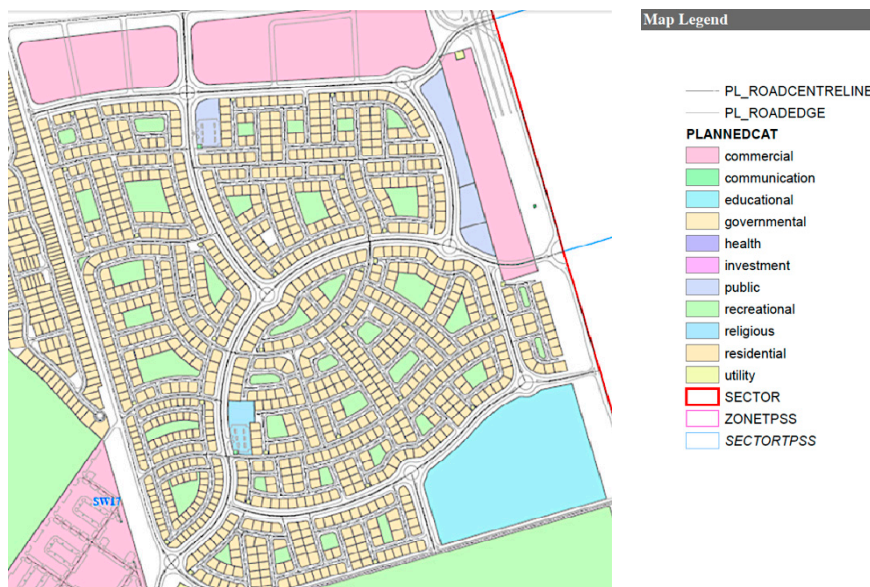


Figure 3. Watani Community in Abu Dhabi: land use plan (Source: ADM).

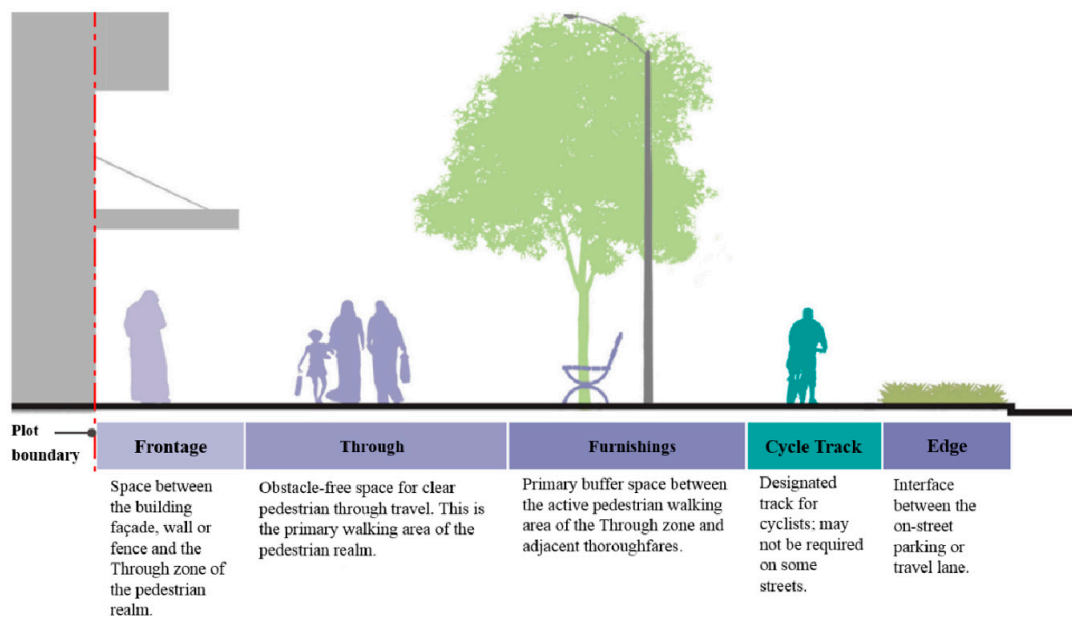


Figure 4. An example of a cross section for a street showing public realm zones and shading elements (Source: [53]).

Civic Space Standards: According to the PRDM, the main civic spaces are categorized into three groups: parks, streetscapes, and public spaces. Parks category includes various local types of spaces that suit the residential development in Abu Dhabi: art park, *baraha* (a traditional small semi-private space located in the *fareej*), community garden, linear park and *meyadeen* (a traditional small semi-public central meeting areas within the *fareej*). Public spaces include two main civic spaces: mosque and plaza [52]. All these spaces are regulated in terms of different design guidelines where applicable including car parking lots, shading elements, softscape and hardscape elements, and infrastructure.

