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THE AMERICAN UNIVERSITY IN CAIRO
SCHOOL OF SCIENCES AND ENGINEERING

Guidelines for Sustainable Urban Zero Pollution Community (S.U.Z.C)

BY

Mianda Khattab

A thesis submitted in partial fulfillment of the requirements for the degree of

Masters of Science in Environmental Engineering

Under the supervision of:

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Table of Contents

ABSTRACT	8
CHAPTER 1: INTRODUCTION	11
1.1. UNDERSTANDING YOUR COMMUNITY	11
1.2. COMMUNITY TYPES:	12
1.3. SUSTAINABILITY	13
1.4. SUSTAINABLE COMMUNITY	18
1.5. THE MAIN AIM OF THE SUSTAINABLE COMMUNITY	18
1.6. Benefits of having a Sustainable Community	21
1.7. Problem Statement	22
CHAPTER 2: LITREATURE REVIEW	23
2.1. Community Development & Sustainability Concept	23
2.2. Community Development Practice model	24
2.3. Problems with Urban Communities	29
2.4. Sustainable Community	31
2.5. Zero Pollution Concept	31
2.5.1. Zero Waste Concept	32
2.5.2. Zero Waste History	36
2.5.3 Net Zero Water	41
CHAPTER 3: PROPOSED GUIDELINES FOR A SUSTAINABLE URBAN ZERO POLLUTION COMMUNITY	44
3.1 INTRODUCTION	444
3.2 S.U.Z.C Values	47
3.3 S.U.Z.C Concept	49
3.4 Relationship between Community Owners/ members	50
3.5. S.U.Z.C OBJECTIVE	51
3.6. S.U.Z.C. PROPOSED GUIDELINES	52
3.6.1. SUSTAINABLE SITE MANAGEMENT (36 CREDITS):	55
3.6.2. ENVIRONMENTAL MANAGEMENT (44 CREDITS)	63
3.6.3. GREEN TEAM (20 Credits)	73
3.7. S.U.Z.C. PROPOSED GUIDELINES FOR OWNERS	77
3.8. COMMUNITY RATING SYSTEM	82
CHAPTER 4: COMPARATIVE ANALYSIS WITH LEED-ND	84
4.1. INTRODUCTION	84
4.1.1. Importance of LEED	84
4.1.2. HISTORY OF LEED	85
4.1.3. LEED FACTS (U.S.G.B.C., 2013)	85
4.2. LEED FOR NEIGHBORHOOD DEVELOPMENT (LEED-ND)	86
4.2.1. LEED-ND rating system divisions	87
4.2.2. Minimum Energy Performance	89
4.2.3. WATER EFFICIENCY	90
4.2.4. SOLID WASTE MANAGEMENT (SWM)	91

4.3. COMPARATIVE ANALYSIS BETWEEN S.U.Z.C AND LEED-ND RATING.....	92
CHAPTER 5: MADINATY CASE STUDY- NEW CAIRO	100
5.1. INTRODUCTION	100
5.2 MADINATY SCORE BASED ON S.U.Z.C. GUIDELINES	101
5.2.1. For the Community Pre-requisites.....	101
5.2.2. Madinaty abiding to Environmental Management.....	103
5.2.3. Madinaty Example on Energy Efficiency	115
5.3. MADINATY RATING BASED ON THE PROPOSED S.U.Z.C. GUIDELINES.....	116
CHAPTER 6: CONCLUSIONS & RECOMMENDATIONS.....	124
6.1 CONCLUSIONS	124
6.2. RECOMMENDATIONS.....	127
REFERENCES	128
APPENDICES.....	134
APPENDIX I- A Novel Approach Towards a Sustainable Ecotourism Community.....	135
APPENDIX II- Beyond Zero Waste Concept, A Revolution for Sustainable Community.....	158
APPENDIX III: Madinaty- New Cairo_ Supplementary Documents.....	173
APPENDIX IV: Sustainable Community Tools.....	191

List of Abbreviations:

ASHRAE: American Society for Heating, Refrigeration and Air Conditioning

C&D: Construction & Demolition

EPA: Environmental Protection Agency

IUCN: International Union for the Conservation of Natural Resources

LEED: Leadership in Energy and Environmental Design

MSW: Municipal Solid Wastes

ND: Neighborhood

O.C.: Operational Cost

S.U.Z.C: Sustainable Urban Zero Pollution Community

UN: United Nations

UK: United Kingdom

U.S.G.B.C: U.S. for Green Building Council

USDA: United States Department of Agriculture

UNCSD: United Nations Conference on Sustainable Development

UNWTO: United Nations World Tourism Organization

VOC: Volatile Organic Compounds

WCED: World Commission on Environment and Development

List of Figures:

Figure 1: Area of Inter-Domain Dialogue.....	15
Figure 2: Shared Ethics of Sustainability (Gomis et al, 2011).....	15
Figure 3: Sustainable Community Pie Chart Aims (Sustainable Development, 2015).....	19
Figure 4: Cradle-to-Cradle Approach (El-Haggar).....	33
Figure 5: Regular Production Process (Eco Cycle-Building Zero Waste Communities.....	34
Figure 6: Zero Waste Production Process (Eco Cycle-Building Zero Waste Communities).....	35
Figure 7: Sustainable Urban Community Points of Focus.....	37
Figure 8: Zero Waste Sustainable Urban Community Points of Focus.....	38
Figure 9: Sustainable Community Mixed Usage Sample (Seifer, 2014).....	46
Figure 10: Sustainable urban Zero pollution Community Diagram.....	46
Figure 11: S.U.Z.C. Characteristics Diagram.....	47
Figure 12: S.U.Z.C Owners Connection Diagram.....	50
Figure 13: S.U.Z.C. Guidelines Flowchart.....	54
Figure 14: Comparison between Different Types of Bulbs (Charlison Lights, 2013).....	66
Figure 15: S.U.Z.C Net Zero Waste Water Flowchart.....	68
Figure 16: S.U.Z.C. Zero Solid Waste Management Flowchart.....	70
Figure 17: Green Team Illustrative Diagram.....	73
Figure 18: Trash Bins in P1 stage in Madinaty.....	103
Figure 19: Trash Bins in P1 stage in Madinaty.....	104
Figure 20: Other Trash Bin Systems in Madinaty.....	105
Figure 21: Madinaty Trash Bin Collection trucks.....	106
Figure 22: Madinaty Trash Bin Collection- During Maintenance.....	107
Figure 23: Madinaty- Water Storage Tanks.....	109
Figure 24: Step#1: Impurities Refinery.....	110
Figure 25: Step#2 Sand SeparationStep#3: Irriation for Bacteria, with AIR DIFFUSERS.....	111
Figure 26: Step#3 Irriation for Bacteria, with AIR DIFFUSERS.....	112
Figure 27: Anaerobic container, nitrates is used to activated the bacteria.....	112
Figure 28: Grey Container Aerobic.....	112
Figure 29: Hydraulic to collect the sludge from the bottom of the container.....	113
Figure 30: Chlorine + Air Line to turn/stir the air.....	114
Figure 31: Solar Cell Lightening System.....	115

List of Flowcharts:

Flowchart 1: Proposed ZERO Waste Concept for Urban Sustainable Community Flowchart.....	40
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List of Tables:

Table 1: S.U.Z.C. Rating system	49
Table 2: Sustainable Site Management Division (36 Credits)	55
Table 3: Community Streets and Parking Management Division (24 credits).....	59
Table 4: Environmental Management Division (44 Credits)	63
Table 5: Green Team Division (20 Credits).....	74
Table 6: S.U.Z.C Owners Commitment.....	77
Table 7: S.U.Z.C. Rating System - For the Community	82
Table 8: S.U.Z.C Rating System- For the Owners.....	83
Table 9.A.: LEED-ND vs S.U.Z.C.	94
Table 9.B.: LEED-ND vs S.U.Z.C.....	95
Table 9.C.: LEED-ND vs S.U.Z.C.....	97
Table 9.D.: LEED-ND vs S.U.Z.C.	98
Table 10: Proposed S.U.Z.C Guidelines vs Madinaty Rating.....	116
Table 11: Proposed S.U.Z.C. Guidelines vs Madinaty Rating.....	117
Table 12: Proposed S.U.Z.C guidelines vs Madinaty Rating.....	119
Table 13: Proposed S.U.Z.C guidelines vs Madinaty Rating.....	120
Table 14: S.U.Z.C Owners Guidelines vs Madinaty Rating- OW.1 Buildings.....	121
Table 15: S.U.Z.C Owners Guidelines vs Madinaty Rating- OW.3 School	122
Table 16: S.U.Z.C Owners Guidelines vs Madinaty Rating- OW.5 Mosque	123

ABSTRACT

The concept of sustainability has been introduced in the 1980s with the focus of environmental protection, where many developed and developing countries were and still are aiming to reach sustainability. Yet, with the increase of urbanization level, the tendency to meet the needs of the rising population is increasing without the focus of the environmental resources that are being abused in return. This leads to increasing the gap and the greed within the community between the rich people who can afford to abuse resources and the poor who can barely access their daily needs. This gap is concluded in an ignorant, negatively diversified and laid back community; in addition to threatening the upcoming generations about finding their needs in terms of natural resources being available for them. Solving this over looked problem is defined under applying sustainability concept for communities. Not only that but also presenting the full image of environmental and occupant's impacts to prevent the greed behind the need of having a secured, resourceful living.

The primary focus in this thesis was first to study novel approaches of zero pollution to implement within the application of sustainability concepts within the community. Starting with the tourism communities which are counted to be the primary income source to Egypt and some countries. The integration of sustainability concept with ecotourism communities via applying a zero waste concept is essential. Moving a step further, studying the effect of zero waste concept on the sustainable urban communities was another focus. This emphasis was considered after the realization of urbanization increase, which means more natural resources being abused.

One further step is studying the environmental effect from urban communities was the next and main objective of this thesis topic. Urban communities affected the environment not only by solid wastes but also by water, energy and land usage; by this it is also affecting the sustainability of an urban community. Thus proposing several solutions to conserve water, utilize solid wastes, save energy and optimize land usage was the main focus. These proposed solutions are considered as novel approaches

known as Zero Pollution, designed as guidelines to serve the urban community aiming at saving the environment.

The proposed Sustainable Urban Zero Pollution Community (S.U.Z.C.) guidelines consists of 100 credits, that are hypothetically identified as a measuring tool, and focuses on three major segments for community guidance and evaluation. These segments are known as sustainable site management (36 credits), environmental management (44 credits) and a new integration of green team/ sustainability champions (20 credits). In addition to proposing guidelines for owners either residential or commercial buildings within the community, so as to ensure that everyone within the community is aware about the main objective and abiding to the sustainable community needs. These guidelines should serve and encourage the investing owners to act sustainably as the proposed community aims at.

Two rating systems were also developed in this thesis, one for the community rating and the other is for the buildings' owners' evaluation and reward. The reward is reduction in operational cost for encouraged and participated owners towards sustainability as mentioned in Chapter 3 in this thesis.

The proposed guidelines were compared with the widely used community rating system, LEED-ND which is more applicable for the developed countries. The comparative analysis was done and discussed in Chapter 4 in this thesis, and it is concluded that there are several advantages of the proposed guidelines for the S.U.Z.C over LEED-ND starting with being simple, focused, understandable and inexpensive to follow with easiness and efficiency points of focus being the main drivers for it. While also being purposeful about energy, water, air, materials and habitat as mentioned in chapter 3 in this thesis under **several novel approaches**. And this shall serve any developed and developing country, any new or existing community.

Last but not least, Madinaty- New Cairo, a promising sustainable future urban community, was considered as the case study in this thesis. It is an application to the proposed guidelines to know how easy, understandable and applicable the guidelines are to users. The case study was evaluated based on the proposed guidelines points and rating system, and the evaluation is presented in Chapter 5 in this thesis. The conclusion of this section shows that Madinaty-New Cairo is in-line with the guidelines pre-

requisites in terms of designing for green buildings, weighing the available landscape in rational proportions for infrastructure vs green areas vs corresponding parking spaces. In addition to meeting 54 credits out of the proposed 100 credits which qualifies Madinaty to a Bronze certification as per the proposed S.U.Z.C. rating system.

CHAPTER 1: INTRODUCTION

A community is a public access place with common features being shared together with the community members. It can sometimes be divided into sub-communities which are often interconnected formulating the traditions and habits of the bigger community. These sub-communities can be interrelated to follow similar cultural definitions reflecting the bigger community image. It is important to understand the surrounding community as it is the place where a person belongs to, while sharing information and holding social interactions ensuring ease of community members interaction and communication.

1.1. UNDERSTANDING YOUR COMMUNITY

Understanding the community helps in establishing a common ground between the community leaders and citizens. These citizens will be exposed to what is going within the community, how to act and what are their expected roles towards the surrounding environment.

One of the most efficient methods to help in understanding the community is identified by learning more about the surrounding community in terms of its history, objective, policies and regulations. In addition to, visualizing the changes occurring through the ongoing lifestyle and activities, infrastructure styles and architecture. (Community Health and Development, 2015); this method is divided under:

- a. Observing the current people living within the community, learning more about their lifestyles and what does the community offer in return
- b. Studying the activities held within a community and their effects on the members so as to avoid any unlikely activity
- c. Gathering current and historical information about the community either by surveys, interviews or group talks.
- d. Studying the community's physical characteristics like the infrastructure, commercial areas and the architectural tendency as well as its topography as in the landscape areas.

- e. Learning more about the community demographics like the population, genders, income, employment and location. In addition to the community policies and regulations.
- g. Describe the community in your own words and put an aim that you would like to see your community working towards and reach.

1.2. *COMMUNITY TYPES*

Studying the similarities and differences between communities is important to further understand your community and decide on a proper action plan that suits the surrounding environment.

Rural, commercial, business, industrial, tourism and urban are different types of communities. Starting with the rural community which is also known as the country farm lands, is identified by the small number of population and more of natural areas included within; having trucks or tractors usually the mode of transportation. (Community Types: Urban, Rural and Suburban, 2015)

Commercial communities are as the name implies, communities based on selling and buying goods. It is somehow similar to the business community concept where its economy is based on the commodities. However, business communities shouldn't only provide products, it can also be service and it is offered on a bigger land space, wider and deeper focus and outreach to the community and other communities than the commercial community. (Community Types: Urban, Rural and Suburban, 2015)

A community that is driven based on producing standard products in massive amounts to serve wider population number, is known as the industrial community. The link between industries and businesses is that the type of industry helps in identifying the corresponding business and market focus categories. (Community Types: Urban, Rural and Suburban, 2015)

Tourism community which is a fast growing new type of industry having its economy built on all touristic activities like travelling, shopping, sightseeing, recreational travels, water sports,

entertainment, hotels and accommodation, air flight and cruises. In addition to the services being provided by the hotel or the place of accommodation itself. (Community Types: Urban, Rural and Suburban, 2015)

Lastly, and most important of all is the urban community, which is growing fast specially under the concept of urbanism. Urbanism is causing a rapid increase in urban communities population leading to fast depletion of resources and immediately affecting the sustainability of the community. That is why urban communities are the focus of this thesis research with the need of proposing guidelines including environmental solutions that ensures reduction in natural resources depletion. (Community Types: Urban, Rural and Suburban, 2015)

1.3. *SUSTAINABILITY*

Sustainability as defined in 1987 in the report of World Commission on the Environment and Development, is “the environmental management of natural resources to suit the needs of the current generations without altering those of the future and upcoming ones” (Sustainability, 2015). Sustainability concept is majorly focused by the environmental sustainability, economic sustainability and social sustainability, being identified as its three main pillars of action. Sustainability is also linked with sustainable development which is known to be the guiding path to reach sustainable acts.

Based on previous research studies, sustainability and sustainable development are being looked at in terms of using the latest technologies and updating the current environmental policies in any concerned developed country. The aim behind having an Eco-city or Zero-carbon city is to have a healthier and less polluted city with more available resources meeting more future needs as discussed in a study by Gomis, et al. (Gomis, et al., 2011).

However, as per Gomis, et al, the environmental, social and economic guidelines are not the only major aspects for reaching a sustainable community. As also referred by business leaders and economists in several studies being conducted, sustainability is believed to be engineering and

economics being integrated together. This merging is done for the sake of profitability with no reflection of ethics or moral actions and maybe that is why most of the countries aiming for sustainability fail to deliver the needed stable and secure atmosphere.

Accordingly Gomis, et al. (2011) defined sustainability to be “***a moral way of acting***, and ideally habitual in which the person or group intends to avoid deleterious effects on the environmental, social, and economic domains. In addition to being consistent with a harmonious relationship with those domains that is conducive to a flourishing life.” But how did the authors reach this definition? After studying the three major points of focus of sustainability identified under the environment, social and economic. And by interviewing several business owners in the economic sector, for instance. The conclusion by all of them was that sustainability is profitability and environmentalists focus on acting in manners that lead to minimum environmental impacts pertaining to human existence and survival.

All of the specialists in each sector are focused on their own sector’s wellbeing. However, what they are missing is that they all should share the same ground of ethical behavior that Gomis, et al illustrated which depends on “the area of inter-domain” as shown in figure 1. Joining the points of intersection between the 3 identified domains having a 3 domain intersection as shown in figure 2, identified as shared ethics of sustainability.

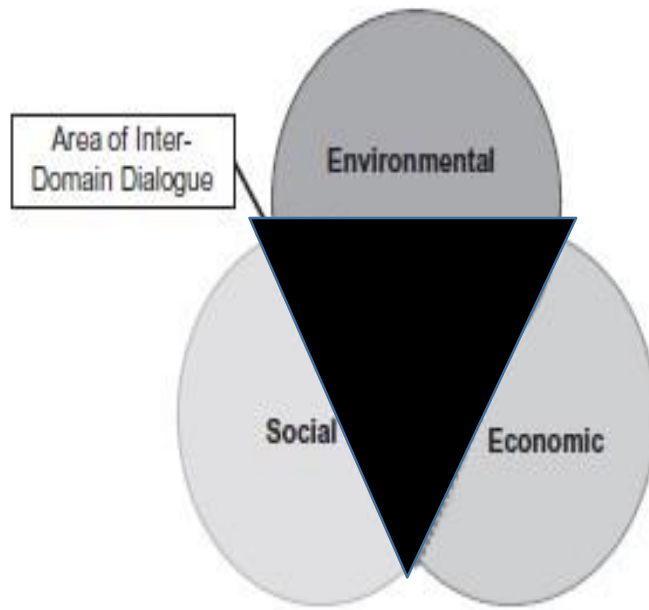


Figure 1: Area of Inter-Domain Dialogue

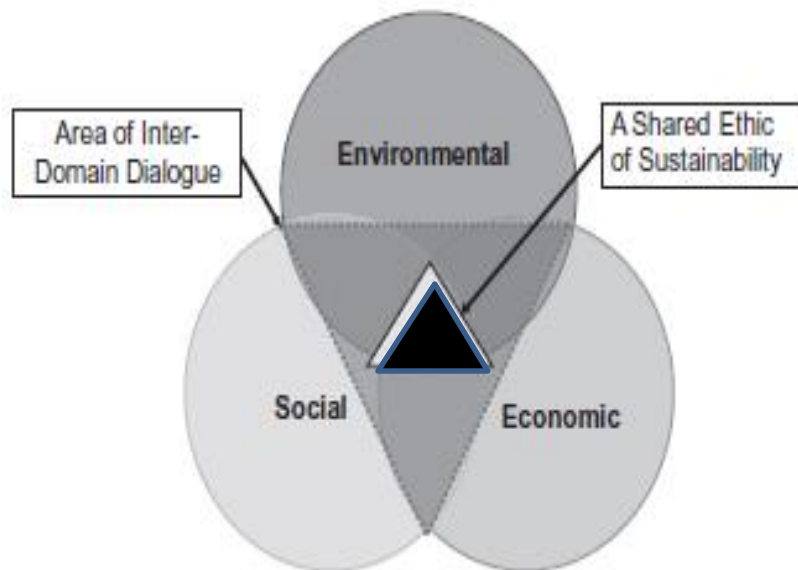


Figure 2: Shared Ethics of Sustainability (Gomis et al, 2011)

Global problems like the greenhouse effect, might be caused by one domain, yet it affects all domains and the entire world. Thus, a definition highlighting an attitude or a chain of actions towards the world should be addressed and transparently worked through towards improvement, and that is defined under ethics.

