

## The Mechanisms of Achieving and Rating Urban Sustainable Neighborhood Projects in Baghdad City (Hypothesis Academic Vision)

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### Abstract

This scientific study seeks to shed the light on the first academic sustainable housing projects study designed by the fourth stage students in Baghdad University-Architecture Engineering Department, 2015, in a site in Baghdad city chosen for its environmental and site potentialities that achieve urban sustainability. The idea of the academic project is adopting urban sustainable neighborhood principles starting with the development and planning level, mixed uses strategies, the application of TOD and green transportation, site and green natural areas preservation, reaching to the design level by designing compact within contemporary housing clusters which applied green technologies from the use of renewable energies like solar panels, green roof gardens, water recycling, to the designing detail of an eco-house in urban orchard area. Finally, the researcher seeks to rate the projects according to (LEED - ND) rating system to measure the level of sustainability in some of the best- chosen academic projects in order to study the possibility of achieving the universal principles of the sustainability in the local projects. The findings are so many creative academic projects which showed two main results, firstly the possibilities of applying the universal principles of urban sustainable neighborhood in Iraqi cities in general and Baghdad as a case study to achieve urban sustainability and secondly the necessity of developing a local Iraqi urban sustainability criteria and rating systems suit with Iraqi environment and work with the local microclimate.

**Keywords:** Urban Sustainability, Smart Growth, LEED-ND, New Urbanism

### اليات تحقيق وتقييم مشاريع المحلة السكنية الحضرية المستدامة في مدينة بغداد (تصور أكاديمي افتراضي)

#### الخلاصة

تسعى هذه الدراسة العلمية الى تسليط الضوء على اول دراسة اكااديمية لمشاريع اسكانية مستدامة صممت من قبل طلبة المرحلة الرابعة في جامعة بغداد- قسم هندسة العمارة عام ٢٠١٥. في موقع ضمن مدينة بغداد اختير لما له من الامكانات البيئية والموقعية التي تحقق الاستدامة الحضرية. تكمن فكرة هذا المشروع الاكاديمي على تبني مبادئ المحلة السكنية الحضرية المستدامة بدءا بالمستوى التخطيطي والتطويري، استراتيجيات السكن المتعدد الاستعمالات، تطبيق اليات تصميم السكن الموجه نحو عقد النقل والنقل الاخضر، الحفاظ على الارض الخضراء الطبيعية، وصولا الى المستوى التصميمي عن طريق تصميم السكن المتضام ضمن تجميعات سكنية معاصرة تطبق تقنيات البناء

الاخضر من توظيف الطاقات المتجددة كخلايا الطاقة الشمسية، والسقوف الخضراء، والماء المعاد تدويره، وصولاً إلى التصاميم التفصيلية في تصميم المسكن الأيكولوجي في منطقة البساتين الحضرية. وكخاتمة يسعى الباحث إلى تقييم المشاريع المنتخبة باستخدام نظام لييد للمحلة السكنية المستدامة لقياس مستوى الاستدامة في بعض أفضل المشاريع الأكاديمية المنتخبة بهدف دراسة إمكانية تحقيق مبادئ الاستدامة العالمية في المشاريع المحلية. النتائج كانت العديد من المشاريع الأكاديمية المبدعة التي بينت نتيجتين أساسيتين الأولى إمكانية تطبيق المبادئ العالمية للمحلة السكنية الحضرية المستدامة في المدن العراقية عامة وبغداد كحالة دراسية لتحقيق الاستدامة الحضرية، والثاني هو ضرورة تطوير معايير وانظمة تقييم استدامة حضرية محلية تتلائم مع بيئة العراق وتعمل ضمن المناخ المحلي.

**الكلمات المرشدة:** الاستدامة الحضرية، النمو الذكي، لييد -المحلة السكنية، الحضرية الجديدة.

## INTRODUCTION

In 2015, the students of the 4<sup>th</sup> stage examined the first academic sustainable housing course in the Baghdad University–Architecture engineering department. The idea of this course is the adoption of sustainable practices of the urban design by introducing and teaching our students the basic and the principles of successful sustainable neighborhoods' design and its multiple levels. The problem in the course was the lack of the students' awareness and theoretical background of the basic principles of sustainability and sustainable development and how to combine them with sustainable neighborhoods' design in the limitation's course time. Accordingly, the problem of the research paper is the lack of identifying the most successful proposal that achieve urban sustainability by applying most of sustainable neighborhood principles in multiple levels. So, the idea of this research paper comes in two parts: the first theoretical part is the inductive overview one which explains the development of the urban sustainable neighbourhood principles and its interrelation with Smart Growth strategies, New Urbanism movement, and US Green Building Council to achieve urban sustainability through LEED\_ND program. And the second part is the practical one which provides innovative tools to measure urban sustainability using LEED-ND rating tools. The findings represented by providing a base in which the developer in Iraq can apply, measure, and identify whether the proposed urban project is sustainable or not depending on LEED-ND universal rating system. Moreover, the results showed the urgent need to develop an Iraqi urban sustainability standard in line with the contemporary sustainable language of the time. Theoretical part: The development of the sustainable neighborhood principles. Smart Growth strategies:

Although the working with Smart Growth principles and strategies started in the early of 1990s, the official term of Smart Growth can be traced back to the 1997 when many reliable Associations and organizations adopt this term at this year, the American Planning Association (APA) launched "Growing Smart Legislative Guidebook: Model Statutes for Planning and the Management of Change" followed by "The Took Kit for Smart Growth" which published by the Natural Resources Defense Council (NRDC), and then the State of Maryland legislated the Smart Growth and Neighborhood Conservation Act. Since then, Smart Growth applications have started to spread and developed rapidly year after year [1].