Based on the above analysis, it is noticed that the generic thoroughfare and civic space standards within FBC are mostly covered by the locally applied urban form-related regulations and guidelines

in Abu Dhabi. However, not all of the regulations are ‘mandatory’. For example, allocating lanes for cycling within new residential contexts is ‘optional’. Moreover, although shading is an essential component which helps promote walkability, the manuals do not depict a clear set of regulations that encourage people to walk. And the R.O.W. width is limited to determining the dimensions for the pedestrian realm, frontage lane and travel way, while in the FBC additional elements which would enhance creating desired places such as the Frontage Type, are also included.

5.3.3. Block Standards

The Plan Abu Dhabi 2030 puts forward a vision for the Emirati neighborhood which is formed by several residential blocks named as the *fareej*, the traditional residential block in Abu Dhabi. The proposed dimension of each block (*fareej*) is 240 m × 240 m. The Neighborhood Planning document introduces a typical Emirati neighborhood that resonates with the hierarchical traditional open spaces of the *fareej* starting with courtyard houses, the *baraha* and the *sikka* [26,63]. The provision of *sikkas* is considered an effective strategy for increasing walkability and street connectivity because they provide direct access for all residents to different community facilities including transit stops, retail centers, mosques and schools [53]. Despite defining the block size in Abu Dhabi’s urban form-related documents, the maximum size of the block was not identified. This might end up with inappropriate block size that hinders walkability.

5.3.4. Building Type Standards

The newly developed Emirati urban neighborhoods in Abu Dhabi include different types of buildings, but the single-family house is still the only developed housing type with a minimum lot size of 625 m² inside Abu Dhabi island and 900 m² outside it [63]. According to the CFPS, when the population of a community is 6000 residents or more, the neighborhood center must include various facilities including community center, clinic, early learning center/nursery, community police point as well as nursery + primary school and/or K12 schools [61]. Also, the Unified Executive Regulations for Law No. (4) 1983 for Organizing the Construction Work in the Emirate of Abu Dhabi identifies the commercial and public service buildings including mosques, schools, clinics and other community facilities. These building types are regulated in terms of the minimum site size that is required to deliver the service, the type of the community facility, and the maximum plot coverage. The aboveground services are regulated through the UCDM including the location of solid waste collection bin [60,61].

Compared to the FBC components, the provision of housing in Abu Dhabi is restricted to single-family houses with various number of bedrooms and architectural styles (Figure 5). Furthermore, in spite of its importance in creating more inviting and walkable neighborhoods as well as identifying how the building interacts with the public realm, the Frontage Type of different building categories is missing in the urban form-related regulations and guidelines. For service and facilities buildings in the neighborhood, the treatment of the form of higher floors to respect the human scale and encourage the pedestrian movement is not considered.



Figure 5. Single-family house types within Al Falah community in Abu Dhabi, (a) Three bedroom villa, heritage style; (b) Four bedroom villa, Andalusian style; (c) Five bedroom villa, modern style (Source: [64]).

5.3.5. Building Form Standards

According to Abu Dhabi's urban form-related regulations, the minimum setbacks, the minimum length of buildings' elevations that face the street, the maximum building height, the height of architectural elements, the height of the *majlis* (men's guest hall) and ancillary buildings, the height of the ground floor, the maximum height of the ground floor, and the minimum and the maximum height of the typical floors, are all well identified [63]. Meanwhile, the Executive Regulation for Organizing the Construction Work defines the Built-to Line only for the ancillary buildings of villas. The construction of an outside *majlis*, additional services, guard rooms, and electricity rooms by the external residential plot fences facing main or secondary roads is conditionally allowed if their architectural design matches the design of the fence, and their constructions must not exceed 30% of the length of the fence. There were no requirements for any special treatment for specific building elements including corners [63]. The commercial signs over buildings are regulated based on the permitted dimensions, typologies, location, and position on buildings. The regulations also state that no sign or portion of a sign shall cover any major architectural element of a building or obstruct views into and out of the business premises (excluding glass fascia). All signs within a signage zone on a building must be consistent in height and position and designed to complement the building. Additionally, the DoT determines the amount of car parking lots based on the plot size and the uses and activities within a building [65]. Minimum two car parking lots, with minimum dimensions of 2.7 m × 5.5 m, should be provided for each residential unit within the housing plot [62].