Another point for ethical sustainability or social justice is ensuring that the wealthiest citizens will not consume more than their resource share, if not less. This will give the chance for the poor citizens to be able to find their daily needs.

As stated in some of the environmental sustainability frameworks nowadays, that people are consuming the irreplaceable natural resources at a faster pace than those resources can ever be replenished. Thus an ethically sustainable society is the one that stops wasteful resource abuse, introduces social equity for poorer people. Whereas being able to make ethical decision in terms of fairly identifying the sustainable natural resources and important they are to our daily lives according to their consumption level and the products being produced using them as materials.

If these scarce natural resources can be replaced by other resources to prevent their depletion and this is to ensure appreciating the “Moral value of commodities and goods” as stated by (Kibert, 2011) & (Warner, 2009). This means that people will understand the value of the product they are buying and if it is made of recyclable materials for instance or not. This study was all supported by the UN Declaration on the Right to Development; they mentioned that “the objective of sustainable development in terms of environmental rights is an essential ingredient of development from a human rights perspective” (Jeffery, 2005)

Ethical behavior has to be implemented in each of the 3 sustainability domains in addition to being a standalone foundation to sustainability as mentioned by Warner and Jeffery. If facing a problem in resources or meeting the needs or environmental pollution or low economic level for instance, one should first start by asking open- ended questions to grab as much information as possible from the public, then study the answers, break them down into smaller problems, choose the best problems in

terms of most commonly stated or high in priority and then start looking for the best ethical solutions to solve the problems while questioning the human rights and identifying their interests (Warner, 2009).

Now, since sustainability is important to our daily lives and for the future generations and how ethics is acting as the 4th main pillar for reaching community sustainability is highly needed in our daily lives. Thus the main focus now is on spreading the needed awareness and addressing the current on-going issues with sustainability within the community. Starting with raising awareness among different educational levels and curriculums; focusing at students who are expected to be the future leaders within business managerial ethics context in line with their society responsibility.

Most of the available studies ensures that ethics + environmental concern + sustainability programs being introduced in several schools in UK are gaining learners' attention even those with non-business majors. This study concluded that most of the children have shown their eagerness to learn more and accordingly act as community responsible citizens (De Loura, 2013). Advantages of applying such awareness starting with students themselves is to get introduced about their socioeconomic and environmental activities reflections in the community they are part of. This is important so that when they are teens they will have the needed foundation of responsibility and action that shall guide them to act differently and efficiently thus being efficient leaders.

Many parents nowadays may not be supportive or understandable with their children new tactics towards the environment and that is due to their tradition of long time actions and their busy lives. That is why schools should start promoting sustainability by integrating it within the school curriculum. In addition to integrating vital businesses acts as community real life projects or case studies so as to engage kids who will eventually drive their parents to change their mind set and act differently which will then be like a one positive step forward (De Loura, 2013). This is applied in the thesis by including a green team to teach the community occupants all about sustainability, the need of being innovative and how to teach one another daily green activities.

In conclusion sustainable actions just like any actions held in our daily lives should not be based only on environmental focus, social and economic outcomes. But also on the ethical behaviors and acts

that will assure a transparent way of dealing leading to more successful and prosperous outcomes as aimed for within a sustainable community. Including sustainable studies within the community is important, and this is reflected in the proposed S.U.Z.C. guidelines under the scope of Green Team under awareness, training and education.

1.4. SUSTAINABLE COMMUNITY

Communities reaching sustainability is a new concept that has been introduced by the UN in late 1960s (UN Department for economic and social affairs, 2013). However, it has not been taken into consideration till a couple of years ago when population levels started to massively increase and the resources started to be abused leading to an imbalance in the ecosystem. Several developed countries have started implementing the concept of sustainable communities and very few have already reached this goal, while some developing countries are still trying to apply it. That is why it is important to study the main drivers, measurements, actions and benefits leading to sustainability in terms of Economic Standard, Environmental Standard and Social Standard.

In brief, sustainable communities are communities that are designed and created in a sustainable acting manner either by saving the natural resources or efficiently using them so that the upcoming generations will find their natural resources needs availability.

1.5. THE MAIN AIM OF THE SUSTAINABLE COMMUNITY

As shown in figure 3, there are eight goals that **all** should be met in order to say that one has achieved a sustainable community. The eight objectives are integrating all kinds of sustainable activities in line with the responsible citizens within a community which when done efficiently and ethically, the community will be said to be sustainable. Starting with the **Governance**, which should govern the community with responsible leadership; a clear aim of actions and activities to reach a sustainable community. The governance is expected to act accordingly setting a role model to those who will follow from the society and it should include community participation when deciding on an

act to be done. Not only that but also, a set of policies to have a clear official statement of actions, needs and aims and even communicating the expected roles from the community member. Thus two-way communication is a very essential key that will strengthen the bond between the government and the community members. In addition to being open to new ideas, sharing of roles and duties and elaborating the developed policies or laws will ease the transition towards a sustainable community (Sustainable Development, 2015).

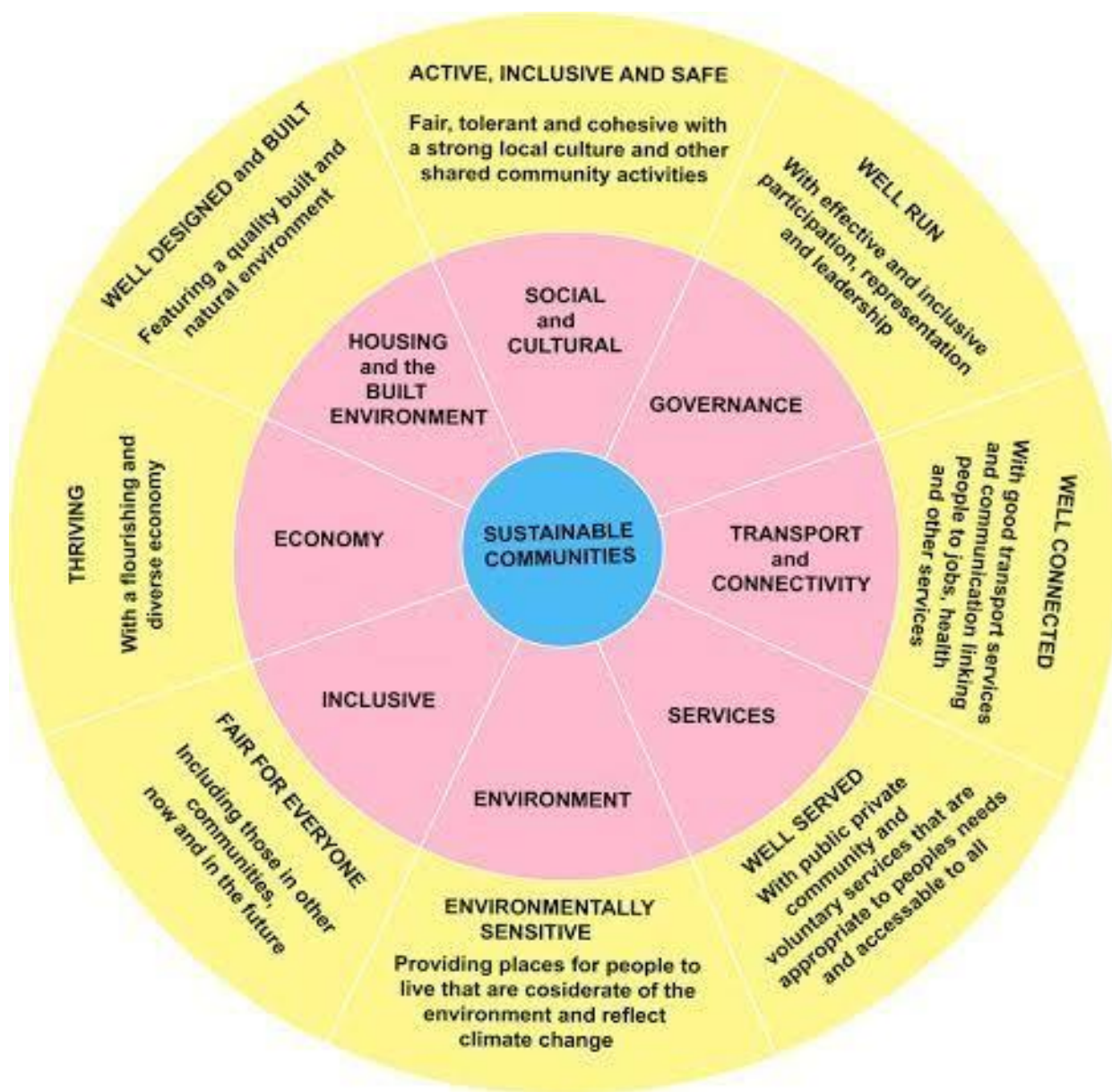


Figure 3: Sustainable Community Pie Chart Aims (Sustainable Development, 2015)

Services provided by the government or private sector within a community to meet the needs for the citizens is another aim as shown in figure 3. These services should increase the level of job opportunities, be accessible to all community members and levels as well as being affordable and easy to use. As affordable and accessible **transportation** and housing are considered to be included in the community services, they are aiming at being introduced at a proper cost providing the needed level of safety and security for the users. For instance, the transportation should be properly introduced with engineered roads and special lanes for cycling and properly introduced parks or pedestrian areas for walking. And this is to ease the transition from one place to another within the community using well connected transportation modes either public transportation or cycling or even walking in the short distance places, with less accidents rates and saving time.

For the **housings** which should be well designed and built infrastructure sharing a positive feeling of wellbeing, relaxation and safety i.e. low/no crime levels, with the people living within. In addition to the **Social, Equity and Environmental aspects** which means that community events should be held on a frequent/ regular **social** basis being safe and active. This is to enhance the social level between the neighborhood members will look out to one another introducing a community friendly activities and policies.

Environmental sensitivity should be taken care of in terms of planting green areas, ensuring there is a clean neighborhood, hold the needed awareness and activities to ensure wastes recycling starting from household till recycling sites. All of that is doable to be done yet without ethical behavior and **equity** between members there will be a gap within the community which will lead to mis-achievement or failure towards the done activities for reaching a sustainable community. Thus everything should be fairly and transparently held while being available meaning that there is no age, sex, religion or color racism. Meanwhile jobs, health services, education are all accessible and affordable to all community members and levels being fair to everyone no matter who he/she is.

Lastly, when the previous points are covered properly this will reflect on the community **economy level**, when it is stated that the community is heading on the right track towards being a sustainable community this will lead to thriving of the community. For example better living standards, moderate and big business will open and thus providing more job opportunities and services as well to meet the community needs; and this will all reflect back on enhancing the community economy level.

By looking at the short-term goals, one may prioritize which task to start with or to focus on according to the current needs. However, on the long run all of the goals should be met effectively and efficiently so that we can say that Sustainable Community has been achieved. And this should be clearly defined by the government and the shareholders upon having a proper communication with one another and with the community members to prioritize the solutions to the main deficiencies and then move towards the other non-urgent goals.

1.6. BENEFITS OF HAVING A SUSTAINABLE COMMUNITY

Having an acceptable quality drinking water and breathable air in addition to a healthy food style, educational level, properly encouraging and competitive life style which ensures safety and freedom of citizens for their own rights and welfare with equality of rights are some of the core points towards aiming for a sustainable community as mentioned by (Smith, 2008)

Having a pollution free is the aim of every citizen however it is never met in real life. Yet by following the concept for sustainable communities which primarily purposes at ensuring proper usage of natural resources. These resources should be sufficient to meet the needs of the current without threatening the availability of resources needed by the future generations. (Smith, 2008)

It is observed that reaching a sustainable community as a concept will lead to a better lifestyle that is full of secure and positive atmosphere for a more productive living. It will also lead to less urge to travel to somewhere less polluted or less dense. This leads to not only the community's driving to pollution free strategy but also spreading it for several countries all over the world. (Smith, 2008)

1.7. *PROBLEM STATEMENT*

Due to the depletion of natural resources with the on-going increase of population and demand which is not only affecting the current living but threatening not only the lives of the future generations but also affecting the current community members. When resources are being abused, the rich people who can still afford to get resources at higher prices even if they will use it for their own welfare when it may not be a necessity to them as it is to other lower level citizens. Thus depleting the resources will lead to the decrease of the lower community level members share and increasing the difficulty of their access to any available resources.

This will lead to widening a gap between the community levels which will reflect on lowers security levels, more crime, less job opportunities and lower community economy level. As a proposed solution to that is the rise of sustainable acts either by designing and building new sustainable communities or by acting on changing existing communities to be sustainable. The measure for a sustainable community is defined under how much sustainable are the organizations or life style or products or services being provided in this community. The life style and these services are like Urban Sustainability, Transportation, Infrastructure and even Food Processing and Products; each has a separate measure however reaching sustainability depends on prioritizing aims, which is to be defined by the government or shareholders.

CHAPTER 2: LITREATURE REVIEW

Sustainable urban communities are the focus of the talk and main concern to most of the developing and developed countries. Even though some of the developed countries have aimed, acted and almost reached to sustainable communities however, they are considered minorities.

A sustainable urban community is very important, not only because it is the type that ensures availability of natural resources to the current and future generations but it also enhances the standard of living, the surrounding atmosphere. This will reflect back on a better, secure and more stable mindset of citizens leading to enhancing their living efficiency, quality and performance. All of these benefits will link back to being more motivated, encouraged and efficient in their work, leading to a more productive community and enhancing its level of economy.

2.1. COMMUNITY DEVELOPMENT & SUSTAINABILITY CONCEPT

As Sustainable Urban Community development concept has not been implemented yet, it is essential to study for future implementation. The history of the **word community** is dated back centuries ago where it started as physical location identification where people of the same interests gather and share similar traditions. This definition remained till the 1980s when the evolution of internet started and the word community started to be a virtual word or an online social interaction definition (Meriam-Webster Incorporation, 2015).

The word **development** dates back since the industrial revolution in the 1800s where it reflects strong and fast speed growth. Accordingly when it was applied to the community it meant applying factors to change the community for a better living. However as it was a fast paced plan it was targeting short term adjustments rather than long term needs and preventions. It also interacted with the very minimal or almost no community members or opinion givers which led to starting gaps within the community (PeerNetBC, 2015)

In the meantime **sustainability concept** started to arise, it started back in the United Nations in the early 1970's during a human environmental conference gathering all of the developing countries to discuss about (Human Family Rights); aiming at having an action plan that shall satisfy the conference importance. (World Economic and Social Survey, 2013). It started with identifying the current deficiencies, the objective needs in terms of clean air, clean water, safe environment and proper food as the core rights to be developed. Looking closely into the reason of existence of these points, exact problem and expected solutions; it was found that the human needs are in connection with the available resources from Nature.

So how to properly balance those needs with Nature's scarce resources? This was the main objective behind the International Union for the Conservation of Natural Resources (IUCN) & World Commission on Environment and Development (WCED) in 1980s. IUCN & WCED introduced the concept of Sustainable Development and plan of action for a better change. The main points behind WCED's study were Economical point of view, Social Standards and life, Cultural Aspect and Environmental concerns. (UNCSD, 2011).

2.2. COMMUNITY DEVELOPMENT PRACTICE MODEL

Community development practice started when countries started to give help to develop Emerging nations via some projects known mostly as community organization. However in the early 1970's setting a clear principal to the term community development became the interest of most developing nations as it referred to being a must for an economic development focus in line with community organization aims. (Smith, 2006) & (Bullen, 2007)

Community development known basis is a needed act in which if any refinements are to be made, so it shall be as time passes by or over generation and that is to meet the current era. Ten years later (1980) the importance of introducing community development concept started to flow in the educational curriculums aiming at engaging the community and persons in the Community

development act. Later on the community development concept was known to be viewed in four ways starting with a defined **process** to move the community from one step to the other forward, a **method** which is identified for working towards the defined community goal. Another point is a **program** to carry on the needed activities and awareness to achieve the aim. Lastly a **movement** where the community members becomes committed. All of these points are gathered under the focus of identifying issues and tasks within the community, understanding the change while working towards a better change based on proposed community solutions and adapting to it (EPA-USDA PARTNERSHIP, 2015).

Several definitions by different authors are mentioned, since the beginning of the community development introduction, most of them refer to the community development as a set of practices. These practices are being done to assist the community be in a better shape. It started with the help of community members and it carried on by collaborate the society members with a general aim or objective to reach that serves the community. (EPA-USDA PARTNERSHIP, 2015)

1. “The involvement of people and the coordination and integration of all efforts directed at bettering conditions.” (Lotz, 1970)
2. “A process, as a method, as a program, and as a movement; or as a set of purposes.” (Hauswald, 1971)
3. ““A series of community improvements which take place over time as a result of the common efforts of various groups of people. Each successive improvement is a discrete unit of community development. It meets a human want or need.” (Dunbar, 1972)”
4. “The deliberate attempt by community people to work together to guide the future of their communities, and the development of a corresponding set of techniques for assisting community people in such a process.” (Bennett, 1973)”

5. “A process of creating special community organizations throughout society which will be responsible for channeling demands to centers of power, to distributors of benefits.” (Hammock, 1973)
6. “All of the efforts made to establish and maintain human interaction while improving the appropriateness of the physical setting to that interaction. Underlying values to this development are the recognition of the individual’s right to select the extent of community or privacy and the group’s right to identify its own needs for community development.” (Koneya, 1975)
7. “The active involvement of people at the level of the local community in resisting or supporting some cause or issue that interest them.” (Ravitz, 1982)
8. “Many community development efforts are essentially efforts to help community residents understand what is happening and recognize some of the choices they face in order to achieve the future community they desire.” (Shaffer, 1990)

Yet focusing on assisting the community and delivering the current community needs is a major focus specially with the increase of the population worldwide and the introduction of new technologies every second. This all leads to an increase in the daily needs which can be fulfilled by using massive amounts of natural resources leading to environmental and natural abuse. This will be reflected back on the community in the long run of being resources deficient. By then community development will be an un-met necessity and might be a hard process to defined and achieve as the number of variables for living are increasing with the decrease of natural resources availability.