Many definitions came to introduce Smart Growth strategies but all of them agreed that Smart Growth refers to the development principles and practices that lead and create more efficient, compact, interconnected, mixed, accessible land use urban

patterns which produce more livable, healthier and has proven to be more sustainable communities in great affordable neighborhoods [2]. In addition, Kelsey, 2004 defined Smart Growth as: “a philosophy based on a set of principles designed to guide local communities to promote and ensure development activities that yield improved quality of life, environmental sensitivity, economic revitalization, and sense of place” [3]. Smart Growth has five strategies concentrate on the development, design, transportation, community and open space protection. With these strategies Smart Growth has ten recognized principles started with the mixed land uses, compact design, housing opportunities, walkable neighborhoods, sense of place, preserve natural open spaces, community involvement, and variety direction of development, multiple transportation options, and cost-effectiveness [4].

From the above, the development of urban sustainability principles started when the organizations adopted smarter growth strategies, however, these strategies were not the first in launching urban sustainability principles.

### **New Urbanism and urban sustainability**

With the diverse definitions of sustainability and sustainable development since the term appearance in 1969 and the official famous definition in 1987 which address and identify the impact of human activities on the environment, there is a lack of finding a comprehensive definition of urban sustainability and sustainable urban development term. However, the concept is adopted by a movement which promotes urban design practices that achieve urban sustainability and encompasses its principles. This movement called itself a New Urbanism, which appeared in the early of 1980's. Since then, the New Urbanism congress, which established by the activists of the architects, physical planners and developers in 1993 laid the foundation for the movement's principles and their achievements [5]. Lots of changes have been achieved by this movement, especially after the guiding movement document publishing in 2008-2009 (Canons of Sustainable Architecture and Urbanism) clarifying the relationship between New Urbanism and sustainability, including the engagement of Urbanism, architecture, construction practice and conservation in the creation of humane and interconnected places, and providing better models for future development [6].

The principles of the New Urbanism focus on the development of the traditional neighborhoods' design in a sustainable way based on friendly mixed use zoning, walkable, limited or free car parts, protecting natural environment, providing a range of affordable housing opportunities, efficient use of natural resources [7]. These principles seem to be similar to Smart Growth principles, however, New Urbanism movement set a specific strategies for implementing these goals by a group of architects and urban planners versus setting Smart Growth policies which came with a community of environmentalists and policy planners [8].

The popularity of Smart Growth achievements has emerged with the concept of urban sustainability and New Urbanism principles and interrelated with them in spite of all their changeable trends. Urban sustainability changed the attitude of the development debate away from the traditional growth as Robert Riddell mentioned in his book (Sustainable urban planning, 2004). He made a comparison between the traditional planning and the sustainable, innovative planning, describing the traditional one as a low variety, logical, structural outcomes, normative, and rigid characteristics While urban sustainability planning intends to be complex verities, creative, procedural outcomes, optimistic, considers alternatives characteristics, and a

lot left at his book [9]. Over time, Smart Growth considered urban sustainability planning ‘for its implementations that lead to the social equity, ecological integrity, and affordability with economic profits [10]. In addition, New Urbanism principles similar to the Smart Growth ones, both of them call for the compactness, walkable areas, mixed-uses, public and range of transportations and diverse range of housing [11]. Both of them seek for higher quality of life for healthier people [12].

From the above, and from the previous researches, the research collected the most appropriate definition for urban sustainability by defining it as "the development process which try to promote the urban formation with all its evolving of physical dimensions (built environment, street layout, land uses, transportation, population density, dispersal &llllkkkk concentration degree, mass to space density, and infrastructure...Etc.) to the highest level of urban performance in a way that enhance the community livability and leads to the social structure coherent, residents satisfaction, economic development on the one hand and respecting, the environment in which protecting and not bleeding natural resources on the other hand [13].

So, New Urbanism, Smart Growth, or any other movement work in some principles that lead to enhance the quality of life through developing the built environment can reach in one way or another urban sustainability.

### **Sustainable Neighborhood**

Since the Clarence Perry's neighborhood unit concept, and the Radburn principles of Clarence Stein and Henry Wright for the traditional neighborhood Design appearance 1929 [14], neighborhood planning developed to include a variety of housing opportunities and land uses with civic, commercial, educational facilities, buildings, to be located within 5 minutes walking distance of private homes, creating a vivid community that serves a wide range of residents. A neighborhood concept served by a network of paths, streets, and lanes suitable for pedestrians as well as vehicles and provides the residents the options of walking, biking or driving to places within their neighborhood. So it is the place where people live and spend most of their time) [15]. In addition, the neighborhood considers the main unit which form our cities. Thus, planning and design of urban neighborhood must be comprehensive to meet residents' requirements and accommodating new development by considering the needs of the future generation [16].

Nowadays and with the rising of urban sustainability principles and criteria, the most sustainable neighborhoods tend to adopt them, and neighborhood resilience amidst changing economic and socio-political conditions [17]. Accordingly, there is no clear, comprehensive definition for the sustainable neighbourhood rather than it is agreeing to meet and respond to the main definition of sustainability and its dimensions in multi-level scale. In this regards, UN-Habitat that has support for better urban future, improved a set of strategies for sustainable neighbourhood, which provide a broad range of factors involving “Adequate space for streets and an efficient street network, High density, Mixed land-use, Social mix and Limited land-use specialization” as the main principles of planning for a sustainable neighbourhood [18].

### **LEED and green building council**

The U.S. Green Building Council (USGBC) is a nonprofit association composed in 1993 of many groups of architects, planners, builders, environmentalists, leaders from every sector of the building industry, teachers, students, lawyers and anyone

share the same vision and passion to the sustainable built environment [19]. This entity works to promote buildings and communities with healthy, profitable, responsible places to live and work with a mission takes on its consideration the transmission of the built environment designed, operated and maintained to enable social, healthy and response environment that that improves the quality of life [20].