Accordingly, most of the regulating elements in Building Form Standards are covered by the urban form-related regulations and guidelines in Abu Dhabi. However, these regulations and guidelines are fairly fragmented. Also, the regulations of car parking lots are separate from those of buildings and the Built-to Line regulation is not well identified as it is restricted for services and ancillary buildings that are built within the villa. Consequently, this does not ensure the variation of the visual character of streets and building corners.

5.3.6. Frontage Type Standards

The Frontage Type standards help create active frontages, attract pedestrians, as well as ensure the proper transition between the public and the private realms. As previously mentioned, the house plot in the Emirati neighborhood is usually surrounded by solid fences. ADM [63] provides regulations for the maximum height (4.0 m) and the minimum height (0.9 m) of the fence. If the side fence is facing a walkway between two plots it is allowed to exceed the maximum height and to be 6.0 m for achieving. However, in this case the solid part of the fence must not exceed 4.0 m. Also, the style of the fence should match the frontage style of the villa. Based on this analysis, it is revealed that the Frontage Type standards in the local urban form-related regulations in Abu Dhabi are limited to fences of the housing plots and they do not actually identify the various frontage types and the way in which the building frontage should be interrelated with the public realm.

5.3.7. Architectural Standards

The local urban form-related regulations and guidelines in Abu Dhabi stipulate that attention must be paid when designing the fenestration on the secondary elevations due to the need for privacy. For example, windows could be perpendicular to the boundary wall in order to maintain the privacy between the adjacent houses [68] (Figure 6).

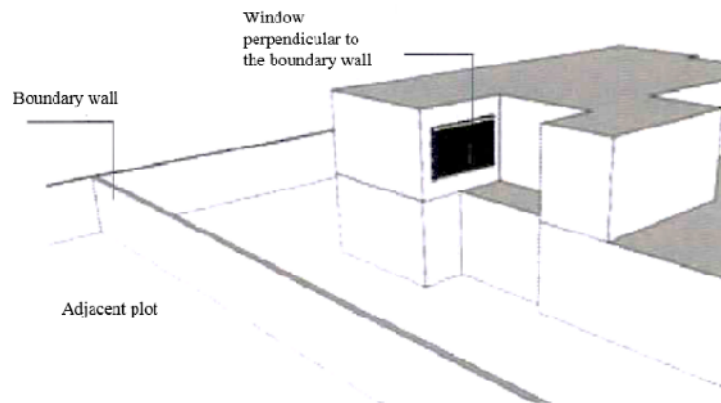


Figure 6. A window is perpendicular to the boundary wall to achieve privacy (Source: [68]).

Moreover, achieving the compulsory 1 Pearl Villa in Estidama rating system requires meeting various standards and guidelines including applying light colors finishes for exterior walls. Moreover, windows should be located in shaded areas (i.e., recessed into walls) and a *mashrabiya* (lattice wooden screen) style shading device should be used [55,56]. Abu Dhabi Municipality [63] introduced several regulations for permitting the addition of projections and balconies, including the canopy projection of the main entrance. The use of architectural elements like *barjeel* (traditional wind tower) or dome is allowed where the highest point shall not exceed 2.0 m from the highest point of the roof.

Despite these Architectural Standards, Abu Dhabi still lacks sufficient regulations that are more related to its architectural heritage. Most of the current regulations are optional and limited to some guidelines for the projections, balconies and the architectural forms. Also, there is a lack of regulations for the architectural treatment of buildings corners.

5.3.8. Glossary

All the manuals are associated with definitions and glossaries for all terms used, but still there is no unified glossary for the scattered urban form-related regulations and guidelines in Abu Dhabi.

All in all, the above investigation revealed that the urban form-related regulations and guidelines for new urban neighborhoods in Abu Dhabi are distributed among about 20 documents; some of them are not mandatory and many of them do not depend on illustrations. Furthermore, not all the components of the FBCs are covered in these regulations and guidelines. And these regulations and guidelines actually discourage the diversification of housing types. Abu Dhabi depends mainly on conventional zoning and does not have a clear Regulating Plan for its new urban neighborhoods. Finally, Table S1 summarizes the results of the comparison between the components of FBCs on the one hand, and the local urban form-related regulations and guidelines for new urban neighborhoods in Abu Dhabi on the other hand. The table indicates the degree of achievement using the color code shown underneath the Table S1. It also illustrates whether the type of legislation is a mandatory standard (S) or just a guideline (G).