Saying that while referring to the environmental abuse leans back on the concept of sustainability which was realized in the 1970s however it did not have a global definition till the introduction of **sustainable development concept** in the early 1990s by the UN (Global Learning Center, 2009).

As a community has been defined earlier to be a sum of minor underneath communities for instance like tourism community, industrial community and urban community. Each of which has its own

underneath defined smaller communities like educational, hospitality, welfare, social and economic. So integrating sustainable acts within each segment of the previously defined communities and sub-communities is a hard mission to achieve but never impossible. First of all for the industrial sustainability or industrial ecology community, is known to be the industry which understands the environment well that it ensures the reusing or recycling of its wastes in an environmental/safe waste utilization method. This goes through all of the industrial processes starting with the raw materials, to the production stage, to the product, to the transportation to customers, to the customers' usage and disposal till the product return back to the waste management site. (Allenby, 2006)

Moving on to another community sustainability type which is the tourism community known as one of the fast growing industry as it has almost increased by 40% since 1960 till date and it is expected to represent almost 25% of the globe's population in 5 years. Tourism Community has many benefits economically as getting introduced to foreign currencies and better market share. And socially by providing more job opportunities and better lifestyles yet the environmental point of view is not yet a focus. In other words in line with the industry growth huge amount of natural resources are being consumed so as to cover for the needs of the current tourists.

Tourism sustainability refers back to the modes of how tourists and touristic countries behave towards the environment. Many of which are claiming to be a sustainable site or Eco-touristic destination going under any type of sustainability certification just to attract more tourists and build a strong economic stand. However, as the word sustainability is getting into more definitions and role modifications and with the increase between the rich who can afford to pay more for a luxurious vacation. This could be entertaining but on the other side they are abusing the environment; and the poor who are struggling to locate their daily needs for a living this all leads to a focus of further improvement in the daily practices and activities being done. At the end of the day tourism community in line with industrial communities and many other sub-communities should collaborate in working towards a better bigger globe or community.

Saying this, with such an increase in the tourism industry and abuse of natural resources this will lead to an unbalance in the ecosystem, as the environment will not be able to cope with a rapid increase in high number of tourists in such a short period of time with an unbalance of resources usages. Stating how important tourism industry is and how fast it is flourishing while affecting the surrounding environment with the community social levels and standards. This shall lead to identifying the need to having a sustainable tourism so as not only to protect the current living and surrounding environment but also ensuring the availability of the needed resources for the future generations as the word sustainable reflects (Khattab & El Hagggar, 2016 a).

So, some of the suggested mitigations working towards having a sustainable tourism are avoiding getting involved in environmental depletion acts while raising awareness within the community members and invest in trainings and educational experiences to the hired employees. Also, ensuring that the cultural experience is shared with the tourists so as it adds more community values and checking for more community adding value acts while also focusing on other industries that might be a source of income to back up the drop that might happen from tourism industry. Lastly acting in transparency and communication between the government and community members. (Khattab & El Hagggar, 2016 a).

In brief, as sustainability concept is integrated with the community development outcome and as it guarantees a safe living with a better life style and cleaner environment. Thus it is important to study the impact of sustainability and modes of applications within the urban community, since it is considered to be a fast growing area due to urbanization with high level of natural resources depletion.

2.3. PROBLEMS WITH URBAN COMMUNITIES

Another important community example is the urban community, which is also the main focus of this thesis research. Urban communities are known to be the most densely populated communities worldwide as they are projected to cover almost 70% of the world's population as projected by Fast Company & Inc. (Fast Company, Co Design, 2012). Such increase in Urban areas and urban population will reflect back on the level of unemployment leading to an increase as the income and job opportunities will be limited as well as educational and health opportunities; in addition to the increase in the level of like insecurities and services with the reasoning of more illiteracy and violence in a further unhealthy environment (The World Bank Group, 2011).

Urban communities are facing increasing problems to be identified under the threatened communities and this is due to the large number of population living in and those moving from rural areas to urban ones, known as urbanization. The risk that urban communities are facing is the poor level of economic standards leading to accounting for another contributing factor like increasing taxes or increasing housing rents and costs leading to unaffordable housing. As a result, a lot of families will be homeless and this will increase the level of insecurity within the community. This may also lead to less availability for job opportunities and similarly education and health care services. Consequently, all of that will lead to increasing the level of illiteracy, unemployment and crime levels on the streets. Not only that but the level of poverty will increase and the gap between the rich and the poor will widen leading to a community segregation.

This will result in an unhealthy and unsafe community to live in (Center for America Progress, 2015). Apart from the social gap and economic deficiency within the community, the environment will be also affected with the huge number of people living within a specified area. As each area is naturally present with its own natural resources that are present to serve certain needs for a specific number of people. This will result in natural resources abusing in line with the huge amounts of wastes being

increasingly generated by increasing citizens with low or poor waste management will lead to further environmental pollution.

With the increase in illiteracy and unemployment levels citizens might tend to seek non environmental jobs like those who take specific types of wastes from the trash bins in the streets and sell them to second beneficiaries who may not environmentally utilize the wastes. Lastly, in such dense populated community with the majority of the population seeking proper health care or attention, this might lead to the rise of un-studied or non- familiar or new diseases and viruses within the community that could have been prevented if a sustainable living was understood and acted upon from the beginning.

In the light of saying that, there is a need to focus more on sustainable work and activities within the community so as to shift an existing unhealthy and non-environmental community to a healthier, life worth and environmental society. Thus reflecting back at lower usage of natural resources, less pollution, better educational and health care standards and finally a safe environment to live in and start businesses and touristic seeing raising the community economy level.

A clean environment will not rise only by identifying rules and policies, it will rise by the help of community members working hands in hands abiding to the governmental environmental laws. In addition to the proper awareness needed to ensure the establishment of a solid sustainable and zero waste definition and guidelines, with the highlight of the expected actions by the community and the expected rewards provided by the government. Last of all, heading for better economic standards and more job opportunities leading to a more stable and safe environment.

2.4. SUSTAINABLE COMMUNITY

59 rating tools are there in 22 countries, most of which are in the United States, followed by Germany, China and United Kingdom with the most famous or commonly used is LEED-ND, as shown in the Global Survey of Urban Sustainability Rating tools, 2014 (Criterion Planners, 2014), Appendix IV. All of these tools aim at solving the urban community problems. A sustainable community or neighborhood ensures that the current resources being used are sufficient and they don't interfere with the future generation's needs. However it started as a concept but now it is more of an advertisement word used by governments, facilities and touristic resorts and hotels aiming for a better focus and higher money return back when this country or place is said to be sustainable.

2.5. ZERO POLLUTION CONCEPT

Zero pollution is a concept aiming at having zero emissions, noise pollution free environment and zero waste. Pollution sources in general are air, water, and soil, as well as generation of all types of wastes such as construction and demolition waste, landscape waste, municipal solid waste and liquid waste (municipal waste water).

This thesis will be more focused on developing new guidelines that are applicable for both existing and new communities; integrating the concept of sustainability in urban communities in Egypt by applying Zero pollution which is Zero Solid Waste, zero net waste water, zero noise pollution and zero air pollution. A new community can easily abide to the proposed guidelines with high rating while the existing community can modify its activities and enhance the infrastructure to apply the guidelines while achieving a low rating.

2.5.1. Zero Waste Concept

One of the new sustainability generated concepts is “**zero waste**” which is referring to studying the use of resources for long term efficiency. Zero waste can be achieved efficiently while following the Cradle to Cradle approach (El-Haggar, 2007).

Zero waste is a strategical goal or more of a philosophy and a principle of design that was introduced in the early 1970s having different definitions as per the level of understanding and awareness to different community members. However most of them are centered about the concept of recycling for a whole system or a full product lifecycle so as to minimize the produced wastes and accordingly maximize the recycled products. Zero Waste varies in how its definitions are introduced for instance in the Japanese Industries zero waste is known as zero defected products. Other definition is that “zero waste is a practical theory on how to obtain maximum efficiency from the use of resources” as defined by the Zero Waste Institute [(European Regional Development Fund, 2015) & (GrassRoots Recycling Network, 2015)].

Zero waste started in 1970s by community recycling programs pioneers however it was considered as a design approach rather than a source of solutions for a better living. Later on in the early 2000s Zero Waste was referred to as a practical theory to maximize production efficiency. By Mid-2001 Zero Waste in New Zealand had a future approach till 2020 defining it as an eliminating tool rather than a waste management method aiming at a change in the way material are introduced in a production process. In addition to defining how the materials are managed in the society and then how are they returned back into products, this is from the environmental standard.

As shown in figure 4 it is a close loop starting with the raw materials extraction from earth (cradle) till it is returned back sustainably to earth following a safe utilization process. This process starts with raw materials extraction going through the needed processing and manufacturing of materials then packaging to be transported to the corresponding factories or stores then used in homes and then the wastes are divided into recyclable or reusable wastes. The wastes are collected and sent to a transfer

station which will check for the needed recycling ones to be done on-site, else if any recyclable material cannot be done on-site then it will be sent to an off-site recycling. This ensures the optimum and most efficient use of resources and reusing of products.

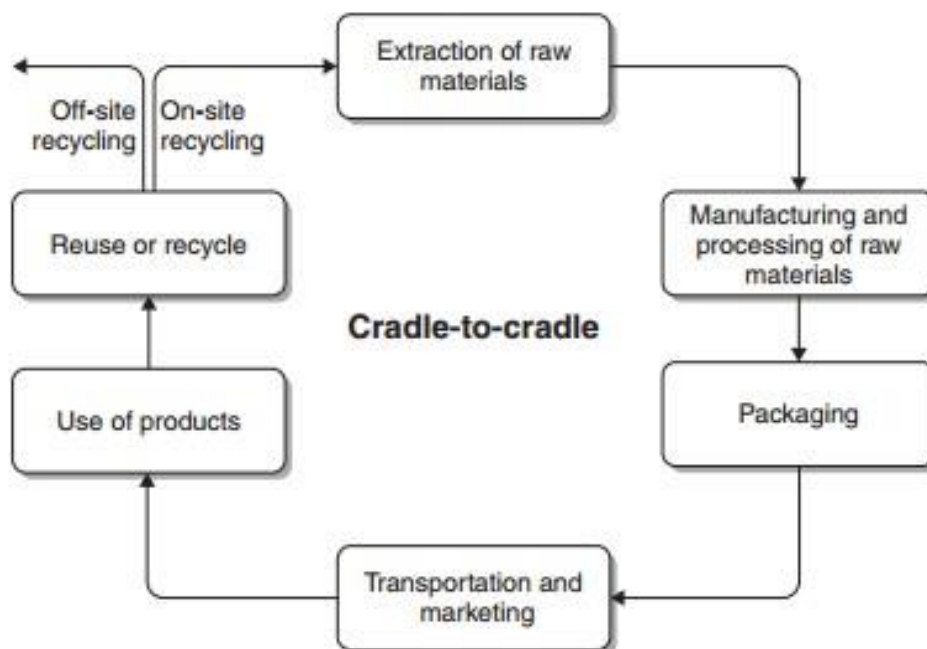


Figure 4: Cradle-to-Cradle Approach (El-Haggar)

A production process is a defined set of procedure followed to reach the desired product. The difference between daily or trendy or so-got-used-to production system and zero waste is shown in figures 5 and 6. Figure 5 starts with extracting the needed natural resources which are sent to the manufacturing facility that results in producing the needed product via wasteful process leading to high levels of pollution. Then the product is sent to a distributor then to customers using it who will throw the wastes after reusing and then it will be sent to resources destruction which is either landfill or incinerators, leading to further natural resources loss that is reflected on the current and will be negatively impacting the future generations, in line with the increase in land, water and air pollution levels.



Figure 5: Regular Production Process (Eco Cycle-Building Zero Waste Communities)

Figure 6 shows a simple, yet meaningful production process of the zero waste cycle which starts with clear policies or rules on how to conserve, use and reuse natural resources, going to a smart designed manufacturing facility that follows cradle-to-cradle production process, then going to distributors and community members who will use the products yet with the presence of community programs on how to reuse the products or environmentally dispose them; the citizens will have a responsible vision and lines of action to save their community, environment and secure the resources for future generations and thus act sustainably under zero waste concept. Then the remaining wastes will be sent to resource recover infrastructures that replaces incinerators and landfills aiming to recover more than 90% of the wastes. Lastly empowered citizens who are now living in a supportive, clean and challenging lifestyle which is one reward to them and the government. They can set defined incentives to those who introduce new modes of waste recycling or reusing and those who work harder for further environmental saving (Eco Cycle-Building Zero Waste Communities)

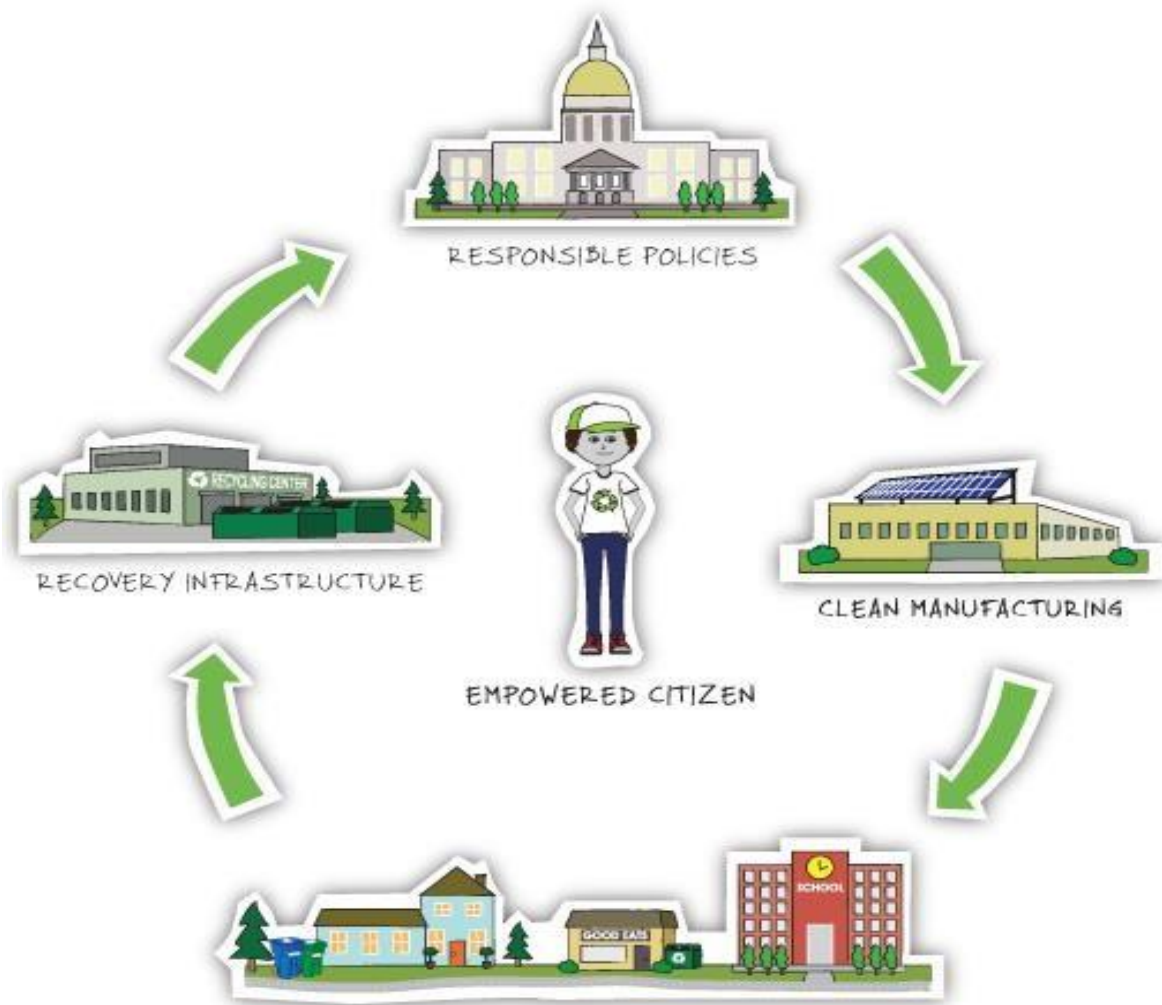


Figure 6: Zero Waste Production Process (Eco Cycle-Building Zero Waste Communities)

Looking from an economic point of view, Zero Waste is defined as a way to transform the present cost into more value added resources that should be used by the industry. In addition to, for the social point of view, Zero Waste will provide a self-sustained community that will provide job opportunities, better livings, and efficient lifestyle. This will better the current economic stands which will reflect on the surrounding social life within the community. Lastly, it is focused on excluding any concept for landfills, disposal fees and illiteracy of waste management while including environmental designs, educational programs within the schools, trainings and research studies, green regulations, branding for

zero waste businesses and including resource recovery infrastructures (European Regional Development Fund, 2015).

As per the Institute for Zero Waste in Africa (2015) which identified the below common zero waste beliefs among people giving wrong or misleading information about it, and maybe that is why Zero Waste concept is always seen as a philosophical concept rather than a design strategy.

- Redesigning products and packaging: Implementing a clear and clean design and production technique starting with the planning of natural resources usage till minimization of the recovered materials through the production process is one of zero waste aims.
- Producer Responsibility: The manufacturer is held responsible physically and financially for the “cannot be recycled” types of wastes; and this prevents or decreases the presence of waste in the incinerators or the landfills.
- Infrastructural Investment: Encouraging the community to invest in new resource recovery facilities instead of using the tax money in increasing the landfills or new incinerators.
- Monetary Efficiency: Applying taxes and introducing policies that makes that prevents any usage of natural resources by manufactures and finding an alternative way to produced products is a must.
- Job Creation: If the waste in the incinerators and landfills were usefully re-processed again to be reproduced in other forms of products, this would certainly help the society environmentally and economically by introducing almost 10 times more and new job opportunities.

2.5.2. Zero Waste History

Zero waste mainly aims at solving the problem that “so-called” sustainable area generate, which is briefly defined as abusing the natural resources resulting from not reusing these wastes or having a modified product lifecycle that minimizes the usage of natural resources. A sustainable urban community is concerned mainly with sustainable sites where **managing the wastes is one of the main**

concerns. The major contributors to sustainable communities are energy efficient, Water efficient, Indoor Air Quality and Materials and Resources as shown in figure 7.



Figure 7: Sustainable Urban Community Points of Focus

A Zero Waste Sustainable community, which is the focus of this thesis research, will include more or less similar structures as that defined by USGBC in LEED-ND. Couple of novel approaches in this thesis community structure is including zero waste and zero net water concepts, which were not considered under LEED-ND; and that is one of the major differences between LEED-ND. Figure 8 briefly describes the points of focus for the zero waste sustainable urban community. Starting by setting clear policies and ethical environmental acts by the government which acts as the role model to the society. Then planning a clear timeline for achieving the needed zero waste sustainable community, which should reflect on the activities and improvements being done to drive it through a better economic standards. While also offering job opportunities serving the public. In addition to following cradle-

to-cradle approach that ensures both resources and waste management that ensures utilization and management of resources, ensuring energy, water and land efficiency in usage and in the produced outputs. Furthermore guarantying that the citizens are empowered and engaged within the community either in activities, innovations or by opinions. Moving to giving room for creativity and new solutions for a better zero waste management community ensuring the community engagement.