USGBC developed LEED (Leadership in Energy and Environmental Design) green building rating systems. Nowadays, The LEED green building rating systems are the most recognized, nationally accepted, and rapidly grow systems used for promoting and rating green development [21]. LEED has many programs<sup>1</sup> with credits for all LEED rating systems in same six categories as noted in Figure (1). These categories started with site, water, energy, material, indoor air quality and ended with innovation of design that differs from region to region [22]. There is a lot to say about LEED programs which come to evaluate the environmental performance, and promote an integrated design process. However and coinciding and reflecting the ideas of Smart Growth and New Urbanism ideas, the U.S. Green Building Council, co-developed by the Natural Resources Defence Council, and the Congress for the New Urbanism, LEED-ND standards as seen in Figure (2) which developed by the researcher. They found that working separately are insufficient and sometimes even at odds with one another in manage the environmental, economic and social challenges.



Figure 1: LEED categories [23]

**Their principles** became interrelated to LEED\_ND<sup>2</sup> and considered part of its principles which included mixed, compact land uses planning, a variety of transportation choices, sustainable design, livable cities, walkable neighborhoods, open space preservation and natural resource protection, housing opportunities and affordability, climate change and action, social justice and cost effective, healthy living encouragement.. etc [25].

<sup>11</sup> LEED has many programs included( and launched LEED Version 1.0 in 1998): New Construction, Commercial, Interiors, Core & Shell, Schools, Homes, Existing Buildings: Operations & Maintenance, neighborhoods and new rating systems will soon be available for health care facilities, retail buildings. [24].

<sup>2</sup> LEED-ND means (Leadership in Energy and Environmental Design- Neighborhood Development). This rating system contains a set of measurable standards that identify whether a development or proposed design of a couple of buildings can be environmentally friendly project, considering the development's location and access, its internal pattern and design, and its use of green technology and building techniques. These standards include prerequisites as a baseline for sustainable neighborhood development) and credits as (additional standards) [26]. **This research paper will explain the main prerequisites briefly taking in consideration the research's length.**

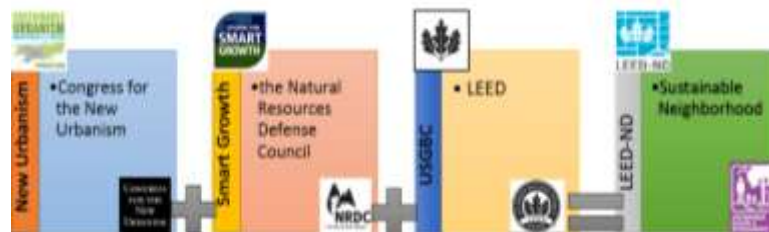


Figure (2). The born of LEED-ND (The researcher analysis)

In detail, sustainable neighborhood should have: An Integrated design system combining residential and nonresidential activities into one neighborhood design, Walkable distance, Lots of housing types with the diverse range of residents' economic levels, Range of jobs types near houses to reduce transportations cost, Transit connectivity, Walkable well designed streets, Green technologies and infrastructure, shading systems, orientations to contribute efficiency performance, water management and recycling, Green spaces and landscape architecture, parks, and encouraging natural environment and agriculture facilities ,and If possible keeping the natural topography and native ecological habitats[27]

These principles take a broad the approach to develop a sustainable neighborhood. For a formal certification checklist see Appendix (1). This appendix represents LEED-ND checklist depending on the newest version of (LEED- ND V4) which launched in 2014 [28] and (A) Project for Hajer Ismail's Rating checklist)

This checklist uses all the sustainability principles with three main categories that combine the principles of all the ideas together:

- Smart location and linkages (represents the Smart Growth applications).
- Neighborhood pattern and design (concerning New Urbanism).
- Green infrastructure and design strategies (related to the GBC) [29].

Hence, the study gave an inductive overview to the most important organization history in developing and adopting urban sustainability principles to reach the sustainable neighborhood. Moreover, this study and in its practical part will depend on the main categories of these principles to rate the students' academic projects and see the effectiveness of this universal rating system for evaluating the Iraqi projects.

### Practical part: Sustainability applications for students' projects

#### Project description

The idea of the project depends on the establishment of sustainable or at least green<sup>1</sup> residential complex with (2500 residents in 500 housing units), at (5 person/unit) average as a minimum. This project follows the principles, sustainable neighbourhood strategies for better design performance. All of these strategies come into harmony with the climate, social and local economic environment.. Each student

<sup>1</sup> The difference between Sustainability and Green is controversial, however, there is agreement that sustainability is the big goal and the whole system, while green is part of it and representing individual products and processes [30]

can apply as much possible of sustainable neighbourhood principles to gain urban sustainability strategies which consist of:

**A. Development strategies:** The project provides a lot of housing opportunities and allowed to design them in compact building or medium- density high rise buildings depending on their ideas. In addition, there will be an eco-productive solo houses for farming processes. Also, design a multistory housing building (7-5 floors), including three types of apartments: {small family apartment with one bedroom (56 m<sup>2</sup>), medium family apartment with two bedrooms (88 m<sup>2</sup>), and large family apartment with two bedrooms and quest room (133 m<sup>2</sup>)}. With the neighbourhood centre (which should design with all facilities). In addition, students should design an ecological productive housing (125 m<sup>2</sup>) in the orchard area.

**B. Design strategies (efficient performance):** Create patterns of housing buildings using one or number of techniques that reduce the cost of living, and reduce the impact on the environment, including: The use of solar panels to generate electricity and heat water, The use of green roofs, green walls, and recycled building materials, Water management and grey water reuse in irrigation gardens and green roofs. Shading techniques: louvers and sun spaces. (Supervising, Team).