5.4. Comparing the Development Process of the Urban Form-Related Regulations and Guidelines in Abu Dhabi with That of Form-Based Codes

Similar to development process of FBCs, scoping, documenting, and assembling stages were considered while developing the urban form-related regulations and guidelines of new urban neighborhoods in Abu Dhabi. These regulations and guidelines were mainly initiated based on the administrative decisions issued by ADUPC and ADM in addition to the contribution of other relevant authorities in Abu Dhabi. On the other hand, the community involvement was merely limited to the contribution in a public survey for developing the PRDM. So, the process of developing these regulations and guidelines resulted in 'By-right' standards that significantly lack public involvement.

5.5. Added/Modified Items to the Proposed Localized Form-Based Code for New Urban Neighborhoods in Abu Dhabi

Based on the above investigations and the identified gaps in the local urban form-related regulations and guidelines for new urban neighborhoods in Abu Dhabi (as summarized in Table S1), the research proposes some additions and/or modifications to these sets of local scattered regulations and guidelines to be organized in a way that ultimately achieves what might be considered a localized FBC framework for new urban neighborhoods in Abu Dhabi. Table S1 illustrates the main gaps (2nd Column) and the corresponding recommended additions/modifications (3rd Column). It is thus envisaged that a localized FBC for new urban neighborhoods in Abu Dhabi could be eventually realized when the scattered locally applied regulations are reorganized in one document and its gaps are bridged utilizing the main components of the FBCs. As a result, the proposed localized FBC for the new urban neighborhoods in Abu Dhabi could be composed of Table S1 in addition to the added/modified elements in Table 3.

Table 3. The added/modified items to the proposed localized FBC framework for new urban neighborhoods in Abu Dhabi.

FBC—Components	Form-Related Standards/Guidelines in Abu Dhabi	To Be Added/Modified Items
Regulating plan	Depends on conventional zoning Public space standards	Regulating plans must be developed for new neighborhoods
Cycle track	Providing cycle track is optional	Convert the provision of cycle track to be mandatory in neighborhoods
Right of way	The frontage type for each street type is not identified Block standards	Identify the allowable frontage types for each street type
Providing cycle track is optional	Convert the provision of cycle track to be mandatory in neighborhoods Building types standards	Providing cycle track is optional
Frontage type	Frontage types are not identified	Identify different frontage types
Building size and massing	The relation between height and massing is not identified Building form standards	Identify the relation between height and massing
Built-to line	Considered only in residential villas	Identify the built-to line for commercial buildings
Frontage types standards	Frontage type is limited to solid fences surrounds the villas	Identify different frontage types
Architectural standards	The provision of architectural forms is limited	Identify guiding forms that reflect Abu Dhabi character and heritage

6. Investigating the Applicability of the Proposed Localized Form-Based Code for New Urban Neighborhoods in Abu Dhabi

The following Section is an exploration of the responses of all interviewed stakeholders' regarding the applicability of the above proposed localized FBC for new urban neighborhoods in Abu Dhabi. As shown in Table 4, four major applicability concerns were defined including; first, the ability to unify the current urban form-related regulations and guidelines into one document. Second is whether the appropriate type of FBC is that developed for each individual neighborhood or it should be developed as a unified code suitable for all neighborhoods in Abu Dhabi? Third is the community involvement in the process of the FBC development as a significantly missing item in the locally applied regulations and guidelines. Fourth is considering developing various housing types instead of the only single-family house type currently being developed in Abu Dhabi. Table 4 illustrates the target interviewing groups for each of these four applicability concerns as relevant.

Table 4. Target groups for interviews about the applicability of the proposed localized FBC for new urban neighborhoods in Abu Dhabi.

FBC—General Issues	Form-Related Regulations/Guidelines in Abu Dhabi	To Be Considered for Abu Dhabi	Target Group for Applicability Interviews
Unified urban form-related regulations	The urban form-related regulations and guidelines are fragmented.	Unify all urban form-related regulations and guidelines in one FBC document with mandatory standards.	ADUPC, ADM, Planners
Developing FBC for each neighborhood or for all neighborhoods	There are general and special standards for neighborhoods.	Select an appropriate process type for developing FBC for new neighborhoods.	ADUPC, ADM
Involvement of local community in developing the FBC	The community participation was limited to one document and was not much significant.	Effectively involve community members.	ADUPC, ADM, Planners, Local community
Considering various housing types	The provision of houses is limited to single-family houses.	Consider various housing types including multi-story residential blocks.	ADUPC, ADM, Planners, Local community