Figure 8: Zero Waste Sustainable Urban Community Points of Focus

As the scope of the zero waste sustainable urban community is more focused, detailed and aimful than the sustainable urban community, this leads to the presence of more job opportunities to cover for the new sections defined in the community. Additionally, the government should ensure rewarding the acts of the community members in support with the community main goal so as to

empower citizens to carry-on with the good and needed activities. Lastly ensuring that there is a clear timeline defined from the beginning for either transforming the current community or starting a new one abiding to the main objective of the zero waste sustainable urban community. This should be done while making progress assessments and measures to ensure that the community is heading towards the desired path. A zero waste sustainable urban community follows an Eco-Cycle strategy to achieve the needed aim **where managing the resources and accordingly the wastes is the main focus** as discussed in the coming paragraphs, from (Khattab & El-Haggar, 2016 b).

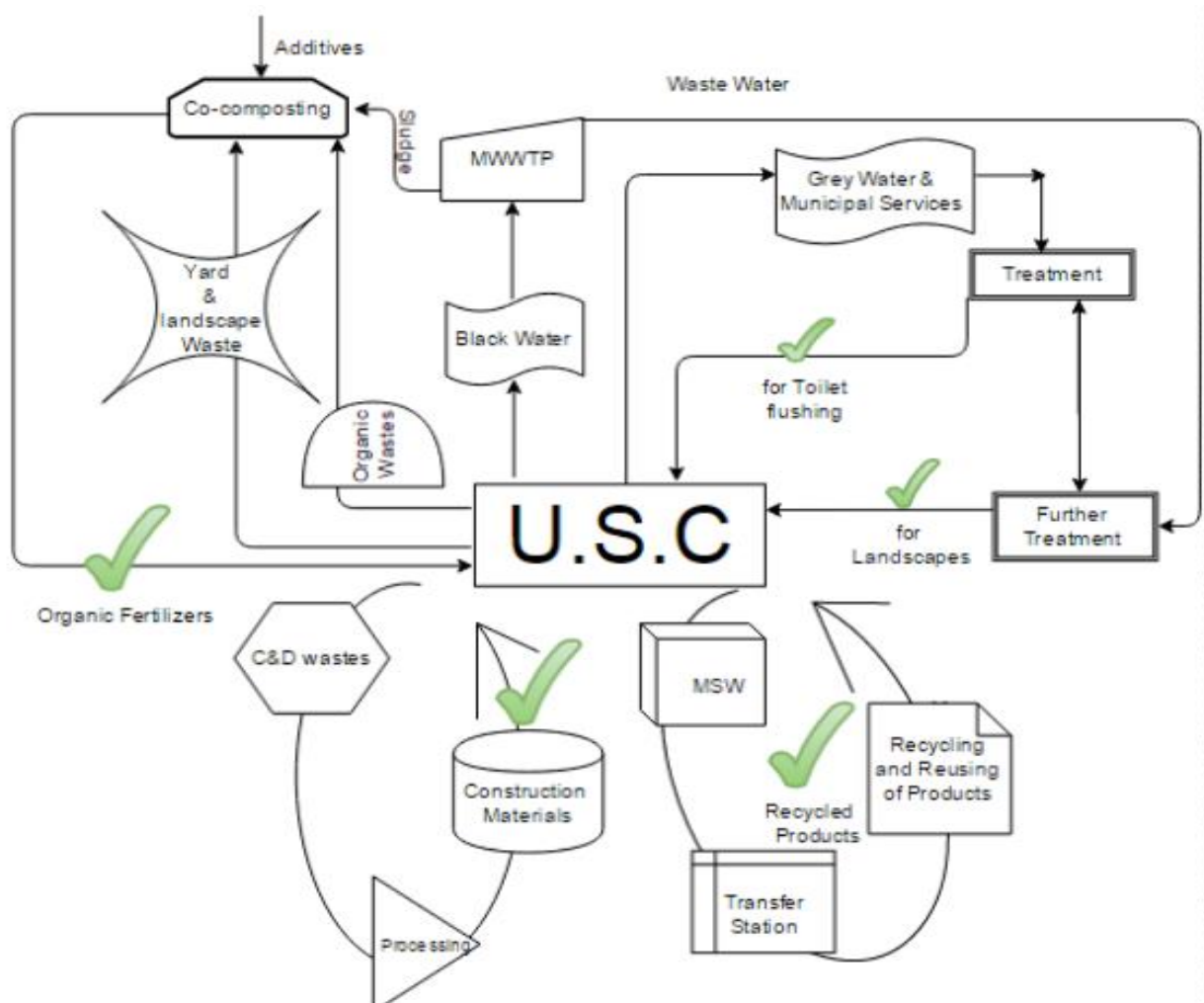
Flowchart 1 introduces a cradle-to-cradle zero waste concept model for a sustainable zero waste Urban Sustainable Community (U.S.C) which produces municipal solid wastes (MSW) which are defined to be the daily wastes; being divided as non-organic MSW and Organic food wastes. All of the wastes are collected from the U.S.C. where the non-organic MSW are being sent into a transfer station which is defined as waste management sites allowing for safe waste utilization systems unlike landfills (El-Haggar, 2007). The collection trucks transfer/unload the wastes from a location to the transfer station.

In a transfer station facility the wastes are further separated and larger trucks can send the segregated wastes into recycling facilities, that the recyclables or products and materials that can be reused are being transferred to their facility of specialty and after being recycled or modified for reusing; the products such as coat hangers and waste plastic bags are resent back to the U.S.C. and this aims at environmentally reusing the generated wastes (by recycling or reusing) also minimizing the amount of natural resources needed to produce new products and this all leads back to another closed loop of MSW from and to U.S.C as shown in flowchart 1.

Then the construction and demolition (C&D) wastes which result from destruction of an existing building in an existing community or the construction of new buildings in new and existing communities. The types of wastes extracted from this phase can be categorized as ceramics, marble, bricks, concrete

in addition to many other materials that when processed can result in other construction and materials such as paving interlocks, bricks and plain concrete.

Municipal Liquor wastes, also known as sewage wastes are another type of wastes being produced in the U.S.C. This type of waste will be treated by sewage treatment processes to produce sludge and effluent or safe reusable water. The effluent can be used in irrigation systems, cleaning modes or for the AC’s cooling towers while the sludge will be mixed with other organic waste for a co-composting process (El-Haggar, Sustainable Industrial Design and Waste Management, Cradle-to-Cradle for sustainable development, 2007) as described in flowchart 1.



Flowchart 1: Proposed Zero Waste Concept for Urban Sustainable Community Flowchart

Then the black water going to a Municipal Waste Water Treatment Plant (MWWTP), the

organic food wastes in line with yard wastes, grass and leaves wastes will undergo co-composting. Co-composting is aerobic waste decomposition process where the waste is stacked in piles for fermentation using the sludge produced from the municipal liquor wastes (sewage wastes) loop discussed above. These in addition to some additives like rock phosphate and potassium. which are to be added to adjust the desired output from the co-composting stage which are organic fertilizers. These organic fertilizers will be used for organic farming and can be added on the golf land or green areas within the U.S.C so as to increase its fertility and this will be the forth closed loop within the U.S.C community.

Lastly, for the grey water produced from the U.S.C, it will undergo treatment so as to be re-used again in toilet flushing, and the excess of grey water with the excess of black water discussed earlier can undergo further treatment to be used for landscape and irrigation. The sustainable zero waste community strategy discussed is designed to serve the community for a healthier, safer and pollution less environment by applying cradle-to-cradle approach in all of the available waste production types and thus ensuring zero waste approach is being applied. In other words, ensuring that the produced output wastes are being used as input products within U.S.C. thus saving natural resources, reducing waste accumulation level, introducing new job opportunities and enhancing the economic standards of the community as well as its lifestyle and lastly reducing pollution; all leading to serving the community and having a balanced eco-system. (Khattab & El-Haggar, 2016 b).

2.5.3 Net Zero Water

Net zero water is a new concept that is related to the community sustainability as well as energy and solid wastes however it is not a common focus with limited publications or research about it yet, in how to reach zero waste water as reaching zero net energy and zero waste.

Net zero water is “*facilities that maintain the same quantity and quality of natural water resources by decreasing consumption and directing water to the same watershed*” as defined by the

US Army. (US Army, 2014). Another definition to zero net water is “*the balance between annual potable water use and annual rainfall*” as defined by Olmos and Loge, 2013. (Joustra & Yeh, 2015)

It was observed that Net Zero Water is a new concept with narrow research information as mentioned, thus it is considered to be one of the novel approaches and points of focus to include within this thesis.

Objective & Methodology

The key objective for this thesis is to develop new guidelines that is applicable for both existing and new communities; integrating the concept of sustainability in urban communities in Egypt by following the Zero Pollution novel approach which is Zero Waste, Zero noise Pollution, zero air emissions and Zero Net Water which is a brand new topic of focus being developed and integrated in the guidelines for a more detailed and further elaborative and inclusive guidelines. In addition to a rating system and a comparative analysis between the proposed S.U.Z.C. guidelines and the commonly used rating system, LEED-ND.

The Methodology of this thesis starts by studying the effect of solid waste on the tourism communities as they are considered to be the primary source of income in some developed countries and in Egypt as well. This was accompanied by introducing a novel approach that utilizes the solid wastes under a zero waste concept. Then expanding the study of zero solid waste to urban communities, which are increasing in the number of population primarily due to urbanization, on solid waste was presented in a second paper. It was concluded with optimizing the previous novel approach for utilizing solid wastes within the urban communities. Then, through the literature review studied in this thesis including the definition of sustainable community, the problems with urban communities and the history of zero waste and zero net water. It was concluded to develop novel zero pollution concept which assisted in developing the proposed S.U.Z.C guidelines and rating system. This concept is developed based on the literature review study of the need of having a sustainable urban community while

introducing new modes of solid waste and grey and black water utilization within the community; with reference to the cradle-to-cradle approach. These guidelines were compared by the most famous and commonly referred to and used rating system in the developing countries, LEED-ND. Lastly, applying S.U.Z.C. rating system on Madinaty- New Cairo case study to validate the proposed rating system. Madinaty was evaluated according to the proposed guidelines.

CHAPTER 3: PROPOSED GUIDELINES FOR A SUSTAINABLE URBAN ZERO POLLUTION COMMUNITY

3.1 INTRODUCTION

Guidelines are defined as set of rules defined so as to provide a clear set of directions or actions expected to follow. One of the famous guidelines is the LEED for Neighborhood Development Guide which was issued by the early 2000's by the U.S. Green Building Council (U.S.G.B.C.). However it is designed more to fit US and European countries heading towards sustainability, but the proposed guidelines are tailored for a sustainable urban community in the Middle East using Zero Pollution Strategy.

The proposed guidelines are looking for a zero pollution sustainable urban community which is composed of green buildings, infrastructure and surrounding environment. A neighborhood is “a place with its own unique character and function, where people can live, work, shop, and interact with their neighbors.... In addition to being the place with high level of walkability, social cohesion and stability, and neighborhood resiliency amidst changing economic and sociopolitical conditions” as defined by LEED-ND as illustrated in the comparative analysis chapter. Thus encountering a sustainable neighborhood means green buildings with ease of access from the streets, as paved streets with good and safe conditions, stable living, encouraging environment for work and living, the presence of all of the needed facilities in a walking distance, designed walking areas, trees shading the streets at the sides and most importantly, clean environment to live in.

Just as expected and aimed for at any community, and as by definition, the community is a Safe and livable place to live in facilitating reaching the daily needs either products, services or even entertainment and wellbeing. The S.U.Z.C. integrates the aim of the community with sustainability definition in having a Compact and connected adaptive and durable community, efficient services, products and lifestyle applying environmentally friendly acts in energy, water, materials, wastes and Indoor/Outdoor air quality. In addition to including part for citizens and businesses innovation for introducing new techniques in reaching a further sustainable community and lifestyle. And lastly being economically stable, offering job opportunities and paying back at the community to have a better lifestyle.

S.U.Z.C. is assumed to be a fully developed one-zone mixed-use community of around 500,000 occupant that does not require any under construction traffic, parking management, pollution precautions or study. However, this might be included in a future modified or revised version for the guidelines.

Figure 9 shows a sample of the mixed usage S.U.Z.C. community type meaning that it is a multifunctional and multi-income based community. The community should include residential buildings, business buildings, walking areas, recreational facilities and hospital. Figure 10 describes the proposed S.U.Z.C. which is primarily based on Green Building acting as an educational model for other community buildings.



Figure 9: Sustainable Community Mixed Usage Sample (Seifer, 2014)

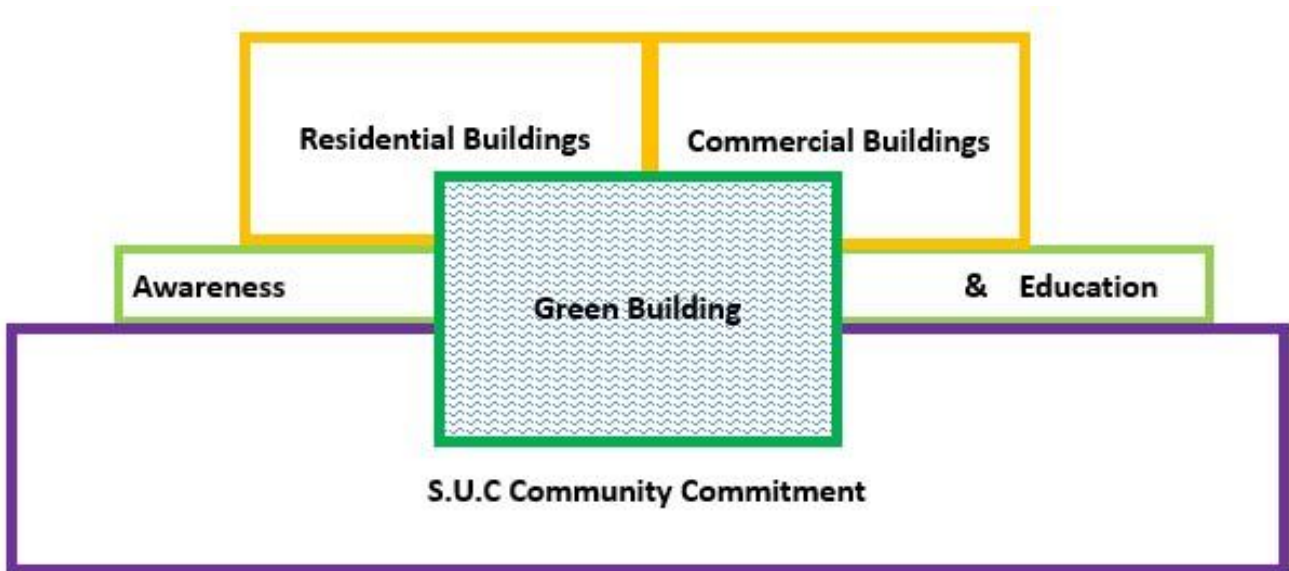


Figure 10: Sustainable urban Zero pollution Community Diagram

A mixed use community with different activities going within, is considered to be a multifunctional community that should open more room for innovation and creativity allowing for one's mind imagination to widen and bring further solutions for further sustainable community. In addition to innovation, more job opportunities will be provided due to the diverse and various goings-on within the community; hence being a multi income community with a better living standard and lifestyle leading to further community members comfort and community stability, as shown in figure 11.

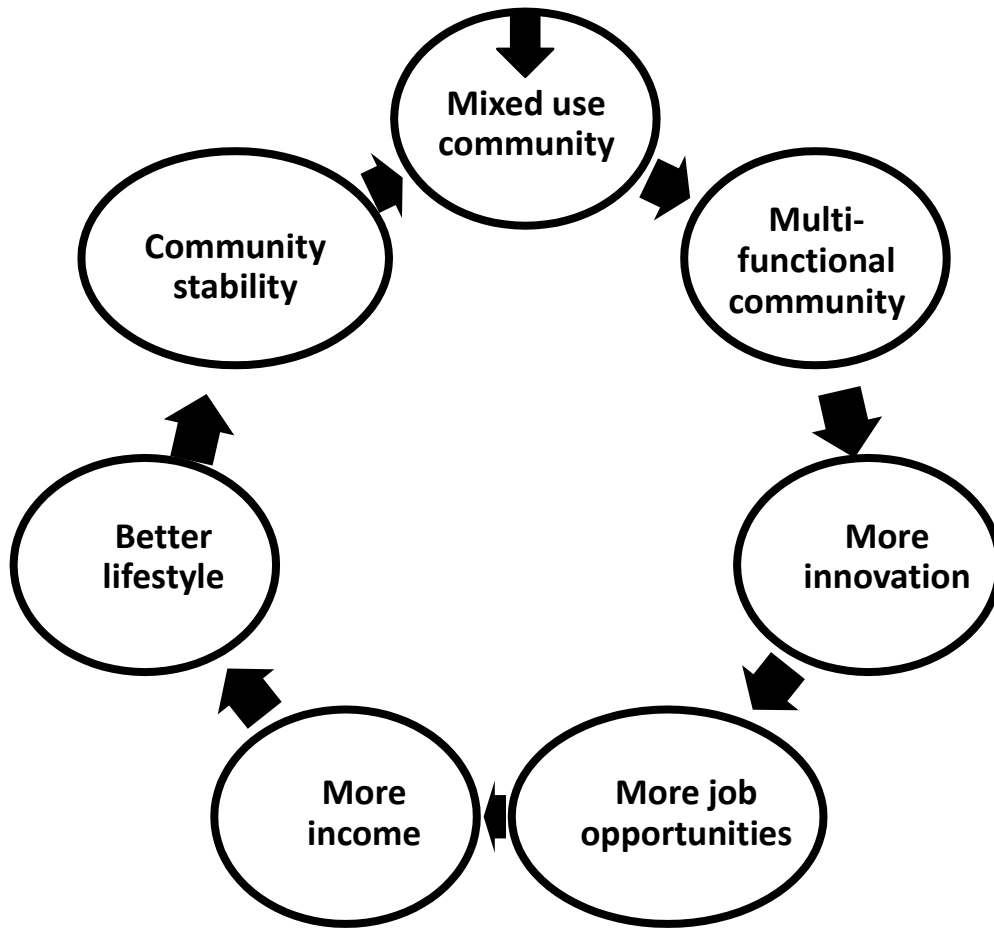


Figure 11: S.U.Z.C. Characteristics Diagram

3.2 S.U.Z.C VALUES

The core values of the proposed S.U.Z.C., which are the guiding principles for the proposed guidelines that are initiated by the sustainability concept pillars of environmental, economic and social; however they are more detailed while including more points to ensure a detailed and widened focus community values.