**D. Transport and mobility strategies:** The project's location allowed to adopt the idea of TOD (which explained in detail in the locations' transportation paragraph) in a walking distance not exceed 400 m (1/4 mile). As well as, one of the main conditions is to create social interaction by designing, gathering places with green spaces and water bodies bring the residents together and create walkable, car free areas

**E. Natural preservation and protection strategies:** In this chosen project the most important thing is the orchard area which almost takes three- quarters of the project area (14.2 ha from 19.2 ha), the idea is how to preserve it with all the former neighborhood requirements and how to sustain it with the suggested ecological housing farmers or residents. This might considered the most significant and the key concept of the project (Supervising Team).

### **Project location and sustainable potentialities**

In this project, the design team tried to choose the location which has the most available sustainable potentialities that help to promote the idea of the sustainable neighborhood. Therefore, the project chosen by the supervising team to be located in the lower south- west side of Baghdad in Al-Qadisiyah District, (33°16'12.1" N-44°21'38.5" E), In front of Baghdad University, at the opposite side of the Tigris River. Its location near the Tigris River gave it many privileges, 70% of the site is a green palm orchard with agricultural possibilities, high groundwater table, as well as the microclimate of the area near the river and high temperature in summer with the north- west wind provide a natural ventilation to the area as seen in Figure (3-A).

### **Location's Transportation**

The site surrounded by many transportation networks, which have the potentialities to adopt the idea of TOD (Transit Oriented Development) principles. Transit stations often focus on building form and increase location efficiency from

walkability to use public transportation that decrease the cost of living, increase region connection (IN- OUT) services, promote retail development that raise the land value in the neighborhood, make the neighborhood more livable and enhance the recreational activities in the area [31]. From the east side its located beside an old secondary railway line starts from The Universal Railway Station, passed Dora district and end with Babylon province ( as seen in Figure (3-B) which enable the students from using it and reactivate it as a public transit node. From the southern side the Jadiria bridge end with the project location to turn right and connected to Al-Qadisiyah highway. These streets show the importance of the location and access roads to the site. (Students site analysis, 2015)



Figure (3-A) the project location (Students' site analysis, and Google map website, 2015)

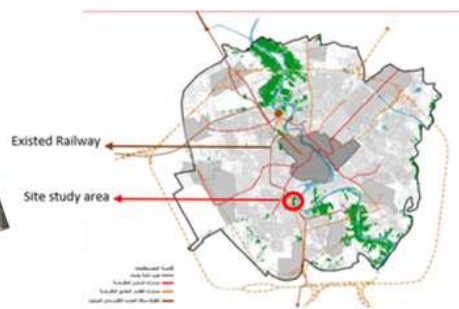


Figure (3-B) Railway lines in Baghdad and site study area (Students' site analysis, from Baghdad Mayoralty, Design Engineering Department, 2015)

### LEED-ND checklist and some chosen students' projects

As mentioned before, LEED-ND checklist has three main categories and two sub-categories. Each category classified into prerequisites, requirements which are mandatory and have no credits and should be applied at each project. Then the checklist has requirements with options depending on the area and the ideas of the project. These requirements actually are the details of the prerequisites and each of them has credit depending on the degree of achievement [32]. So, the research evaluates 3 student projects (named (A), (B), (C) as illustrated in Figure (4) which chosen for accomplishing the most of the sustainability principles with LEED-ND checklist. Furthermore, we will explain the prerequisites of the LEED-ND checklist for each project, while the total score for the applicable requirements will be discussed in the final discussion and presented in table (1, 2, 3). And all the detail will be written in each student's checklist which can be found in the appendixes (1, &

2).

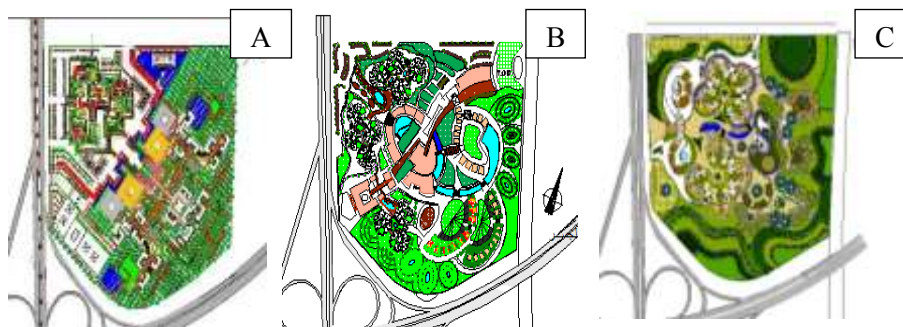


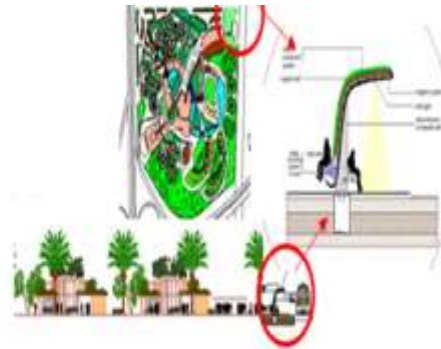
Figure 4: Projects' designed in CAD program by: (A) Hajer Ismail, (B) Melad Kareem, and (C) Maraim Ali.