6.1. Stakeholders' Opinions about Unifying the Form-Related Regulations and Guidelines in One FBC Document

The interviewed representatives of the central authority from ADUPC, the local authority from ADM, and the concerned planners were asked about unifying all the scattered locally applied urban form-related regulations and guidelines into one FBC code. All of them emphasized the importance and the need for merging all of these regulations and guidelines in spite of acknowledging some major associated difficulties. In detail, the interviewed representative of ADUPC claimed that although Abu Dhabi has most of the FBC components, the major constraint for a unified code is 'the lack of maturity of the planning system'. He added that Abu Dhabi lacks a robust legislative framework which would help implement all regulations and guidelines within the manuals mainly issued by ADUPC. Additionally, he indicated that when the first version of the Abu Dhabi Urban Development Code was finalized and accepted in 2010, various partners of the ADUPC argued that it would be difficult to implement because of its wide breadth and thus it should be pared down for smoother implementation. Therefore, from the point of view of the ADUPC's representative, to realize a unified FBC in Abu Dhabi, the willingness of all stakeholders has to change in order to be able to develop a common strategic plan as well as to impose mandatory regulations, not just guidelines.

On the other hand, all the interviewed representatives of ADM encouraged unifying the urban form-related regulations and guidelines. All of them explicated that this would facilitate the municipal technical revision of urban development projects, thus, reducing the time and steps needed for issuing the construction licenses. They added that this would also overcome the coordination difficulties associated with the existence of several governmental authorities currently responsible for various urban form-related regulations. Still, there was some concern about the difficulty of combining all the urban form-related regulations and guidelines into one code as claimed by one of the interviewed representatives of ADM. He argued that this would require a different planning system through which strategic plans could be developed and all scattered goals and strategies among related authorities could be unified.

The interviewed planners affirmed that the urban form-related regulations and guidelines are fragmented, and several government authorities enacted various regulations for the same element but usually with different requirements. So, for them, developing one source for the urban form regulations pertaining to new urban neighborhoods in Abu Dhabi would significantly facilitate the urban development processes.

In conclusion, although all stakeholders principally agreed on unifying the currently fragmented urban form-related regulations and guidelines into one mandatory FBC, the major problem was the

existence of several parties and authorities who are responsible for devising these regulations and guidelines and the lack of a sturdy legal framework that helps impose them.

6.2. Stakeholders' Opinions about the Appropriate Type of Form-Based Codes for New Urban Neighborhoods in Abu Dhabi

As clarified in this research, in some cases FBCs have been developed for all new urban neighborhoods in a city while in other cases, a dedicated FBC has been developed for a specific project, usually in a form of a calibrated version of the SmartCode. Although the interviewed representative of ADUPC believed that Abu Dhabi is not ready yet to adopt this code, he supposed that a standard SmartCode might be the best type of FBC. When he was asked if the proposed FBC needs to be first adopted as 'By-right' standards, without public consultation, he agreed as, for him, this would maintain the required strict level of regulations. On the other hand, all the five interviewed representatives of ADM, maintained that having both general regulations for all Abu Dhabi's new urban neighborhoods beside additional regulations for each of these neighborhoods might be the best solution. They explained that each urban development project has its own design concept reflecting the specificity and distinction of its unique urban context and location. Additionally, they added that such a margin of flexibility would encourage innovative design solutions.

So, in brief, it seems that there is some sort of an agreement among the stakeholders that having a 'standard' FBC for new urban neighborhoods in Abu Dhabi alongside some specific regulations relevant to each development project might be the most suitable type of FBC to be applied, at least for the time being.

6.3. Stakeholders' Opinions about the Community Involvement in the Development of Abu Dhabi's Form-Based Code for New Urban Neighborhoods

The opinions of the stakeholders varied significantly about the issue of community participation in the development of the FBC for Abu Dhabi. The interviewed representative of ADUPC mentioned that community consultation could take place only through focus groups from those who would likely live in newly developed neighborhoods. Meanwhile, only two of the five interviewed representatives of ADM strongly agreed with the notion of community involvement in developing FBCs for new urban neighborhoods. They asserted that residents should be asked about their functional needs including the design of their houses and how they imagine their community. One of them suggested that community participation can be through showing them various design models for villas to select from and then asking them about their opinion and whether or not they might need any modifications.

Nonetheless, three of the five interviewed local authority representatives of the ADM were against community participation in the formation of the FBC for two reasons. First, they believed that there is a lack of community awareness about the importance of standards in regulating spaces as the first one of them clarified. Second, they assumed that the involvement of community members would consume a lot of time during the process of developing the regulations for new neighborhoods. Instead, they suggested that the residents living in previously developed projects could be asked to define the problems they face in their communities so the designers can avoid them in newly designed neighborhoods. They maintained that, first, we should increase the awareness of the community about the participation in the development of standards for new neighborhoods and how their participation would benefit the whole community. Only after assuring that the community members are ready to participate, they can be involved from the beginning.