The proposed principles of S.U.Z.C. are environmental, social and ecological, ethics and integrity, leadership, optimism and positivity.

I. Environmental

Establishing clear and fair guidelines that serves as a guard to the surrounding environment in terms of air, water, materials and energy while identifying a rating system for evaluation and reward.

II. Social & Ecological

To enhance the social life standards and definitions of actions while identifying the link between citizens within a community and nature. This will help in restoring the ecosystem with reference to the sustainability pillars of social, economic and environmental.

III. Ethics & Integrity

Upholding ethical moralities like transparency, fair ruling from the government who are the community leaders, honesty, righteousness and decency. Also, being fair and democratic by disregarding any gender, age, religion, abilities and disabilities and political opinions while providing fair chances of access of resources at reasonable and affordable commodity and services prices and fair chances of job opportunities within the community.

IV. Leadership

Leading the community towards Green activities, manners, infrastructure and surrounding atmosphere.

V. Optimism & Positivity

Providing a stable and motivational lifestyle and atmosphere will lead to better health, better efficiency and excellency in proficiency.

3.3 S.U.Z.C CONCEPT

Achieving sustainability and going green is today's main focus topic which is unfortunately being used to be more of a marketing word than a lifestyle strategy. Research studies shows that LEED-ND is the leading rating system for communities, however, it is mostly applicable for USA or developed countries.

LEED-ND is doable and applicable mostly in several developed countries and mainly for new communities as stated by U.S.G.B.C. Thus there is a need to develop a rating system that serves developed and developing countries, new and existing communities; with the integration of novel approaches about zero pollution like Zero solid and liquid waste, Zero Net Water and zero noise pollution.

The main criteria behind the proposed S.U.Z.C guidelines are simple, focused, understandable and inexpensive rating system with efficiency focus being the main drivers for it purposeful about energy, water, air, materials and habitat.

The rating system for the proposed S.U.Z.C. will have four sustainability levels as shown in Table 1 and it will be discussed in details at the end of this chapter.

Table 1: S.U.Z.C. Rating system

S.U.Z.C Bronze	ACHIEVE 40% MIN. SAVING
S.U.Z.C Silver	ACHIEVE 50% MIN. SAVING
S.U.Z.C Gold	ACHIEVE 60% MIN. SAVING
S.U.Z.C Platinum	ACHIEVE 80% MIN. SAVING

3.4 RELATIONSHIP BETWEEN COMMUNITY OWNERS/ MEMBERS



Figure 12: S.U.Z.C Owners Connection Diagram

As part of the community owners role of delivering the main aim behind establishing the community itself and identifying the expectations from all of the community occupants, it is important too to symbolize the relation between them ensuring that the roles and expectations are stated clear.

Figure 12 briefly identifies this link, zone 1 is the intersection between the community owners, the residential buildings owners and the commercial buildings owners and it reflects back the image of figure 10 mentioned about having a green building acting as an educational tool to owners who would like their building to be functioning and entitled Green, regardless if they are residential or business type. In addition to having the role of the green team to be in common while encouraging residential and commercial owners to participate with the green team activities as well; and lastly having green education either its via awareness, marketing for the green acts or even pointing the green advantage in the mentioned building type to customers.

Zone 2 is the community owners' main focus apart from presenting the needed guidelines in line with objective, but also ensuring the proper green education plan to community occupants by

training, awareness, workshops and raising innovation in addition to establishing preventive and corrective maintenance team.

Zones 3 & 4 are the residential buildings owners and the commercial buildings owners points of focus and role is to ensure that the residents should follow and adapt to the common points between them and the community which is the same as that mentioned between the commercial buildings and the community, which is number 5 with an optional achievement to number 1.

Zone 5 reflects the common similarities between each type of community with the S.U.Z.C like grey water networking and treatment system (for individuals), grey water treatment system (for the community), flushing toilets with treated water, land irrigation using treated water, solid waste sorting, hard-scape is to use high SRI material and soft-scape is to use native or local plants which ensures less absorption of water and better look. Last but not least, enhancing in-building indoor air quality by using low Volatile Organic Compounds (VOC) and lastly proposing an efficient, realistic and doable parking management plan.

Lastly for zone 6 which reflects the intersection between the residential buildings and the commercial buildings so traffic and parking management plan is needed, ensuring reduction of noise pollution (incase a shopping mall is constructed in front of a residential building) and lastly air pollution reduction from commercial buildings, which might arise from the food court or restaurants chimneys.

3.5. S.U.Z.C OBJECTIVE

Developing practical guidelines for S.U.Z.C. while applying a zero pollution novel approach of **zero solid waste, zero net waste water, zero noise pollution** and **zero emissions** Concept that serves at protecting not only the environment but also the natural resources and enhancing standards of living to occupants for the current and future generations.

3.6. S.U.Z.C. PROPOSED GUIDELINES

The main divisions of the S.U.Z.C. holding the objective of having a balanced, realistic, measurable and comfortable sustainable community lifestyle are community commitment and owner commitment. Starting with the community commitment which is concerned about open parks, areas and model farms, recreational facilities, local food production, community streets, lanes, transportation and parking management. In addition to the environmental management that is the focus of the community as well as the owners who will build or open businesses within the community. The environmental management focuses on reaching zero net waste water, zero noise pollution, zero solid waste, zero emission, better and environmentally friendly materials usage and selection, better energy efficiency and enhancing indoor air quality and outdoor air quality.

Last but not least, as part of the community commitment is the introduction to the green team which is focusing on providing further community support and stressing on the main objective of the community by holding educational trainings about green buildings, the community, how to be sustainable, sustainability starting at home, green buildings and environmentally friendly acts.

The green team is more concerned about innovation, trainings, awareness, penalties and rewards. Innovation is for a further outreach community involvement, innovation should be a practiced and motivational act to be done within the community, again being linked with the proper awareness and the sufficient rewards based on the innovative idea. Awareness is about providing community educational trainings about green buildings, the aim or focus of the community. Trainings are related to the awareness program where they are linked to workshops too aiming for providing the needed support and assistance to community members and business owners on further spreading of environmental and sustainable acts to be done while applying them through workshops and encouraging innovation through on-community competitions. Lastly, penalties and rewards are intended about having clear neighborhood rules with assigned following up team and proper awareness spread within the community means applying penalties

on those who don't abide to the planned, constructed and designed for environmental safety. On the contrary, those who try to excel and save the environment further should be rewarded for their efforts.

Furthermore, as per the community commitment is to provide proper and clear guidelines to the owners who are willing to build a building, start a business, open a restaurant or a café, schools or universities, or even shopping malls. The guidelines proposed by the community aim at maintaining the community objective even to investing owners while giving them the needed full guidance to act in accordance with the community shareholders and members expectations; which when done, credits are achieved by the owners qualifying them for several rewards levels depending on the owned credits reflecting back on discounts on operational costs, as it will be discussed later.

The proposed guidelines, consists of 100 credits, as shown in figure 13, these credits mentioned in the proposed guidelines are just **measures** that are used for feasibility study. Each section within the guidelines includes sub-section that are composed of several sub points, each point is credited by 1 credit. This credit is a hypothetical number to be referred to and studied later on for a properly identified and acknowledged rating tool. These credits are based on scarcity of the resources as well as severity and hazardous of the impacts on the environment.

The proposed guidelines 100 credits are divided for 36 Crs for sustainable site management section which includes open areas/parks, recreational facilities, local food production, community streets and parking management. In addition to 44 Crs for Environmental Management for both community and owners business focus which focuses on energy efficiency, water and rain water efficiency, waste management, material selection management and Indoor/ Outdoor Air Quality and Green Building. Lastly, 20 Crs are for the Green Team which is the community team responsible for awareness programs, trainings and workshops, holding innovation competitions and applying the needed penalties and rewards for all community activities and acts done by Business owners, residential owners and community citizens. In addition to a number of pre-requisites in sustainable site management, energy efficiency, waste water management, solid waste management, materials selection and others falling under the Green Team focus.

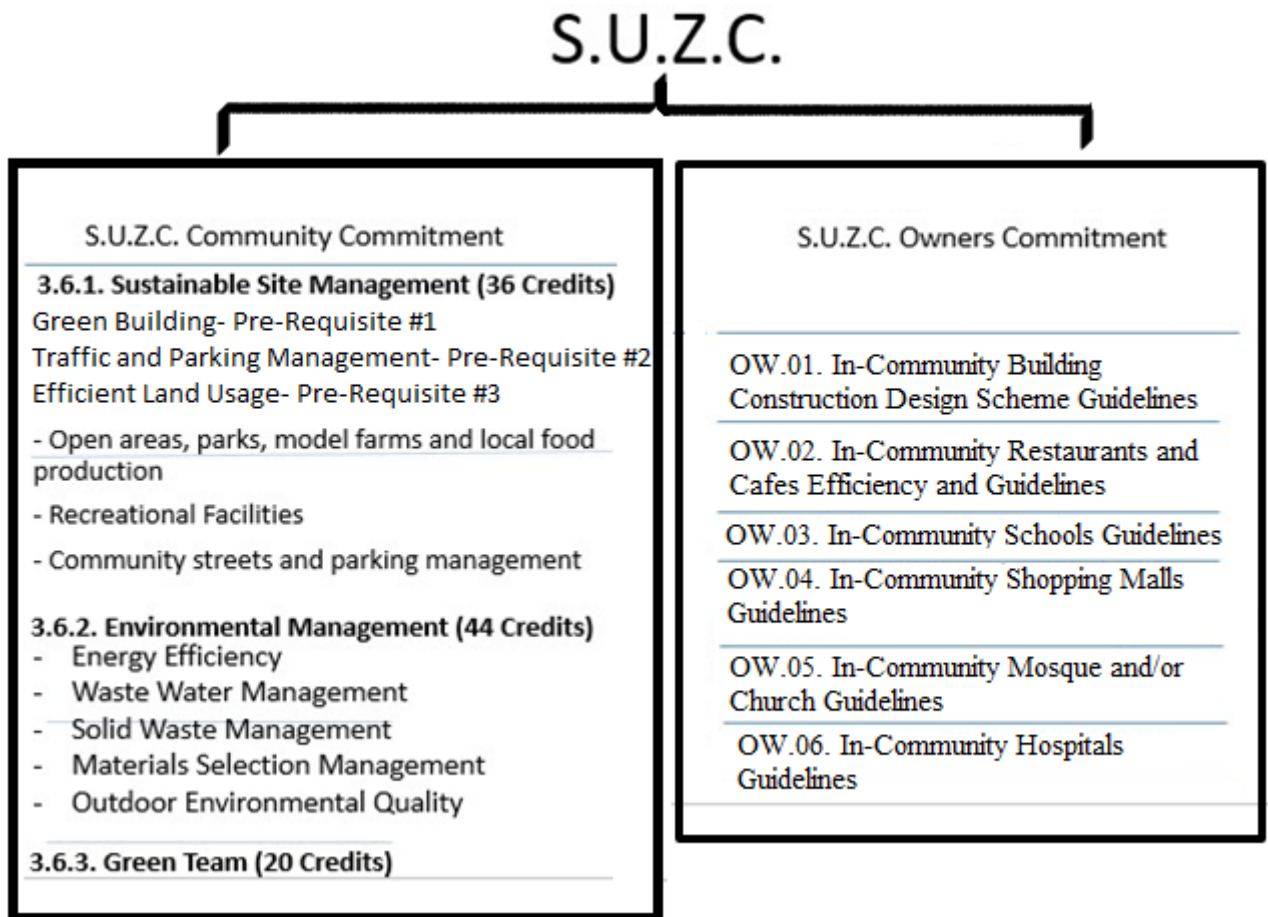


Figure 13: S.U.Z.C. Guidelines Flowchart

In addition to the previously mentioned points for the community owners which have the biggest weight of points and higher focus in the guidelines; as they are considered to be the role model for all of the investing business and residential owners as well as the community occupants. Additional guidelines are identified to business/ commercial and residential owners for those who are willing to apply sustainable acts, building strategies and activities within the community are going to earn points qualifying them for operation costs discounts rewards. The Owners guidelines are mentioned for the building orientation and efficiency, In-community restaurants and cafés efficiency and guidelines, In-community schools, In-community shopping malls efficiency and guidelines, In-community mosque and/or church and lastly, In-community hospital guidelines.

3.6.1. Sustainable Site Management (36 CREDITS):

Sustainable site management is the first section in the proposed guidelines as shown in table 2 defined first by the pre-requisites and then the credits divisions which when added up gives the total section credits of 36 credits.

Table 2: Sustainable Site Management Division (36 Credits)

Sustainable Site Management			
S01: Pre-Requisite #1: Green Building			
S02: Pre-Requisite #2: Traffic and Parking Management Plan			
S03: Pre-Requisite #3: Efficient Land Use Plan			
S04	Cr.1	Open Areas/Parks, Model Farms and Local food Production	6 Credits
S05	Cr.2	Recreational Facilities	6 Credits
S06	Cr.3	Community Streets and Parking Management	
		Cr.3.a Transportation	6 Credits
		Cr.3.b Street Lanes	12 Credits
		Cr.3.c Parking Management	6 Credits

S01: Green Building (Pre-Requisite#1):

A green building is the type of building that is known for its sustainability in design, construction and demolition, daily activities, materials and resources and finally preventive preservation. Including a green building within the community is important to act as a model to the investors and other business owners who need to have their buildings being identified and certified as green buildings; in addition to serving as educational means to community occupants in terms of expected activities and needed participation.

Requirement:

- Introducing a Green Building within the community that serves at meeting the community needs in addition to being an on-site example
- Green Team is responsible for the on-going awareness acts on Green Buildings and carrying on community tours

Importance of having a green building on-community:

The main objective behind including the green building as the community pre-requisite is that it will act as an educating tool and guiding real life application for further community learning and applying activities.

Advantages of having a green building on-community

Many benefits are defined under having a green building model within the community. First of all is the environmental benefits which will guide to methods of decreasing pollutants and emissions, waste water and waste management techniques, heat island reduction effect as well as better and healthy indoor air quality.

Second of all are the economic benefits which includes energy savings in operational costs and accordingly in long term project savings as well as water savings by reducing potable water supply and reusing water in a treated format thus water scarcity and stress decreases. Lastly are the social benefits which focus on increasing occupants' working, living and health standards lifestyle and recreation, while also improving level of learning to students in school and bettering patients' health in hospitals.

S02: Traffic & Parking Management Plan (Pre-Requisite#2)

As per the community focus of ensuring occupants' safety and comfort, traffic and parking management plans are a must to serve this aim as well as proposing clear plans in case of blocked street, congested road, or under modification roads where there should be an alternative route plan identified to

the community members. For the parking management plan it also needs to be identified as it is considered part of the landscape management for instance which is more efficient, underground or outdoor areas parking for hospitals and shopping malls?

Requirement:

- Identifying the needed traffic and parking management plan within the community that ensures safety, ease of use, efficient time management and reducing on-street congestion by applying proper landscape area management.
- Traffic and parking management including disabled lane and a fire/ambulance lanes and bicycle stands.
- Traffic Management Plan especially in case of emergency concerns road closure
- Zero noise pollution

S03: Efficient Land Use Plan (Pre-Requisite#3)

As part of sustainability, efficient landscape usage plan is required so as to ensure that the provided land space is being used with optimum efficiency and maximum production and benefits.

Requirement:

- Pointing the importance of efficient land usage which is interconnected with the community sustainability objective.
- Efficient land usage in terms of building, green areas and parking management
- Ensuring that the proportion of the building dimensions with the surrounding green areas and parking is sufficient and serving the needs

S04: Cr.1 Open Areas/Parks, Model Farms and Local Food Production (6 credits)

Including parks, model farms and local food production within the community is a requirement in the landscape management plan in addition to including other services that are needed to serve the community needs by abiding to the mixed-usage community aim.

Requirements:

- Option 1: children Playing area and/or family gathering area (2 points)
 - 2 points are divided on children playing area and family gathering area where there is different planning for either and different setting of decoration, representation and design.
- Option 2: Restaurants and/or cafés (2 points)
 - 2 points are divided on restaurants and cafés where there is different planning for either and different setting of decoration, maintaining level of cleanliness, representation and design.
In addition to accounting for drive through orders for restaurants and more comfortable atmosphere for cafés where they are basically for friends gathering and additional social get-togethers.
- Option 3: Model farm and Local food production (2 points)
 - 2 points are divided on model farms, which shall act as a guiding model for rural areas which are targeting sustainability, and local food production where it ensures organic food production and harvesting while being a model for roof vegetation.

S05: Cr.2 Recreational Facilities (6 credits)

As focusing on better health and entertainment is part of the community's focus in-line to landscape management; thus recreational facilities are included in the design serving both needs.

Requirements:

- Option 1: Avoid Noise Pollution (2 Points)

- 2 points are counted for any sort of noise pollution outdoors or even indoors that might lead to hearing problems.
- Option 2: Outdoor recreational facility are to be independent or integrated with the community open parks (1-2 Points)
 - 1 point is for constructing an outdoor recreational facility that is NOT linked to the community open Parks
 - 2 points is for constructing an outdoor recreational facility that is linked to the community open Parks which ensure efficient land usage
- Option 3: “Keeping Fit” corner to serve healthy food and drinks (2 points)
 - 2 points are accounted for including the Keeping Fit corner either in schools, parks or in shopping malls. In addition to serving healthy food which is encouraged to be from local organic harvesting products.

S06: Community Streets and Parking Management: (24 credits):

Streets and parking management are essential for increasing inhabitants’ safety and comfort level. This section includes all about the on-street transportation and streets routes, in addition to parking designs. This credit is divided into transportation, street lanes and parking management as shown in table 3.

Table 3: Community Streets and Parking Management Division (24 credits)

S06	Cr.3	Community Streets and Parking Management	
		Cr.3.a Transportation	6 Credits
		Cr.3.b Street Lanes	12 Credit
		Cr.3.c Parking Management	6 Credits

S06: Cr.3.a Transportation (6 Credits)

Relying on personal vehicles for transportation is a major dislike in the community that it is being proposed for replacement and encouragement for other means.

Requirements:

- Option 1: Shaded shuttle buses waiting area to be built on the pavement (2 points)
 - 2 points are for designing and constructing comfortable shaded shuttle buses waiting area.
- Option 2: Shuttle buses are to include proper rides timing and account for removable ramp to be placed for any disabilities (2 points)
 - 2 points are divided in between the time schedule and the removable ramp for any disability.
- Option 3: Encouraging alternative Transportation like Bicycle (2 points)
 - 2 points are for designing and encouraging for alternative moving around modes, one of which could be bicycle, other could be walkability.

S06: Cr.3.b Street Lanes (12 Credits)

Proper street lanes design and decoration reflects the community aim, image and comfort. Thus they should be properly and safely designed while being linked with the alternative transportation modes mentioned in the previous section in line with appropriate corresponding parking management as pointed at in the coming section.

Requirements:

- Option 1: Street Networking Management- Lanes for Bicycles (2 points)
 - 2 points are for accounting for bicycle lanes in the street networking design, which should include 2 way bicycle lanes with proper street separators between the driving lanes and the bicycle lanes.