### Smart Location and Linkages (SLL)

Smart location and linkages have lots of prerequisites required for all projects. Each of the three students followed them all and we will explain them in detail:

**The first SLL prerequisite is Smart location:** All the projects should obtain one or more of these requirements: either infill site, or connected to developed area, or the site located within a street network and transit services no more than a (¼-mile, 400 meter) walk distance of bus or streetcar stops, or the site located near an existing outside facilities no more than a (½- mile, 800 meter) walk distance (USGBC, 2010, pp.5-8) with hierarchical internal street network in a short connection to the shops and railway station, and the provision of open space as parks and recreation spaces [33]. All of them have to apply the basic principles of sustainable neighbourhood planning with a concentration on clear boundaries, design types of land uses which contain a central area consisted of various institutional sites like primary schools, shops with other community facilities with short a destination from any home a (¼-mile, 400 meter radius walk distance). Here, all the three students have the same site which connected from three sides with a very busy street network and located next to the Pharmacy College project nearby (Students site analysis, 2015). However, only one of them (B) reactivated the old railway and used it as a public transit node to help the students reach the college nearby and use it as a good access to the neighborhood facilities from a neglected side as seen in Figure (5). For this detail, she took the credits of the transit facilities and management as seen in Appendix (1) which represent her LEED-ND checklist and results.



**Figure 5: Detail section in (B) Project designed by Melad Kareem student which shows the main entrance of the project a by creating a transport TOD node**

**The second SLL prerequisite is:** wetland and water body conservation. Despite the fact that The river is 400 meters away from the site location, the condition of development strict that "if there is a water body affected by the project within the 50 feet radius (15 m) for the wetlands and 100 feet (30.5 m) for the water bodies, this could be a requirement of development limitation" [34]. Conversely, there are a lot of benefits from water body nearby, students used it as an esthetic element, and as a functional element for irrigation as a green infrastructure network (more detail in the green infrastructure & buildings prerequisite).

**The third SLL prerequisite is:** imperiled species and ecological communities: those whom could be found in the site area. This need a biologist specialist in the natural species within the development team [35]. So, this prerequisite will be neglected at this project (The researcher).

**The Fourth one is: agricultural land conservation:** Here, we have two things to discuss related to each project's characteristics, the first one is the total residential density in the project as a whole and in the orchard area specifically. And the other thing is how to build an ecological housing without cutting any palm in the orchard area. Firstly, for the academic experience and with the limited available area for designing a suitable neighborhood, we allowed to take no more than (15% or 2 ha) from the orchard area and assume that this is not an orchard area (see Melad and Hajer built up area in the green area in appendix (3)). They took almost (2 ha) to cover the triangle built up area requirement and kept the remain orchard area). Another concept, and for the orchard preservation we tried to avoid removing to the agriculture land but we suggested the idea of Green-Replacement which mean any lost green area should be compensated at any other place in the same site with the same percentage at any type of vegetated land (green-roofs, wetlands, even green walls suggested to be within the area of replacement). This policy is not a new, it introduced and launched as an act in Singapore since 2009 to encourage more skyscraper greenery in the crowded developments areas [36]. This idea applied by Maraim project (See appendix 3) whom almost restore all the orchard area by applying the concept of Green-Replacement (the percentage of the green to the built up area, the residential density of the project, and all other details for each student discussed in the Appendix 3 which represented the students' projects density and description). Secondly and if we take the palms' farming, the distance between palm and palm should be between (7-10 m) [34], and the students found the same distance when they visited the site and made their measurements (students site analysis, 2015). For that, all the students for all the projects should build ecological houses within (7\*7m) area and avoid cutting any palm. These houses will support the neighborhood center and provide a daily agriculture food which can be vegetated under the umbrella's shading of the palms especially rise and fruits vegetation. So, as seen in Figure (6) each student designed an eco- house with (125m<sup>2</sup>) as total area with a farm dedicated to the environmentally friendly people whom agreed to support the food production in the area by farming in their land, and all students took all the possible credit for the local food production requirement (The researcher).



**Figure 6: students' Eco houses plan and section designed from the left by (A) Hajer Ismail, (B) Melad Kareem, and (C)**

For the last Prerequisite. (Floodplain Avoidance): Although the area is the hazard of the floodplain for the risk of Baghdad flooding [37] the project didn't put this factor in its consideration. So, this prerequisite will be neglected at this project, according to the hardness of measurement with the short course time

### **Neighborhood Pattern & Design (NPD)**

**First NPD Prerequisite is Walkable Streets:** All the projects should be car free with a main street spine which connected all the project's parts. This street comes to promote reducing vehicle use and to improve public health by providing safe, and comfortable street environments that encourage daily physical activity for the pedestrian. Therefore the street should be wide (a minimum building height-to-street width ratio of 1:3) and all the street should be at least 2.5m wideness and have multiple design options from landscape, fountains, lighting and all the street furniture. LEED-ND has a strict instruction that no more than 20% of the street frontages within the project are faced directly by garage and service [38]. All the students should design a street network with main street spine connected all the parts of the project together with the maximum walking distance.

**Second NPD Prerequisite is Compact Development:** with LEED-ND standard the compactness started with 12 or more dwelling units per acre of buildable land [39]. This mean, and if we convert it into hectare, the residential density should be at least (30 Du/ ha) for the built up area. And as we see in the appendix (3) all the students achieved this density and more. However, we gave the highest credit to the highest compactness and that was for Mariam project, then mailed then Hajer as seen in Appendix (1, &2) which represent their rating checklist. For the Iraqi urban housing standard, if the density between (40-80 Du/ ha) it goes low- rise building, (60-120 Du/ ha) for high- rise buildings [40]. And it is almost the same percentage of the sustainable compact neighborhood and match with LEED-ND standard. However, the developers believe that this density varies from project to project depending on project design, layout, site circumstances, and socio-cultural needs of urban communities [41], and that's what really identified in our students' projects. The alternative planning, layout and the orchard existing area give us a different percentage of residential density (The researcher).