The two interviewed planners plainly refused the community involvement in the formation of the FBC. They believed that the residents can only be consulted on specific issues that satisfy their social needs like privacy and required facilities. They referred their opinion to their belief that local community members usually lack awareness on the importance of standards in regulating urban spaces and thus they cannot effectively contribute to the formation of FBCs.

On the other hand, all the interviewed Emirati residents expressed their willingness to effectively participate and to play a genuine role in developing their homes and neighborhoods. The majority of the interviewed residents (23 persons) claimed that their participation will help determine the appropriate types and sizes of needed services and facilities in their neighborhoods. They added that their participation will assure that these provided services and facilities would keep pace with the requirements of modern life while respecting the local culture of the Emirati society. Some of the interviewees (12 persons) clarified that their participation in the early stages of developing their neighborhoods would reduce time and money that can be later wasted in modifying and/or extending their houses. Other interviewed residents claimed that their participation would provide the chance to explore new ideas raised by the residents themselves (7 persons) as well as to discuss any new design trends adopted by the local authorities and clarify some possible concerns directly during the participatory meetings (4 persons) (Figure 7).

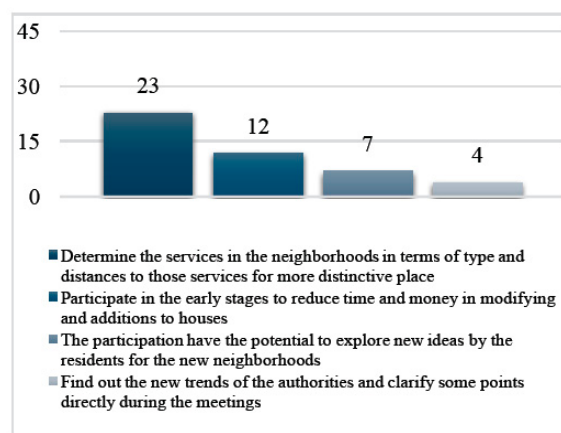


Figure 7. Justification of the importance of community participation by the interviewed Emirati residents.

As for the preferred way of participation, only 5 residents preferred the questionnaire as a way of participation due to the lack of time while the majority (41 persons) preferred to attend public meetings and to directly participate in discussing the design guidelines and regulations with the planners. Thirty-seven of those wanted to allocate special meetings for women and others for men. While only 4 interviewed residents found no problem for having gender-mixed meetings.

Despite the obvious disagreement about community involvement among the majority of the interviewed representatives of the local authority (ADM) and the interviewed planners due to their claim that the Emirati community is not ready yet for being involved in FBCs development, there is some belief that the Emirati community can have its awareness raised. This resonates with what was applied in the City of Cincinnati case study, where sessions were held for the community members for raising their awareness before conducting the design charrettes. Also, in the case of Grandhome, initial events were held to clarify the concept of the Charrette for residents [68]. Bridging the gap between the two distinctive attitudes of the community members who believe in their ability to positively contribute in formulating FBCs for their neighborhoods on the one hand, and the professionals who are profoundly skeptical about that and almost prefer adopting a 'By-right' FBC as the most suitable code on the other hand, is very essential. This actually remains one of the most serious challenges facing the implantation of the proposed localized FBC in the new neighborhoods in Abu Dhabi, simply because 'localized' entails the active involvement of the 'locals'. Also, gender segregation is another socio-cultural challenge facing the inclusive community involvement in developing the localized FBC in Abu Dhabi.

6.4. Stakeholders' Opinions about the Provision of Various Housing Types

The interviewed representative of the central authority (ADUPC) clarified that this issue has been discussed already, but, according to him, there is still no need for mixing housing types, at least at this stage of time. However, he believed that this will be the only choice in the future. In his opinion, giving the people the choice to live in a multi-story residential building is the best way to respond to the individual needs of the Emirati community and its changing demographic trends. He added that, it will be useful to explain to the people how this would reduce the waiting time for getting a plot of land or a villa from a governmental housing institution.

Two out of the five interviewed representatives of the local authority (ADM) said that providing multi-story residential building for Emirati families is inevitable in the future to help save resources. One of them suggested that the multi-story residential buildings may need to have special design considerations, so each flat occupies two floors with a private entrance. In contrast, the other two interviewed representatives of ADM disagree with the allocation of multi-story residential building for Emirati communities. They claimed that they could be provided for new emerging or small families and not for long time (for five years). One of them added that, even in this case, incentives must be offered to encourage Emirati families to accept living in multi-story residential buildings. The fifth interviewed representative of the ADM disagreed with the allocation of multi-story residential buildings all together. In his opinion the multi-story residential building does not encourage the formation of healthy social relationships.