- Option 2: Street Networking Management- Walkability Pavements (2 points)
 - 2 points are for accounting for properly designed walking pavements that are comfortable for walking in the street networking design, which should be designed with proper shading with local trees.
- Option 3: Streets network are to be designed as per the streets principals and guidelines of UAE including but not limited to Reducing congestion, driving time and carbon footprint by interconnecting streets and blocks, Sheltered, protected and shaded pedestrian walking areas, Pedestrian and vehicle curb division (pavement height and design), Controlled Vehicle Speed, Street Elements Design, Street Junction Design, Congestion Controlling plan and lanes dimensions and construction (2 points)
- Option 4: Streets cleaning are to take place during non-rush/non-congested hours (1 point)
 - 1 point is for proper cleaning time schedule that doesn't conflict any high traffic timings.
- Option 5: Streets safety- "push button" for pedestrians or cycles (1 points)
 - 1 point is accounting for the push button for safety.
- Option 6: Streets Safety- Trash Bin on-the-pavement assigned place (1-2 points)
 - 1 point is for trash bins designed to fit in allocated places on the pavement.
 - 2 points is for underground non-automated trash bins, if automated, it will be counted under innovation for waste management.
- Option 7: Streets heat island reduction Techniques (2 points)
 - 2 points are to account for different heat reduction methods like SRI materials, street shades, materials types and color.

S06: Cr.3.c Parking Management: (6 Credits)

Being a reflection on community neatness and organization, if properly designed and abided to, it will ensure noise pollution reduction and decreasing in the driving discomfort level

Requirement:

- Option 1: Parking Management: The construction of a multi-story parking garage building (2 points)
 - 2 points are for proper design of the parking space/ building in addition to accounting for traffic within the garage and materials used.
- Option 2: Parking Management: Underground parking linked with better land use plan (2 points)
 - 2 points are for proper design of the underground parking in addition to accounting for traffic within the garage and materials used.
- Option 3: Parking Management: Undercover parking linked with better energy efficiency (2 points)
 - 2 points are designing for parking space while including energy efficiency acts like solar panels on the undercover shades that are connected to the main street storage banking system to light the street lights.

3.6.2. ENVIRONMENTAL MANAGEMENT (44 CREDITS)

As one of the main focuses of sustainability is environmental concern, this section illustrates more about the environmental contributions being done within the community. This includes light efficiency and landscape efficiency.

Table 4: Environmental Management Division (44 Credits)

Environmental Management			
E01	Cr.1	Energy Efficiency and Landscaping	8 Credits
E02	Cr.2	Waste Water Management	10 Credits
E03	Cr.3	Solid Waste Management	12 Credits
E04	Cr.4	Materials Selection Management	8 Credits
E05	Cr.5	Outdoor Environmental Quality	6 Credits

E01: Cr.1. Energy Efficiency & Landscaping (8 points)

Managing less energy consumption while ensuring the same power, quality and service is the aim of energy efficient community. Energy efficiency is studied in street lights, the usage of solar panels, PV cells, planting using native trees which will use less water during irrigation.

Requirements:

Energy Efficiency:

- Pre-Requisite: Streets lights are to avoid light pollution, ensuring that lightening fixtures are running by solar panels. Check the BUG light rating
- Option 1: Street Lightening: Solar Panels and LED lights (2 points)
 - 1 point is for including standalone centralized solar panels without using LED Lights
 - 2 points are for including the solar panels while also using LED lights which have several advantages over conventional lights.
- Option 2: Undercover car parking system with the installment of PV cells on the shades (2 points)
 - 2 points is for linking the PV cells to the main street energy banking/ storage system that shall light the street lights.

Landscaping:

- Option 1: Usage of native/ local plants that provide a better look and less consumption of water (2 points)
 - The usage of lots of trees at the sides of the trees, parks and in different locations within the community to act as shades and to purify the outdoor air as well. In addition to using local plants that are of less cost than imported plants while consuming less amount of water.

- Option 2: Irrigation system is to be linked with treated waste water networking (2 points)
 - 2 points are divided in between the grey water system and black water system treatments while also encouraging re-using treated water in the irrigation of parks and sides of the streets. which consumes a massive amount of water.

Advantages of LEDs over conventional lights

1. Life time: LEDs can last up to 50,000 ours, in comparison with 10,000 hours for fluorescent
2. Cost Savings: Although the initial cost of LEDs is 2-3 times higher however fewer lamp replacement due to the longer life time will lead to long term cost savings.
3. Energy Consumption: LEDs consume less power than conventional light sources.
4. Maintenance: Due to the longer lifespan of LEDs have minimum maintenance and replacement times.
5. Higher color rendering: LEDs have higher color rendering than High pressure sodium, which improves the visibility, safety and the sense of well-being. This will also help in providing clearer and better quality camera images.
6. Environmental Impact: LEDs are completely safe and do not contain poisonous materials, like some other lights including lead.

Figure 14 shows a comparison between the commonly used Incandescent types of bulbs which have higher running costs (Rs. (Indian Rupee) of 840 which is equivalent to 98.3 EGP/ Year, which is almost 3 times that of CFL and 6 and half times that of LED . In addition to consuming the same ratios in energy; making incandescent types of bulbs be less efficient than CFL and LED even though the three types of bulbs have the same brightness levels. Not only has that, but also incandescent have 50 timed **less** lifetime than LEDs.

In conclusion, the most commonly used types of bulbs are not efficient in terms of energy and long term costs; even though incandescent might be cheaper to buy. However they will require 50 x change of bulb over the same time span of CFL and LED leading to a higher long term cost

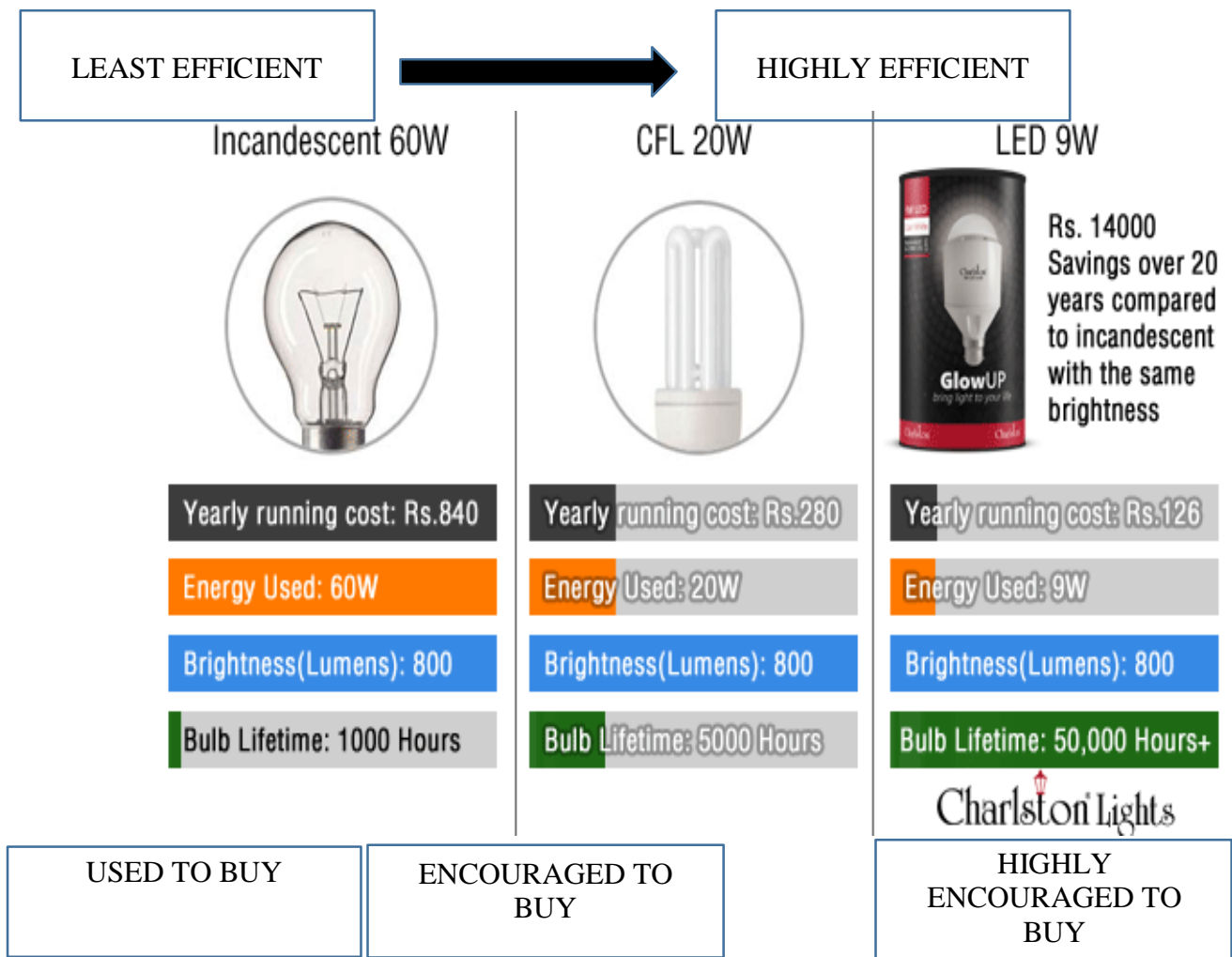


Figure 14: Comparison between Different Types of Bulbs (Charlston Lights, 2013)

E02: Cr.2. Waste Water Management (10 credits)

Focusing more on water which is almost the second major environmental concern after energy, this section shall provide guidelines on implementing a novel approach of reaching **zero net water** via grey and black water reusing.

Requirements:

- Pre-Requisite: Waste Water Management Plan
- Option 1: Grey Water Treatment Facility (3 points)
 - 3 points are divided for providing a grey water treatment facility waste water management plan, in addition to including treatment process, storage tank and proper non-pollution treatment processes. Lastly, ensuring that the grey water treatment follows cradle-to-cradle closed loop approach.
- Option 2: Municipal Waste Water Treatment for irrigation (3 points)
 - 3 points are divided for providing a municipal water treatment facility waste water management plan, in addition to including treatment process, storage tank and proper non-pollution treatment processes. Lastly, ensuring that the grey water treatment follows cradle-to-cradle closed loop approach.
- Option 3: Rain Water Collection/ Treatment Facility (3 points)
 - 3 points are divided for including rain water drainage systems at the side of the road while being linked to the main grey water treatment facility. In addition to, ensuring that the rain water collection treatment facility follows cradle-to-cradle closed loop approach.
- Option 4: Replace water usage by on-site treated waste water for flushing (1 point)

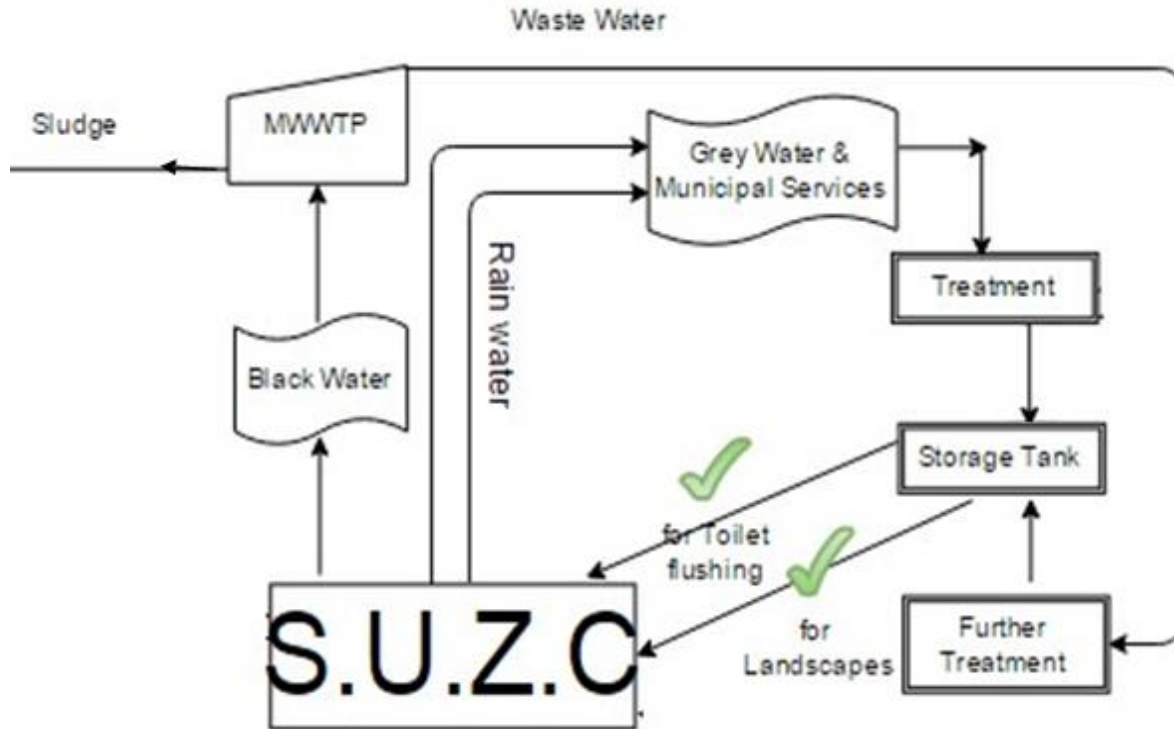


Figure 15: S.U.Z.C Net Zero Waste Water Flowchart

Figure 15 illustrates how the on-community water will be utilized in a flowchart format. Starting with the black water from the sewage system that will pass through a municipal waste water treatment plant (MWWTP) to be treated to produce sludge which will be used in the solid waste co-composting step, to be explained later in the next section. Rain water collected from the side of the streets, grey water collected from the community buildings and other municipal services like street washing collected water with chemicals are to be treated and sent to a storage tank for community reusing in landscapes; while going through further treatment for toilet flushing. By this, cradle to cradle concept in achieving net zero waste water has been achieved.

E03: Cr.3. Solid Waste Management (10 credits)

As waste is the major environmental concern due to its massive amounts accumulation and different types of wastes buildup; this section will implement another novel approach strategy of reaching **zero waste** regardless the type of waste either solid, liquid, landscape or construction and demolition.

Requirements:

The availability of the following points On-site:

- Pre-Requisite: Solid Waste Management Plan
- Option 1: Proper waste collection methods (1 point)
 - Including different types of trash bins all over the community for different waste sorting methods.
- Option 2: Storage, Collection and Availability for Waste Collection Center/s (Transfer Station) (2 points)
 - 2 points are for designing and including waste collection centers within the community while ensuring that cradle-to-cradle concept is being applied.
- Option 3: On-site eco-processing-facilities (2 points)
 - 2 points are for designing and including eco-processing facilities within the community while ensuring that cradle-to-cradle concept is being applied.
- Option 4: Following the **zero waste concept** in waste management (3 points)
 - 3 points are divided based on studying the zero waste concept which is a novel approach within the community waste management design based on different types of wastes.

- Option 5: Landscape, yard and green areas waste management (2 points)
 - 2 points are for including landscape, yard and green waste which require co-composting producing organic fertilizers that are being reused again in the community following cradle-to-cradle approach.

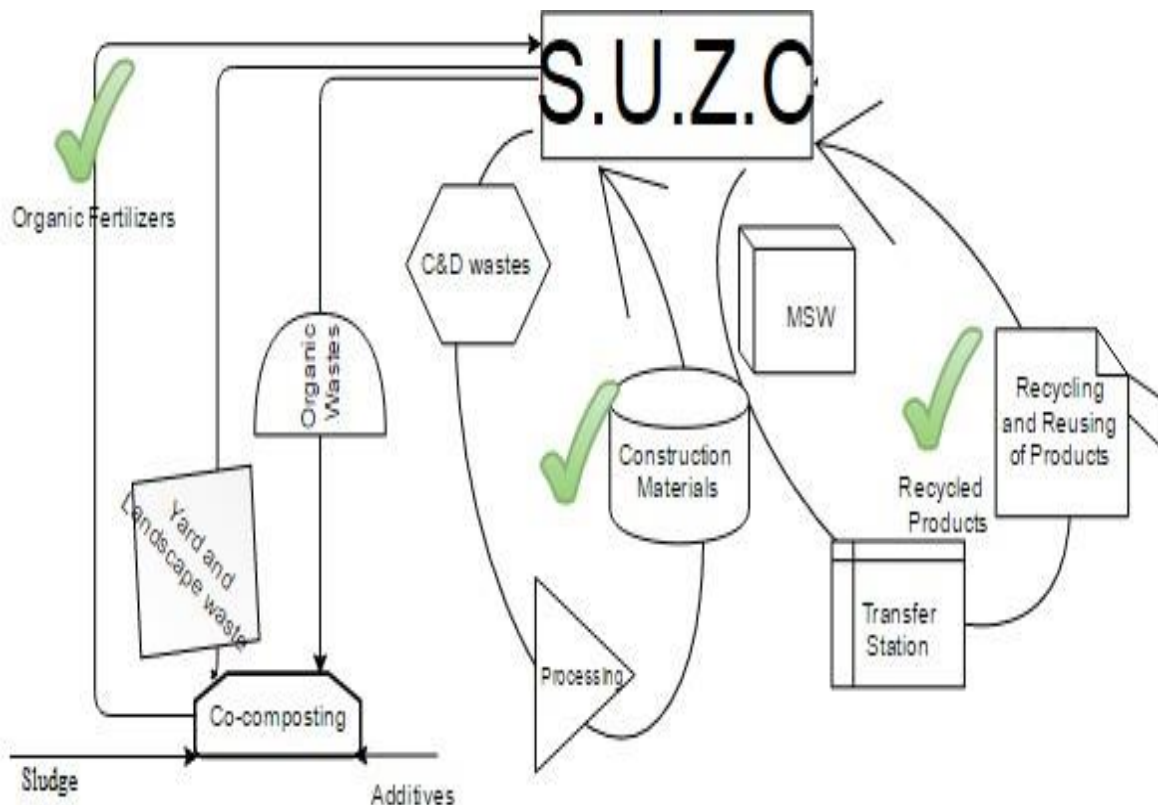


Figure 16: S.U.Z.C. Zero Solid Waste Management Flowchart

Figure 16 illustrated the solid waste management flowchart within the community in three closed cycles, starting with the municipal solid waste (MSW). MSW is the trash collected from the community in different formats either paper, glass and plastics. which will be sent to a transfer station via collection trucks. In the transfer station the wastes will be sorted separating each type of waste aside and then checking and applying reusing and recycling methods as needed so as the new products are being sent again to the community for usage.

The second cycle is about construction and demolition (C&D) wastes that are collected and processed to reproduce construction materials that can be used in the community street asphalts and pavement interlocks.

The third and last cycle is that of organic wastes collected from the community buildings in addition to the yard and landscape wastes collected from local food production farms and parks; they all shall undergo co-composting process while using the sludge produced from the treated black water stated previously, producing organic fertilizers that are sent to the community to be used for organic food production and parks muds since organic fertilizers are known for being rich in carbon content thus they are environmentally friendly to use rather than chemical fertilizers.