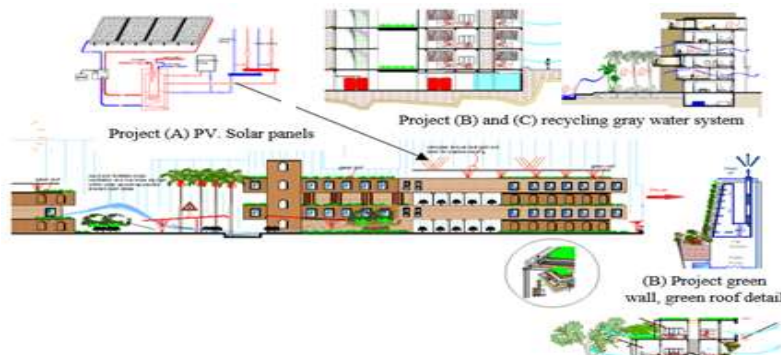
### **NPD Prerequisite: Connected and Open Community**

Thomas mentioned in his book "Architecture and the urban environment", (2002) that the public spaces before the twentieth century could easily be identified and separated, while the new urban contexts the idea of familiarity and amenity tend to be more livable especially in the activity patterns [42]. For this LEED-ND gives more credit for mixed used planning that encourage multiple users (commercial, recreation, and housing) within ¼ mile (400-meter) walking distance from houses [43]. Therefore the project encourages mixed- used planning, However, it varied from project to project, only Hajer applied the idea of mixed- uses and connected the ground floor of the commercial centre with the first floor labor housing which gives her more variety of housing types and more credit for applying this option. Hence, LEED-ND encourages the mixed- income communities and the diverse types of dwellings, the concept is enabling residents from a wide range of economic levels and age groups to live together in one community, the more housing diversity the more points the project got [44].

### Green Infrastructure & Buildings (GIB)

This requirement and its prerequisites depending on LEED- Home certification. LEED stipulated some certified programs at the design and detail level depending on (Unitary HVAC systems, Star Energy, ANSI/ASHRAE/IESNA Standard 90.1-2010, EUI .Etc ) [47]. In Iraq, we don't have such programs to apply and we don't have the green market and software program for monitoring and measuring, moreover, we have in Iraq a rare legislative and legal environmental aspects without the executive one [48]. However, the students studied and adopted many creative ideas which suitable with Baghdad microclimate and we gave the applicable credit whenever it's designed as illustrated in Figure (7).

### GIB



**Figure 7: Project (A), (B) and (c) details showed the green technologies designed by the student**

**Prerequisite: Certified Green Building:** Not applicable

**GIB Prerequisite: Minimum Building Energy Efficiency**

Students used solar panels for electricity and water heating, cooling systems and use the BIPV which mean Building Integrated Photo Voltaic, it is an old system sponsored by US. Department of Energy since 1070s and the first house built in 1980 theirs. But the high cost prevents from spreading it. These days its market for efficiency reached Europe and Japan, [49]. However, we didn't account the total residential and nonresidential need for the shortage project time, but we did give the students the credit for their contribution ideas. See Figure (7) students' solar panels and shading details and Appendix (1, 2) which represents Hajer rating checklist and the credits she took for applying the renewable energy production and cooling – heating district and Melad for Optimizing Building Energy Performance.

**GIB Prerequisite: Minimum Building Water Efficiency**

To conserve natural water resources and reduce the burden on water supply and wastewater management by increasing the water efficiency all students applied the gray water recycling systems as seen in Figure (7). The concept of gray water system depending on treating the flush toilet and reuse it in green roofs, green wall irrigation as well as use it as an esthetic landscape element for its considerable environmental

benefits [50]. For this all the students applied this system and all of them took the credits of water reduction and wastewater management (as seen in Appendix (1, &2).

**GIB Prerequisite: Construction Activity Pollution Prevention**

One of the most important old application in housing construction is the shading systems through the louvers and cantilevers. Recently this idea has come organically with green walls, and green roofs as part of the Exterior façade that promote the building thermal performance reduce the maintenance costs, improve the indoor air quality, and enhance productivity [51]. See the details in Figure (7)

**Discussion: LEED-ND Points and checklist calculations**

From the previous analysis and depending on the available information from the smart location, neighborhood patterns and the green infrastructure availability, we put all the applicable points for each student in the LEED- ND checklists as seen in Appendix (1, 2). Moreover, the results showed in tables (1, 2, & 3).

As seen in table -1- that Melad (B project) took the highest point for using TOD design although Mariam (C project) made a significant achievement by protecting 75% of the green land. While in table -2-Hajer (A project) create a Mixed use housing design and for this she got the highest score for the Neighborhood Pattern & Design category. However, and as seen in table -3-, the lack of green technologies contributed in the inefficiency of the green infrastructure category, but Hajer (A project) has got the highest points for applying Renewable energy production.

**Table 1: Each project’s LEED points for Smart location (the researcher analysis)**

Project name	Preferred location	Access to transit	Bicycle facilities	Housing and job proximity	Wetland and water body conservation	Total Score For smart location
(A)Hajer Ismail	5	-7	-2	3	2	10
(B) Melad Kareem	7	(7) TOD	-2	3	2	<b>19</b>
(C) Maraim Ali	(9) 75% green area	-7	-2	3	2	14

As a result, Melad (B project) took 60 points added 3 points for creativity so the project owned (Gold LEED- ND), Hajer's (A project) collect 59 points and owned (Silver LEED-ND). Finally, Maraim (C project) achieved 50 for missing the mixed uses design and the green technologies details and hold 5 points for creativity so the project took 54 and hold (Silver LEED-ND). As seen in Appendix (1, & 2). These results clarify the possibility of applying such projects in our city and the validation of LEED- ND rating system as an international rating system.