One of the two interviewed planners agreed with the allocation of multi-story residential buildings for Emirati communities but only after studying the special requirements that must be satisfied to encourage Emirati families to live in multi-story buildings. The second interviewed planner claimed that a feasibility study should be conducted because Emirati families mostly prefer to live in a private villa and will not accept to live in multi-story buildings for a long time as well as it might be a socio-political sensitive issue.

Thirty-three out of the 46 interviewed Emirati residents did not agree with the idea of living in multi-story residential buildings. The lack of privacy in those buildings was the main reason behind their opinion. Eight of them clarified that they need a private small garden for themselves and for their children. Some of them added that they would feel restricted in an apartment in a residential block and it is difficult for large families to adapt therein. Still, 13 out of the 46 interviewed Emirati residents agreed with the notion of living in multi-story residential blocks if their flats are occupying the whole floor because, for them, having only one flat occupying the whole floor will provide privacy for their families. They added that the flats should be spacious enough to accommodate all family members. They also asked for developing a nearby park to compensate the absence of their own gardens if they were in private villas. Some residents asserted that buildings should not be too high. So, it is clear that there are conflicting opinions among the interviewees but with the majority of them were against mixing housing types.

All in all, the set of the conducted interviews with the different defined stakeholders has revealed the challenges facing the possible successful implantation of the proposed localized FBC, as summarized in Table 5. The challenge of the fragmented urban form-related regulations and guidelines sounds the least disturbing one with attainable agreement among most interviewed stakeholders. Meanwhile, the other three challenges; the appropriate type of FBC, the extremely limited community participation, and the limited development of only single-family houses, seem the most difficult-to-overcome challenges. More effort is desperately needed to reach solutions.

Table 5. The stakeholders' opinions about the challenges and opportunities facing the application of the proposed localized FBC for Abu Dhabi new urban neighborhoods.

FBC Essential Issues	Challenge	Opportunities	Suggested by
Unified urban form-related regulations		All of stakeholders agreed on unifying all urban form-related regulations and guidelines in one FBC mandatory document	CAR, LAR, IP
		Establish a strategic plan to unify all goals and regulations	CAR, LAR
		Boost the willingness of all stakeholders	CAR
		Unifying the urban form-related regulations and guidelines will facilitate the design process	LAR, IP
Developing FBC for each neighborhood or for all neighborhoods	Appropriate type of FBC for Abu Dhabi	Adopt a 'one-for-all' FBC (a calibrated SmartCode) with special regulations for each community	CAR, LAR
		Adopt 'By-right' FBC, firstly	CAR
Involvement of local community in developing the FBC	Very limited community participation	Some of the stakeholders encouraged the community involvement	CAR, LAR
		Community involvement, if applied, could be through focus groups	CAR
		Raise awareness of Emirati community	LAR
		All express their willingness to participate	ILCM
Considering various housing types	Limited to single-family houses	Hold separate meetings for women and men	ILCM
		Some of the interviewed stakeholders encouraged the provision of various housing types	CAR, LAR, IP
		Residents should be asked if they want to live in multi-story buildings	CAR, LAR
		Incentives should be offer for Emiratis who accept to live in multi-story residential buildings	LAR
		Considering privacy and special elements (for example: not too high multi-story buildings and only one flat per floor)	LAR, IP, ILCM
		Conducting a feasibility study about providing mixing of housing types in Abu Dhabi.	IP

CAR: Central Authority Representative; IP: Interviewed Planners; LAR: Local Authority Representative; ILCM: Interviewed Local Community Members

7. Conclusions and Recommendations

Adopting sustainable urban form has been advocated as the solution for the problems associated with urban sprawl and high dependency on cars. In the USA and other regions, FBCs have been utilized as tools for attaining sustainable urban form in replacement of the lengthily applied conventional zoning in urban design and planning. FBCs have the potential to realize all the characteristics of sustainable urban form through achieving compact, mixed-use, mixed housing types and pedestrian-friendly development as well as promoting a sense of place diversification.

On the other hand, many of the sustainable urban form principles had been achieved in the traditional urbanism in the MENA region and in the UAE in specific. As it is not possible to reconstruct the traditional cities by design, lessons could be learned from the traditional urbanism to help develop neighborhoods that are supportive, foster privacy for households, and guard the rights of neighbors while still applying laws consistently. Despite the recently developed sustainability driven initiatives in Abu Dhabi, the most prevailing urban forms of the newly developed neighborhoods are still unsustainable. This has stimulated thinking of the FBC as an approach for a solution while bearing in mind that FBCs cannot be directly applied in Abu Dhabi urbanism without customization.