E04: Cr.4. Materials Selection Management (8 credits)

As material selection is important in studying, first to be familiar with the material itself and encourage using recycled ones to preserve the natural resources as sustainability aims at. Second to encourage the usage of regional or local materials and hence further enhance the economic standard of the community. Lastly, to be informative about the SRI materials usage that ensures better heat island reduction efficiency and thus better energy management.

Requirements:

- Option 1: Recycling Contents (2-4 Points)
 - 2 points is for 20% recycling content
 - 3 points is for 40% recycling content
 - 4 points is for more than 40% recycling content
- Option 2: Regional Materials (Locally Made) (1-2 points)
 - 1 point is for regional materials within 500 KM range
 - 2 points are for regional materials 100-200 KM range

- Option 3: SRI materials (2 points)
 - 2 points are for including properly selected SRI materials either for waste collection or storage techniques or for waste management methods.

E05: Cr.5. Outdoor Environmental Quality (8 credits)

As the concern is about a community and not just a building, thus the community's outdoor air quality is much more important than indoors. This section touches that under one of the points that pollutes the surrounding air which is smoking and the other one is the chance of odors or smells resulting from unclean or badly treated water used for irrigation. Lastly, visual pollution which might arise from blocking streets or roads for any construction or demolition activity that might produce dust or pollutants disturbing the surrounding air quality.

Requirements:

- Option 1: Smoking allowance in open air areas (2 points)
 - 2 points are for identifying proper smoking areas that shall be defined at specific distance from buildings. While also preferring that the smoking area is surrounded by green areas for better outdoor air purification.
- Option 2: Waste water quality for irrigation (2 points)
 - 1 point is for linking this point with energy management
 - 1 point is for ensuring clean and high water quality
- Option 3: Visual Pollution (2 points)
 - 1 point is for proper avoidance plan to any construction or demolition pollution mode.
 - 1 point is for ensuring occupants' safety

3.6.3. Green Team (20 Credits)

Being a newly proposed hand of help within the community and acting like the communication tool between the community owners and the community occupants'; the presence of the green team members is very essential in ensuring that the community objective is being met while having two way communication method for better link between owners and occupant's and further living comfort.

This section shall describe all about the green team focus from two main perspectives, one is the preventive and corrective maintenance and the other is the community interaction methods.



Figure 17: Green Team Illustrative Diagram

One of the added features in the S.U.Z.C. is the introduction of the Green Team, shown in figure 17, which aims at having one permanent team and office which will serve as the community point of help and knowledge builder. This team is divided into two main sections, one is for the preventive and corrective maintenance team and the other is for the community interaction. This shall have members spread all over the community sharing sustainable manners, acts and traditions in line with the community main aims and targets. Ensuring that citizens within the community are familiar with their expected roles towards the

surrounding community and thus the surrounding environment as it serves. The green team will be holding on-going social activities through innovation competitions, workshops, training sessions and on-community tours. In addition to holding awareness programs that aims at teaching and sharing knowledge with the community members and owners on the on-going sustainable activities, competitions and achievements done so far. And lastly, being the one identified hand of help and link between community owners and all of the community citizens which facilitates the communication and outreaching when needed.

Table 5: Green Team Division (20 Credits)

Green Team			
G01	Cr.1	Education/ Awareness	6 Credits
G02	Cr.2	Champion/ Expert	2 Credits
G03	Cr.3	Innovation	8 Credits
G04	Cr.4	Preventive & Corrective Maintenance	4 Credits

G01: Education (6 Credits):

Education within the community acts like tools of delivering information and receiving feedbacks and suggestions from the community members. Education includes but is not limited to awareness programs, workshops, competitions and educational sessions.

Requirement:

- Pre-Requisite: Awareness programs, Workshops and competitions
- Option 1: Sportive Competitions (2 points)
 - 1 point is for accounting for different competition types like sportive and innovative, encouraging all ages and genders & 1 point is for planning a motivational reward
- Option 2: Different and diverse Awareness modes as Community on-going electronic Magazine and on the shuttle buses (2 points)
- Education sessions on Penalty and Rewards (2 points)
 - 1 point is for penalty section another point is for rewards section.

G02: Champion/ Expert (2 Credits)

The champion is a person who is dedicated to professionally educating other green team members and community members about the needs, expectations, activities, innovations and awareness programs ideas. In addition to ensuring that everything within the community is being efficiently applied and abided to by all members.

The champion should have several characteristics like educational or teaching skills to deliver the needed messages, informative, technically knowledgeable, creative, supportive and ethical.

Requirement:

- Champion/ Expert:
 - Option 1: Delegated for monitoring on-community activities, educational sessions, penalties and rewards (1 point)
 - Option 2: Delegated for green team members training for extended hand of support within the community (1 point)

G03: Innovation (8 Credits)

Innovation is the act of bringing thought-of-impossible thoughts into a successful reality by opening room for creativity. Encouraging innovation within the community is very important so as to ensure that all members are involved and communicating while also being open to new ideas that ensures that the society development is as needed.

Requirement:

- Pre-Requisite: Encourage innovative workshops and competitions
- Option 1: Apply “Activity or Event for a cause” of raising money to award the winning innovative person (2 points)

- Points are accounted for diversifying the activity or events types to cover innovative ideas that abide to the sustainable points within the community. In addition to accounting for a raising money cause for community contribution.
- Option 2: Innovation for Energy Savings (2 points)
 - 2 points are for proper innovation idea that serves the community while being at a decent cost decent and better efficiency output.
- Option 3: Innovation for Water Management (2 points)
 - 2 points are for proper innovation idea that serves the community while being at a decent cost decent and better efficiency output.
- Option 4: Innovation for waste management (2 points)
 - 2 points are for proper innovation idea that serves the community for both/either solid and/or liquid waste, while being at a decent cost decent and better efficiency output.

G04. Preventive & Corrective Maintenance (4 Credits)

Including energy efficient tools, waste water management and waste management equipment within the community and other similar utensils and appliances within the buildings is of high cost. Thus preventing any damages or leakages for instances by applying the needed check-up maintenance and corresponding corrective maintenance in case of any particle failure is high recommended. This acts at serving the community for further energy efficient, water management and control methods.

Requirement:

- Option 1: Being available for any maintenance emergency (1 point)
- Option 2: Having a mechanical and electrical maintenance planning sheet (2 points)
 - 1 point is for mechanical
 - 1 point is for electrical
- Option 3: Conducting weekly performance assessment sheets (1 point)

3.7. S.U.Z.C. PROPOSED GUIDELINES FOR OWNERS

As the community includes the community owners themselves and other external owners for either residential or commercial buildings; thus clear guidelines and defined paths of actions should be defined to have a common ground of expectations between different owners to meet the main community objective and applied efforts.

Table 6: S.U.Z.C Owners Commitment

OW.01	In-community building construction design scheme Guidelines
OW.02	In-Community Restaurants and Cafés Efficiency and Guidelines
OW.03	In-Community Schools Guidelines
OW.04	In-Community Shopping Malls Efficiency and Guidelines
OW.05	In-Community Mosque and/or Church Guidelines
OW.06	In-Community Hospital Guidelines

This section discusses all of the expectations from different types of owners, as shown in table6; either residential or commercial/ business like those for on-community restaurants and cafés, schools, shopping malls, worship areas and hospitals. There are core commitments which are highly preferable for the owner to follow; and they are rewarded by 20% discount on operational costs. In addition to electives which are optional for owners; however if partially or fully met there will be corresponding further discounts than can reach up to additional 40% off

Intend:

Ensuring that buildings owners, either residential or commercial, are following the community standards and guidelines fulfilling the need of implementing a sustainable urban community.

There are Core points which are highly encouraged to abide to; being rewarded at 20% operational cost discount. In addition to Elective points which will be favored if any/all could be applied. Yet receiving further operational cost discounts depending on the number of achieve elective points.

Requirement:

- * Learning more about the Green Building implemented within the community
- * Learning more about the community building pre-requisites that are a must to be applied in order to avoid penalties

Core Points:

1- Traffic and Parking Management Plan like:

- a. Including walkability lanes
- b. Containing parking areas for disabled people
- c. Having a lane for ambulance or fire fighting
- d. Taking into consideration bicycle and motorcycle lanes/stands

2- Waste Water Management Plan like:

- a. Like separating grey water from black water
- b. Using treated grey water for flushing
- c. Using treated waste water for irrigation

3- Solid Waste Management Plan like:

- a. Trash bins for different types of wastes like organic food, paper, plastics and glass.
- b. Collection Trucks

4- Efficient Land Usage Plan like:

- a. The building design should incorporate green areas around
- b. The building design should incorporate different parking types as mentioned above

5- Pollution Prevention and Control Plan like:

- a. The presence of fences and warning signs should be available around the under construction site
- b. Air, waste and water pollution prevention methods are to be accounted for during construction

OW.01. In- Community Building Construction Design Scheme Guidelines:

This section is for any type of building construction within the community, either residential or commercial.

Following the “Energy Efficient Building Guidelines for the MENA Region, 2015
& “Buildings guide for consultants- Estidama Pearl Building

Elective Points “in addition to the section core points”:

1. Building passive design approach
2. Orientation, Form, Typology and design
3. Landscaping design and Roof construction design to decrease the cooling load
4. Ventilation either wind ventilation or natural air ventilation
5. Thermal Comfort, solar heat gain, shading, glazing and Thermal Zoning is the building location in terms of solar radiation

OW. 02. In-Community Restaurants and Cafés Guidelines:

This section is for restaurants and cafés either in park or in shopping malls.

Elective Points “in addition to the section core points”:

1. Using Electronic menus
2. Ensuring a healthy environment

3. Sustainable Restaurant services and tables using recyclable materials
4. Encouraging more LOCAL ORGANIC FOOD
5. On-Community Food delivery is encouraged to be done via Bicycle

OW. 03. In-Community Schools Guidelines:

This section is for schools that are built within the community, one of the main aims is to link education program with sustainable on-community activity and awareness messages.

Inspired by the UNESCO and Environmental Education, in Appendix III under Madinaty British School- Green Building:

Elective Points “in addition to the section core points & the School orientation and massing “Similar to the building massing and orientation in the previous section”

1. Innovative and Challenging learning environment
2. Green Activities and workshops like Earth Day and Planting Day
3. Teaching can be done on projectors rather than white boards
4. The usage of online learning tools rather than using notebooks

OW. 04. In-Community Shopping Malls Guidelines:

This section is for the shopping malls being constructed within the community.

Inspired by “Inside Eco-friendly shopping Malls”. 2014.

Elective Points “in addition to the section core points & the shopping mall orientation and massing “similar to the building massing and orientation in the previous section:

1. Shopping mall orientation is to follow the building orientation guidelines in the previous section
2. Reliance on sunlight for natural daylight and warming in winter → Energy Savings
3. The usage of re-using the customer bags else offering Bio-Degradable shopping bags
4. Noise Pollution Management
5. In-front of the mall traffic and street congestion management

OW. 05. In-Community Mosque and/or Church Guidelines:

This section is for worship areas within the community, briefly mentioned in Appendix III under Madinaty- Mosque- Green Building.

Elective Points “in addition to the section core points & the Worship Building orientation and massing “similar to the building massing and orientation in the previous section:

1. Worship buildings are to use energy produced from solar panels
2. Increase of green areas around the worship place, it can be used in prayer times when needed
3. Material Selection Property like SRI
4. Individual grey water treatment plan, if possible
5. Prior notice to the surrounding buildings about any noise pollution arising from religious occasions trends.

OW. 06. In-Community Hospitals Guidelines:

This section is for hospitals and emergency areas within the community.
To be inspired and followed with reference to “Sustainable Design Guidelines for Hospitals and Outpatient Facilities”, 2013.

Elective Points “in addition to the section core points & the Hospital orientation and massing “Similar to the building massing and orientation in the previous section

1. Indoor Ventilation is to follow Standard ASHRAE 62.1-2013: Ventilation for Acceptable Indoor Air Quality c. and ANSI/ASHRAE/ASHE 170: Ventilation of Health Care Facilities
2. Mechanical Ventilation is to follow the ventilation procedure in ASHRAE 62.1
3. Waste sorting is highly recommended labelling the type of waste i.e. hazardous
4. The increase of green areas within and surrounding the hospital
5. Parking management based on emergency parking and visitors parking

3.8. COMMUNITY RATING SYSTEM

As part of the proposed guidelines, a rating system was developed to reflect the progress of reaching the needed community vision and requirements as per the objective. The rating system is divided into two sections, one is for the community owners themselves which is categorized as Bronze for more than 40 points of credits achieved, Silver for more than 50 points of credits achieved, Gold for more than 60 points of credits achieved and Platinum for more than 80 points of credits achieved and this reflects how far or close is the developed urban community to the designed objective as shown in table 7.

Table 7: S.U.Z.C. Rating System - For the Community

	Bronze	> 40 Points
	Silver	> 50 Points
	Gold	> 60 Points
	Platinum	> 80 Points

The second part of the rating system is focused on the residential buildings and commercial businesses owners. Having several pre-requisites proposed to them in addition to some points that are optional to be achieved yet favored and encouraged for a further sustainable urban zero pollution community. Abiding to the pre-requisites depending on the owner type of building (commercial or residential), will ensure that the owner receives 20% reduction on the operational cost for starters. And this is to encourage owners to apply the pre-requisites and be more enthusiastic about achieving further needs; on the other side, if the owner did not abide to the pre-requisites then 100% operational cost

should be paid as a penalty. Encouraging owners to further abide to the proposed extra tasks or points as per each section will be rewarded by extra operation cost (O.C.) reduction, which can go down to 65% reduction as a maximum. For example achieving 20% of the additional mentioned points under each category will ensure the owner receives further 10% Reduction on O.C. Achieving 50% of the additional mentioned points under each category is equivalent to 20% further reduction on O.C., 75% is 30% further reduction on O.C. and lastly achieving 100% is 40% further reduction on O.C.. Leaving room for innovative ideas while also encouraging them for more sustainable activities and environmental commitment will result in additional 5% reduction on O.C. as shown in table 8.

Table 8: S.U.Z.C Rating System- For the Owners

Abiding to the core points	20% reduction on operational cost
Achieving 20% of the elective points under the corresponding category	Further 10% on the addition cost
Achieving 50% of the elective points under the corresponding category	Further 20% on the addition cost
Achieving 75% of the elective points under the corresponding category	Further 30% on the addition cost
Achieving 100% of the elective points under the corresponding category	Further 40% on the addition cost
Introducing innovative ideas	Further 5% on the addition cost
Maximum Total Reduction	65%

This all shall serve as an encouraging return back benefit to both the community, which ensures that its aim is being met, and by business and residential buildings owners, who get a sense of appreciation towards their commitment and extended improvements.

CHAPTER 4: COMPARATIVE ANALYSIS WITH LEED-ND

4.1. INTRODUCTION

Leadership in Energy and Environmental Design (LEED) is a global U.S. rating system that is being used worldwide. LEED was introduced in early 2000 aiming at providing different levels of certification for green buildings which can be achieved by gaining points for the project as it abides to LEED projects prerequisites. And according to the specified earned points, a project can earn one of the four rating levels which are certified, Silver, Gold or platinum which is the highest number of points earned. The certified rating level means that the project has earned 40-49 points while Silver means that it has earned 50-59 points, Gold is 60-79 points and lastly Platinum is 80 points or more (Environment Writings, 2015). The credits and the prerequisites differ from one project type to another as specified by LEED for instance, there is LEED for building design and construction, LEED for building operations and maintenance, LEED for interior design and construction, LEED for Homes and lastly, LEED for neighborhood development (LEED-ND) which will be the main focus of this section (U.S.G.B.C., 2015 a).

4.1.1. Importance of LEED

As it is defined as a rating system aiming for a green building construction and certification thus working and encouraging towards a green environment meaning a healthier living, more productive places, using energy efficient resources, water management, waste management that are all leading to a pollution less, stress-less environment, innovation and materials savings (U.S.G.B.C., 2015 b)

4.1.2. History of LEED

In 1993, U.S. Green Building Council was established. It aimed at promoting sustainability for industries and buildings. And this was the rise of LEED which was introduced by the Natural Resources Defense Council. The committee at that time was composed of non-profit organizations, builders, designers and governmental agencies. In 1996, Technical committee for LEED was established

During 1994-2006, LEED has been modified from only focusing on new construction standards to a comprehensive development and construction process system. In addition to the noticeable increase in number of volunteers and committees from 6 volunteers in 20 committees to 200 one in 20 committees and 200 professional staff members. From 2006-on wards LEED system introduced official guidelines for other project types as specified. (Environment Writings, 2015)

4.1.3. LEED Facts (U.S.G.B.C., 2013)

As per the U.S.G.B.C, there are 4 main facts about LEED certification summarized under better efficiency, lower energy consumption, materials management and reusing or recycling. Lastly the conclusion is that healthy and efficient environments do go in line with raising the economy standards, as discussed below.

I. LEED Buildings Performance; as per a study held by the U.S. General Services, Department of Energy in 2011 showed that 4 LEED certified buildings were proven to have lower energy consumption by almost 25% when compared to non-LEED certified buildings and this was supported by a report study held by the White House Office of Management and Budget that buildings energy efficiency is highly needed yet as the initial cost being invested might be high however there is a payback period by saving millions of dollars from energy costs over the project life time.

II. Developers started to choose to build better buildings as specified by LEED; as LEED has been proven to provide better projects and buildings benefiting the owners, the operators and the inhabitants by providing a better living environment with a financial savings to the owners as specified thus more developers are choosing to build their building following LEED certification process that implies leadership, innovation and responsibility towards the environment and the society.

III. Materials and water efficiency credits offer benefits to both building occupants and the environment; most of the LEED credits are being achieved either for recycling contents for both materials and water, other credits are for sourcing materials that are being harvested in a short distance i.e. 500 miles thus supporting local economy and lessening the transportation and environmental impact.

IV. A healthy environment and a strong economy can go HAND IN HAND; as mentioned by the U.S.G.B.C. that LEED and U.S.G.B.C's programs are driving the industry to a sustainable green transformation while LEED is the major driving role as it leads buildings to save energy, reduce water, energy and used sources, saving money and creating more job opportunities.

4.2. LEED FOR NEIGHBORHOOD DEVELOPMENT (LEED-ND)

As LEED started by certifying a building then set of buildings then commercial offices, so LEED has grown to certify a full neighborhood. A neighborhood is a place with special characters like a living standard, work, social life full of communication and activities and Fun part; so it is not just a bounded land set on the map as it is an endless foundation of living standards being a self-sufficient small community that is no more than 2000 citizen.

With all the activities within a neighborhood and the never stopping demand of citizens, thus resources will be abused to meet the needs and this will lead to more wastes generation, unbalance in the eco-system and jeopardizing the living of the current people and the future generation who may not find any available resources by then. Thus there is a need to consider sustainable neighborhood which implies efficient resources usages, efficient life style and providing a higher degree of social level, high sense of places living and high environmental standards.

Mentioning the need for a sustainable neighborhood means there should be a rating system and strategies set so as to guide the construction of such neighborhood and acknowledging the corresponding rating level as a reward in return and this is where LEED for Neighborhood Development (LEED-ND) takes place.