**Table 2: Project’s LEED points for Neighborhood Pattern & Design (the researcher)**

Project name	Walkable street	Compact development	Mixed uses	Housing type affordability	Connected open community	Transit facilities	Access to public spaces & recreation	Universal design	Local food production	Schools	Total score for pattern & design
(A)Hajer Ismail	9	3	4	6	2	-1	2	1	1	1	29
(B)Melad Kareem	9	4	-4	5	2	3	2	1	1	1	28
(C)Maraim Ali	9	5	-4	5	2	-1	2	1	1	1	26

**Table 3: Project’s LEED points for Certified Green Building (the researcher)**

Projects’ name	Indoor water reduction	outdoor water reduction	Wastewater management	Solar orientation	Renewable energy production	Heating & cooling system	Infrastructure energy efficiency	Pollution reduction	Total score for green details
(A)Hajer Ismail	1	2	6	1	3	2	-1	-1	15
(B) Melad Kareem	1	2	6	1	2	-2	-1	1	13
(C) Maraim Ali	1	2	6	-1	-3	-2	-1	1	10

**Conclusion and Recommendation**

- The academic projects experience represented a challenge for achieving sustainable neighborhood and the students tried successfully to balance between the development and planning level and the green designing technologies with the housing design level. Despite the fact that the limited course, time and the lack of labs prevented them from reaching to the highest level of sustainability. However, it was a very productive course, put their feet on the first level of achieving sustainability.

- Since the eightieth of the last century the activists and the developers tried to achieve urban sustainability through many programs. Today, LEED-ND comes to gather these programs in to one international rating system and considered the most reliable one among the others around the world.
- As seen in the academic projects and for the missing local standard in Iraq, there is a possibility of applying the universal principles of urban sustainable neighborhood locally, rating our housing projects, and measuring the degree of urban sustainability using LEED-ND principles. However, it has many obstacles which prevent the designers from put the right details calculations, for the variety of programs related and connected with it because of the complicated development process to gain a sustainable neighborhood. In another word, the study proved the possibilities of applying the universal principles of urban sustainable neighborhood in Iraqi cities in general and Baghdad as a case study to achieve urban sustainability.
- In Iraq, and especially in Baghdad there is a possibility to reach sustainable neighborhood for the land potentialities, the knowledge of our engineers, and sources availability. However, there is a need to activate the environmental legislations to protect our natural resources and contribute to enhance the quality of life.
- Finally, there is an urgent need and the possibility to develop a local sustainable neighborhood rating system suits the local environment and Iraqis nature and culture and this system will be the first step to reach urban sustainability.

#### **Academic Project details**

**Supervising Team:** Dr. Kadhmi Faris, Dr. Zaynab Radi, Dr. Abdul-Jawad Hassan, Miss Anfal Moaed, Miss Inas Hassan (all are lecturers in Baghdad University –Architecture Engineering Dept). **Chosen projects designed by:** (A) Hajer Ismail, (B) Melad Kareem, & (C) Maraim Ali, fourth stage students, 2014-2015, in Baghdad University, Architecture Engineering Dept.

#### **References:**

- [1] Knaap, g. & Talen, “New Urbanism and smart growth:a few words from the academy”. *International regional science review*28(2), p.107-108, 2005.
- [2] Craig Anders, Bill Dunster and others.. *Sustainable Communities*. Portland, US: Royal Instiute of British Architects, 2003.
- [3] Kelsey, C. W. “Smart Growth planning principles and parks and recreation”. Retrieved 2012, from *Smart Growth planning principles*. p.p 1-4, 2004. <http://www.playsafe.com/Documents/Magazines/SmartGrowthPlanningPrinciples>.
- [4] Hussein, Wadhah Abdul sahib & Abaas, Zaynab Radi, “ Effectiveness of Sustainable Urban Projects in the city of BaghdadA comparative study of sustainable development projects in Adhamiya and Kadhimiya District.’ *The Iraqi Journal of Architecture*, 9(28), pp. 111-128,2015.
- [5]Anon.,. *New Urbanism*29 May 2015. [Online] Available at: [http://en.wikipedia.org/wiki/New\\_Urbanism](http://en.wikipedia.org/wiki/New_Urbanism)
- [6] Dittmar H., Moule E. & O., *Canons of Su stainable Architecture and Urbanism*, s.l.: congress of New Urbanism. 2008-2009.
- [7] Islam A., Lynn B., & Maher B., 2007. *Negative Environmental Impacts of American Suburban Sprawl and the Environmental Argument for New Urbanism*. [Online] Available at: <http://sitemaker.umich.edu/section007group5/home>. [Accessed 12 June 2015].
- [8] Knaap & Talen, (2005), *ibid*, p. 109.
- [9] Riddell, R., *Sustainable Urban Planning "Tipping the Balance"*. USA: Blackwell publishing, 2004.