To attain its objectives the research, first, explored the locally applied urban form-related regulations and guidelines for new urban neighborhoods in Abu Dhabi and compared them with the defined main components and development processes of the FBC. The results of this comparison revealed both the existing and the missing components of urban form regulations. In terms of the comparison with the developing processes of FBCs, the locally applied urban form-related regulations and guidelines for the new urban neighborhoods in Abu Dhabi's were issued by several local authorities through decision-making processes in which the involvement of local communities

was almost absent. Based on these investigations the research initiated a proposed localized FBC through reorganizing the locally applied urban form-related regulations and guidelines in a FBC format after bridging the revealed gaps with relevant additions and modifications.

Four essential challenges facing the implementation of this proposed localized FBC have been identified and discussed with the target groups of stakeholders representing the central authority, local authority, planners, and local community members. These are; the ability to unify the current urban form-related regulations into one document, the appropriate type of FBC for the case of Abu Dhabi, the involvement of local communities in the development process of the FBC, and the ability to consider various housing types in the new urban neighborhoods. The interviews with the stakeholders' representatives divulged that for attaining a localized FBC for Abu Dhabi, some of these challenges could be overcome conveniently while some others are more challenging. It seems that the paradoxical attitudes of both the professionals and the community members towards the community participation in developing this code is actually the major challenge that should be confronted. Such contradictory attitudes actually require some sort of reconciliation that acknowledges the right of the community in being involved in these decision-making processes but after adequate mutual learning and consensus about the utmost objectives of the FBC. As discussed in Section 1, most successful experiences of the development of FBCs, either inside or outside USA, were associated with rigorous community participation mainly through design charrettes sessions. Also, one should bear in mind that the traditional built environment in the UAE was the output of a decision-making process that had been chiefly led by the local community members.

In light of the findings of this research, its recommendations can be categorized into four levels as follows. Firstly, at the level of the central authority, it is recommended to set a timetable and an action plan for the development and adoption of the proposed localized FBC, conduct several meetings and charrettes with community members during and after developing the code, increase their awareness about the importance of community involvement in developing FBC for new urban neighborhoods in Abu Dhabi, schedule site visits of successful examples and case studies for developing and adopting FBCs, and develop guiding forms that ensure the creation of an expressive architecture that helps promote and preserve the identity of Abu Dhabi. Secondly, at the level of the local authority, the research recommends conducting various workshops and training sessions for the local authorities' personnel and practitioners to enhance their knowledge of the importance of sustainable urban forms and the FBC and clarifying the way of developing and adopting the localized FBC for Abu Dhabi. Thirdly, at the level of the planners, the research recommends raising the planners' awareness of the importance of community involvement in the development process of the localized FBC for new urban neighborhoods. Fourthly, at the level of the community members, the effort from community members must be entwined with that of the central and local authorities as well as the planners to realize the desired sustainable urban form. This could be achieved through the active community involvement in regular community events and design charrettes. Beside raising the community members' awareness about the importance of the FBCs in regulating urban spaces, this would promote the sense of community and encourage the community members to bear responsibility towards their neighborhoods.

In conclusion, the necessity to reduce the negative impact of the unsustainable urban product on the natural resources actually raises the demand for seeking solutions for actions in the planning of local urban communities, even at the cost of modifying current 'unsustainable' behaviors and attitudes. FBCs seem to offer promising solutions in various regions in the world including Abu Dhabi, albeit there are serious challenges that still require attention and action on all levels. The research findings can be cautiously generalized to other cities in the Arabian Gulf region where environmental, social and economic contexts are, to a great extent, similar. For the wider contexts in the MENA region, the phased methodology followed in this research might be attempted to help produce a customized FBC for each local urban context in this region. So, first, the eight category FBC conceptual framework established in this research could be used to compare it with the locally applied regulations of urban

forms and streetscape in each of these urban contexts to define the gaps/additions related to the principles of the FBCs planning system and thus, produce a customized, but still theoretical, FBC. Then, the interviews with stakeholders related to the planning process, including local community members, can be utilized to explore the feasibility of adapting to this conceptually proposed FBC approach.

Supplementary Materials: The following are available online at <http://www.mdpi.com/2073-445X/8/3/47/s1>, Table S1: Summary of the results of the comparison between the components of the FBCs with the local urban form-related regulations and guidelines for new urban neighborhoods in Abu Dhabi.

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