- [10] Paton, L. M. P.” Where has Urban Sustainability Gone? "The Affordable Housing Gap in Smart Growth Development in the U.S.", New England: worcester polytechnic institute. 2011.
- [11] Knaap & Talen, *ibid*, p. 109, 2005.
- [12] Hirschhorn, J. S. Why Smart Growth Needs New Urbanism and Vice-Versa. , 2004. [Online] Available at: <http://www.planetizen.com/node/118>. [Accessed 12 June 2015].
- [13] Abaas, Zaynab R., (2015), developing an Environmental Criteria for sustainable urban site selection, *Planner and development journal*, No.31 .pp.180-206.
- [14] Patricios, N., *Urban Design Principles of the Original Neighborhood Concepts. URBAN MORPHOLOGY*, 6(1), pp. 21-32. 2002.
- [15] Craig Anders, Bill Dunster and others, *ibid*, p.17, 2003.
- [16] Dehghanmongabadi, A., Desember, “Introduction to Achieve Sustainable Neighborhoods”. *International Journal of Arts and Commerce*, 3(9), pp. 17-26. 2014.
- [17] Raimi, Matt, Welch, Aaron, & Benfield, Kaid, *A Citizen’s Guide to LEED for Neighborhood Development: How to Tell if Development is Smart and Green*, s.l.: Raimi + Associates & (NRDC) & U.S. Green Building Council. 2011.
- [18] DehghanManabadi*ibid*, p. 19. , (2014),
- [19] Wargo, J., 2010. *The Green Building Debate "LEED CERTIFICATION"*, North Haven, US: Environment and Human Health, Inc.
- [20] Anon1., 2012. USGBC. [Online] Available at: <http://www.usgbc.org/about> [Accessed 19 June 2015].
- [21] ADS, *Green Building For Environmental Sustainability*, Trueman Blvd. Hilliard.: 2008.
- [22] Anon1, *ibid*, web, 2012.
- [23] lavergne, c. (2015, february 15). knx technology and leed certification. retrieved from dmc technology: <http://www.dmc-technology.com/knx-technology-and-leed-certification/>
- [24] Wargo, (2010), *ibid*, p.11
- [25] Brian n., Mark Simons, Megan Susman, Emma Zinsmeister, and others, 2011. *Smart Growth "a guide to developing and implementing greenhouse gas reductions programs"*, s.l.: U.S. environmental protection agency.
- [26] Brian & O, *ibid*, p.2-8. , (2011
- [27] Ferriter, E. K. (2008). *The sustainability of the new urbanism: case studies from Maryland*. Maryland: UMI, US.
- [28] USGBC, 2014. *LEED V4 for Neighborhood Development Checklist*. [Online] Available at: <http://www.usgbc.org/resources/leed-v4-neighborhood-development-checklist>. [Accessed 9 July 2015].
- [29] Raimi & O., *ibid*, p.2, 2011.
- [30] Ernest J. Yanarella, Richard S. Levine, and Robert W. Lancaste, *Green versus Sustainability. Sustainability*, 2(5), pp. 296-302. 2009.
- [31] Belzer, D. & Autler, G., “Transit Oriented Development: moving from rhetoric to reality, California: The Brookings Institution Center on Urban and Metropolitan Policy 2002.
- [32] USGBC, 2014. *LEED V4 for Neighborhood Development Checklist*. [Online] Available at: <http://www.usgbc.org/resources/leed-v4-neighborhood-development-checklist>. [Accessed 9 July 2015].
- [33] Patricios, *ibid*, pp. 3-4, 2002.



- [34] US.GBC, LEED Rating System Draft: neighborhood development, s.l.: U.S. Green Building Council, 2010.
- [35] US.GBC, *ibid*, p.8., 2010.
- [36] LENG, F. S. & YU-NING H., 12 Jun 2014. Landscaping for Urban Spaces and High-Rises (LUSH) 2.0 Programme: Landscape Replacement Policy for Strategic Areas. [Online] [Available at: <https://www.ura.gov.sg/uol/circulars/2014/jun/dc14-12.aspx>]
- [37] PAAF, (public Authority of Agriculture Affairs)-Kuwait, 2015. Propagation of palm trees. [Online] Available at: <http://website.paaf.gov.kw/paaf/ershad/pb2.jsp>
- [38] Kamal, M., x Iraqi Economist Network. (2010), [Online Available at]: <http://iraqieconomists.net/ar/2014/10/09/> [Accessed 6 July 2015] .
- [39] USGBC, *ibid*, p.31, 2010.
- [40] USGBC, *ibid*, p.34. 2010,
- [41] Housing, P. A, "Urban Housing Standard Handbook". Baghdad: Ministry of Construction and Housing. 2010.
- [42] Thomas, D. Architecture and the urban environment: A vision for the new age. Cape Town: Architectural press. 2002.
- [43] Thomas, *ibid*, p.98, 2002.
- [44] USGBC, Mixed-use neighborhoods. Retrieved from LEED ND: Built Project | v4 - LEED v4: <http://www.usgbc.org/credits/neighborhood-development-plan-neighborhood-development/v4-draft/npdc3>. 2015.
- [45] USGB, *Cibid*, p.31. 2010.
- [46] Wiki., Diversity index. 10 November 2009. [Online] Available at: [https://en.wikipedia.org/wiki/Diversity\\_index](https://en.wikipedia.org/wiki/Diversity_index) [Accessed 7 July 2015].
- [47] Ferriter, E. K. "The sustainability of the new urbanism: case studies from Maryland" Maryland: UMI, US, 2008.
- [48] USGBC, *ibid*, pp. 63-64, 2010.
- [49] Jasim, A. & Saeed, R "Sustainable Development and Environment in Iraq: Reality, Challenges and treatments" The magazine of Economics & Administration, 35(93), pp. 363-377, 2012.
- [50] James T., Goodrich A., Woodhouse M., Margolis R., & Ong S Building-Integrated Photovoltaic (BIPV) in the Residential Sector: An Analysis of Installed Rooftop System Prices, NREL: U.S. Department of Energy, Office of Energy., 2011.
- [51] Loh, S Living wall- a way to green built environment. BEDP Environment Design Guide, 26(1), pp. 1-8., 2008.



**Appendix 3: Students' projects density and description**

Project's Name	DU/ ha multistory housing from built up area	DU/ ha Eco housing from orchard area	Total DU/ ha	FAR multistory housing from total area	FAR: Eco housing from total area	FAR: Eco housing from orchard area	Built up / Total project A.	Green / Total Project A.	Total No. of Houses
(A project) Hajer Ismail	51	8	24	71%	6%	21%	37%	63%	460
(B project) Melad Kareem	68.5	5.5	28	53%	6%	9%	30%	70%	528
(C project) Mariam Ali	83	5	27	38%	6%	8%	25%	75%	520