LEED-ND is a rating system that is applied to new land development projects or redevelopment projects and it contains residential uses, nonresidential uses, or a mix usage buildings as well as the overall infrastructure like roads, transportation and bridges. and safety of the neighborhood area. It aims at improving the neighborhood by focusing on reducing vehicle trips and vehicle distance traveled in addition to, encouraging daily physical activity associated with walking and bicycling while ensuring green buildings are being constructed that will all benefit People, Planet and have a paid back Profit.

4.2.1. LEED-ND rating system divisions

LEED-ND rating system has 3 main strategies holding most of the credits known as smart location and linkage (5 pre-requisites and 27 points) and it briefly guides on where to build. Then Neighborhood pattern and design (3 pre-requisites and 44 points) and it briefly guides on what to build. Lastly, Green Infrastructure and Buildings (4 pre-requisites and 29 points) and it briefly advices on how to manage environmental impacts (U.S.G.B.C, c, 2015).

I. Smart Location and Linkage (SLL)

SLL briefly defines where to build your neighborhood. It is encouraging the neighborhood development within a nearby existing community and this is to reduce the distance travelled between neighborhoods in line with encouraging the redevelopment of already existing towns and neighborhood areas. (U.S.G.B.C., d, 2015).

Several requirements are needed as per LEED-ND to establish a new neighborhood like having a ND Plan and the **plan** should be illustrative about how the site will be serviced with water and wastewater infrastructure, is it going to provide new designs for its own or will it join for a nearby publically owned and planned water and wastewater service areas. Also, the project should demonstrate the transit service defining the minimum and

maximum daily transit services for weekdays and weekends; the transit service includes buses, rail services, vehicles and any other transportation method that is set in the neighborhood plan.

A smart location means that no long driving distances are req., gather work, public buildings, dwellings, shops and any entertaining areas so as to ensure that the need for driving is very minimal and in parallel, walking areas with more greenery sight should be constructed in line with the bicycling lanes so as to encourage walking or cycling instead of driving. In addition to that a smart location should be placed in an area where residents will not be prone to any health risks, restore polluted sites and preserve the natural resources, aquamarine life and agricultural lands.

II. Neighborhood Pattern and Design (NPD)

NPD guides on what should be built within the neighborhood, a compact neighborhood means that there is an efficient usage of the land while taking into consideration that everything should be designed as much as possible to be in a walking or bicycling distance. Also working with diversity for instance including different type and size of dwelling within a neighborhood blending work with shops and schools so as to have a diverse neighborhood. In addition to that, there should be properly constructed parking areas and safe streets with reduced traffics as well as increasing the available green areas like parks, gardens, public community spaces and playing grounds so as to have a healthy and more sustainable environment. (U.S.G.B.C., d, 2015),

LEED-ND has specified prerequisites for the NPD like the walkable streets which should be available and designed in a manner that suits all seasons, provides comfort and entertainment along with safety for users. Walkable streets should be available all through the neighborhood even connecting routes together. Another prerequisite is the compact development to conserve lands while promoting walkability, efficient transportation and livability. Also, the mixed use neighborhood community prerequisite which states that the neighborhood should be located within a 400 meter walking distance to other areas. And if there is a rail system to be used to facilitate transportation and decrease the number of vehicles used then a proper engineering design should be provided along with the neighborhood plan. Another major credit for NPD is the Housing types and Affordability

which is promoting equitable and interactive neighborhood household sizes with a wide economic level range community (U.S.G.B.C., d, 2015).

Also, the houses should be affordable to all citizens either it is a rental or a for sale dwelling. According to the number of rented or sold units the points will be assigned for instance the higher the rented or sold, the higher the assigned point to be maximum of 3 and the least is 1.

Another point in NPD credit is Transportation and demand management which specifies how to reduce pollution and energy consumption from transportation modes and the options specified by LEED-ND. Transit passes for project occupants, making buses, shuttles and vans available for transportations, opening eyes on the option of vehicle pooling or sharing. In addition to that depending on the distance to be travelled for instance if it is a walkable distance and the passenger cannot walk it still so one vehicle should be the transportation mode in a vehicle shared program.

Last but not least is Community outreach and involvement point which insights on engaging the community in several ways that shall start from the design and the construction phase between the community and the developer/designer till workshops for inhabitants to enhance participation and group work.

III. Green Infrastructures and Buildings (GIB); discusses about how to manage any impacts occurring on the environment by designing the infrastructure with energy and water efficient, efficiently using materials while minimizing waste and pollution.

4.2.2. Minimum Energy Performance

Apart from building efficiency, LEED-ND is concerned about energy efficiency for the whole neighborhood in which several achievements are contributes to reaching it: (U.S.G.B.C., d, 2015),

- I. Layout and Solar Orientation; high lightening the possibility of using solar energy like PV (Photo Voltaic) cells or utilizing the usage of sun light system as a heating source for instance. This will depend on the building orientation, the design of the building and the density of buildings in a certain area or space.

II. Renewable Energy and Optimum Distribution System; checking for energy systems that can work on more than one building that are depending on producing power from the heat generated from earth; in which ground energy is known to be of a constant temperature no matter the season variation thus it could be used at all times; another example is a reservoir that will produce energy by driving generators and this is all known as the Geothermal Renewable Energy.

Another example of renewable energy is the Refused Derived Fuel (RDF) or Biomass which is a type of renewable fuel produced from either plastics, municipal wastes or tires being more efficient, less pollution causing and lessening the need of using a conventional fuel type and thus reducing greenhouse gas effects and conserving resources.

Other examples are Wind and Solar energies, in which wind energy works with moving air or wind power which will activate wind turbines which will generate electricity and thus converting kinetic energy into electrical energy. While the solar energy is relying on the sun radiation as a source of light and heat to warm building or water. PV cells can be used in this scenario in which they will directly convert the solar energy into electrical energy.

4.2.3. Water Efficiency

As energy efficiency is important, so as water efficiency where there is a need to improve it in a neighborhood by designing an integrated system. In other words waste water either grey water or black water should be treated to be reused for irrigation or back again into flushing. This process will lead to reducing energy usage, reduce wastewater pollution and reduce the need to use fresh water every time to either flush or irrigate. LEED-ND has specified that a neighborhood plan should retain minimum of 25% of the average project generated wastewater on-site and there should be an on-site treatment plant to treat the water to be reused at a specified level of purity and quality as per the local state regulations. The points will be divided into 1 point if the percentage of reused wastewater is 25% and 2 points if it is 50% (U.S.G.B.C., d, 2015)

A specific focus for LEED-ND in Water Efficiency credits is for the Indoor Water Use Reduction which implies on reducing the indoor water usage by 40% from baseline either it is from public lavatory or shower-head or toilet or even kitchen faucet. And the other divided focus is for the Outdoor Water Use Reduction for instance by reducing the needed water for a landscape irrigation by at least 30% or even showing that the landscape is designed for a minimal irrigation i.e. no need to install permanent irrigation system.

LEED-ND has also mentioned about the rainwater management which implies on reducing the rain runoff water while applying treatment processes to enhance the water quality for reusing and this shall be done maybe by constructing the roads in an engineered sense that the rain runoff water will be collected at the side of the road so as to prevent its accumulation along the road and increasing the risk of accidents; and then it shall be diverted through underground pipes to the on-site treatment system that shall return better water quality back for flushing or irrigation usages for instance.

Last but not least, GIB states about Building reuse which aims at enhancing the building efficiency and conserving resources by reusing older buildings maybe for instance don't demolish any historical building or alter the landscape culture however, modify the building for other usages.

4.2.4. Solid waste management (SWM)

SWM is another concern being covered under GIB in LEED-ND; it aims at reducing wastes from the resource and reducing wastes that are being disposed in the landfill. 50% of the collected wastes should be recycled or reused, there should also be a constructed waste management plan that specifies the amount of wastes generated within an area, how will the wastes be collected and stored if any, will it be on site? Also, there should be collecting bins available at each area and they should be color coded for different types of wastes. Also there should be an on-site transfer station and composting unit to ensure proper waste division, recycling or reusing or even environmentally friendly disposal instead of just dumping in a landfill.

4.3. COMPARATIVE ANALYSIS BETWEEN S.U.Z.C AND LEED-ND RATING

Since LEED rating system is the most commonly used in the U.S. and most referred to in the rest of the world however, it may not be so compatible to other developed and developing countries as it contains some rating credits on points that are only applicable in the U.S. Thus it was the main focus of this thesis research is to develop a rating system that is not only applicable for Middle East, Egypt and other countries, but also includes a novel approach implementation which is the Zero Pollution as discussed in Chapter 3 in this thesis.

Comparative analysis between the S.U.Z.C Guidelines and the LEED-ND rating system as per the below:

- Table 9. Compares between S.U.Z.C (Sustainable Site Management) and LEED-ND (Smart Location and Linkage). S.U.Z.C in this table has 2 pre-requisites which are traffic and parking management and efficient land usage. These 2 pre-requisites are a must for sustainable urban communities where traffic safety and reducing streets congestion by improper parking is essential in addition to ensuring efficient land use plan to prevent any misuse to the available Spaces. Lastly, for this table comparison, other elective points under streets management lanes, land usage, and parking management which are weighed by credits are compared with LEED-ND for the same base of focus; in addition to other added on points under this focus for S.U.Z.C. over LEED-ND.
- Table 10. Compares between S.U.Z.C (Community Streets and Parking Management Points of focus under the Sustainable Site Management Section carry on points) and LEED-ND (Neighborhood Pattern and Design). This table comparison is between a sub point within the S.U.Z.C. guidelines for Sustainable Site Management, named Community streets and Parking Management Plan and it is compared focusing on walking lanes and bicycle lanes which are not a common way of transportation in the developing countries. Thus it is important to include them

and compare them with LEED-ND; in addition to other added on points under this focus for S.U.Z.C. over LEED-ND.

- Table 11. Compares between S.U.Z.C. (Environmental Management) and LEED-ND (Green Infrastructure and Buildings). This table emphasizes the bigger weight inclusion in the S.U.Z.C guidelines on Environmental Management where the novel approach of zero pollution has been introduced, being of an added value on LEED-ND which focuses mainly on Green Buildings. This section also includes other added on points under this focus for S.U.Z.C. over LEED-ND.
- Table 12. Compares between S.U.Z.C. (innovation and Green Team) and LEED-ND (Innovation and Design Process & Regional Priority Credits). Green Team is another initiative within S.U.Z.C. guidelines in comparison with LEED-ND which add a Champion Role as an optional credit within the society. S.U.Z.C presents Green Team as a sustainable community necessity which includes a champion, however it focuses on education and awareness, encouraging innovation, penalties and rewards while also having an on-community preventive and corrective maintenance team being from the green team.

Tables 9.A to 9.D shows the comparison between LEED-ND and S.U.Z.C under the below points. Where the (N.A.) ones are those excluded from the proposed guidelines due to their less demand in the developing countries.

Table 9.A.: LEED-ND vs S.U.Z.C.

LEED-ND

S.U.Z.C

Smart Location & Linkage			28	Sustainable Site Management		36
				Pre-Requisite	Traffic and Parking Management	
				Pre-Requisite	Efficient Land Use	
Prereq	Smart Location	Req.	Present under sustainable landscape management concept			
Prereq	Imperiled Species and Ecological Communities	Req.	N.A.			
Prereq	Wetland and Water Body Conservation	Req.	N.A.			
Prereq	Agricultural Land Conservation	Req.	Present under model farms and local food production concept			
Prereq	Floodplain Avoidance	Req.	N.A.			
Credit	Preferred Locations	10	The Community was planned for construction in a favored place resembling the center of New Cairo as in the case study			
Credit	Brownfield Remediation	2	N.A.			
Credit	Access to Quality Transit	7	N.A.			
Credit	Bicycle Facilities	2	Present under the Street Management Section			
Credit	Housing and Jobs Proximity	3	Present in the community preliminary plan			
Credit	Steep Slope Protection	1	Present under the street network design			
Credit	Site Design for Habitat or Wetland and Water Body Conservation	1	N.A.			
Credit	Restoration of Habitat or Wetlands and Water Bodies	1	N.A.			
Credit	Long-Term Conservation Management of Habitat or Wetlands and Water Bodies	1	N.A.			

Additional points in S.U.Z.C. over LEED-ND under this section are:

1. Restaurants and/or cafés are encouraged to be integrated within the community parks
2. Children playing areas and family gathering seating's and areas
3. Indoor and Outdoor recreational facilities plan

Table 9 B: LEED-ND vs S.U.Z.C

LEED-ND

S.U.Z.C

Neighborhood Pattern & Design			41			Community Streets and Parking Management plan			24
Prereq	Walkable Streets	Required				Present under street lanes section			
Prereq	Compact Development	Required				Present under street network design			
Prereq	Connected and Open Community	Required				Present under street network design			
Credit	Walkable Streets	9				Already present under street lanes section with 2 credits			
Credit	Compact Development	6				Already Present under street network design with 2 credits			
Credit	Mixed-Use Neighborhoods	4				Not Counted as it is considered in the community main objective			
Credit	Housing Types and Affordability	7				Not Counted as it is considered in the community main objective			
Credit	Reduced Parking Footprint	1				Present under the Parking Management Section			
Credit	Connected and Open Community	2				Not Counted as it is considered in the community main objective			
Credit	Transit Facilities	1				Present under the transportation section			
Credit	Transportation Demand Management	2				N.A. as it is proposed to include shuttle buses and bicycles as alternative transportation from cars and walking			
Credit	Access to Civic & Public Space	1				Present under Sustainable Landscape Management			
Credit	Access to Recreation Facilities	1				Present under Sustainable Landscape Management			
Credit	Visitability and Universal Design	1				N.A.			
Credit	Community Outreach and Involvement	2				Present under the Green Team Section			
Credit	Local Food Production	1				Present under the Sustainable Landscape Management			
Credit	Tree-Lined and Shaded Streetscapes	2				Present under the Environmental Management/Landscaping section			
Credit	Neighborhood Schools	1				Present under the proposed facilities and buildings guidelines for owners			

Additional points in S.U.Z.C. over LEED-ND under this section are:

Other guidelines for worship areas, shopping malls, hospital and restaurants and cafés

1. Other guidelines for **Lanes for Bicycles**
2. Other guidelines for **Streets Cleaning**
3. Other guidelines for **Streets Cleaning**
4. Other guidelines for **Streets Safety- Push Buttons**
5. **Streets Heat Island Reduction Techniques**
6. **Full parking management plan alternatives for different usages like in front of homes, shopping malls and hospitals.**

Table 9.C. LEED-ND vs S.U.Z.C.

LEED-ND

S.U.Z.C

Green Infrastructure & Buildings			31	Environmental management	44
Prereq	Certified Green Building		Required	One building is considered in the guidelines as a model- Pre-Requisite#1 in Sustainable Site Management	
Prereq	Minimum Building Energy Performance		Required	Present under Energy Efficiency management plan	
Prereq	Indoor Water Use Reduction		Required	Present as a point under waste water management plan	
Prereq	Construction Activity Pollution Prevention		Required	N.A.	
Credit	Certified Green Buildings		5	Already considered, One building is considered in the guidelines as a model	
Credit	Optimize Building Energy Performance		2	Present under energy efficiency management plus having some examples applied in the on-community green building and also being taken into consideration for awareness under the green team section	
Credit	Indoor Water Use Reduction		1	Present as a point under waste water management plan	
Credit	Outdoor Water Use Reduction		2	Present as a point under waste water management plan	
Credit	Building Reuse		1	N.A.	
Credit	Historic Resource Preservation and Adaptive Reuse		2	N.A.	
Credit	Minimized Site Disturbance		1	Present as a point under the causes of noise disturbance like shopping malls and open recreational facilities	
Credit	Rainwater Management		4	Present as a point of rainwater collection under the waste water plan	
Credit	Heat Island Reduction		1	Present under the needed sections	
Credit	Solar Orientation		1	Present under the building orientation and massing guidelines for all types of on-community buildings	
Credit	Renewable Energy Production		3	Present under energy management section and as examples of the solar panels usage	
Credit	District Heating and Cooling		2	N.A.	
Credit	Infrastructure Energy Efficiency		1	N.A.	
Credit	Wastewater Management		2	Present	
Credit	Recycled and Reused Infrastructure		1	Present under materials management plan	
Credit	Solid Waste Management		1	Present under the solid waste management section for prevention	
Credit	Light Pollution Reduction		1	Present under the energy efficiency management section for prevention	

Additional points in S.U.Z.C. over LEED-ND under this section are:

1. Outdoor Environmental Quality Plan
2. Following Zero Pollution Concepts
3. The usage of Native plants
4. Encouraging recycling contents
5. Encouraging regional materials
6. On-community eco-processing facilities and transfer stations

Table 9 .D: LEED-ND vs S.U.Z.C.

<u>LEED-ND</u>		<u>S.U.Z.C</u>	
Innovation & Design Process		6	
Credit	Innovation	5	Present for all the community segments
Credit	LEED® Accredited Professional	1	Full Section with more focused scope named GREEN TEAM
Regional Priority Credits		4	
Credit	Regional Priority Credit: Region Defined	1	Local Products
Credit	Regional Priority Credit: Region Defined	1	Regional Materials
Credit	Regional Priority Credit: Region Defined	1	
Credit	Regional Priority Credit: Region Defined	1	Green Team

Additional point of S.U.Z.C. over LEED-ND under this section:

Green team is focused about **staff awareness, innovation, and champion, protective and corrective maintenance.**

4.3.1. LEED-ND Ratings vs. S.U.Z.C Rating Criteria Comparison

LEED-ND rating total score is 100, with 10 additional points on innovation and regional priority credits and it is certified as:

Bronze is for earning >40 points, Silver is for >50 points, Gold is for >60 points and Platinum is for >70

S.U.Z.C rating total score is 100, with the inclusion of 8 points under innovation alone as it is known to be the fundamental core of sustainable communities. S.U.Z.C guidelines are certified as:

For the Community rating: Bronze >40 points, Silver is for >50, Gold is for >60 and Platinum is for >80. **In addition to the owners rating evaluation and the corresponding operational costs discounts as discussed previously in the Chapter 3.**

4.3.2. LEED-ND vs S.U.Z.C Conclusion

As per the comparative analysis shown between the proposed guidelines for the S.U.Z.C and LEED-ND; there are several advantages of using the proposed rating system over LEED-ND starting with being simple, focused, understandable and inexpensive to follow with easiness and efficiency focus being the main drivers for it. While also being purposeful about energy, water, air, materials and habitat as mentioned in chapter 3 in this thesis. And this shall serve any developing country.

CHAPTER 5: MADINATY CASE STUDY- NEW CAIRO

5.1. INTRODUCTION

Madinaty, the city aiming for Perfection! It is a suburb working towards self-sustainability on a 33.6 million square meter land space. Being established in June 2006, having a unique design that is catering for meeting the present and the future needs in sustainable manners. Being designed for residential households on 27.6 million square meter while dedicating the remaining space for green areas/park in line with some dedicated services that shall be at Madinaty citizens as well as greater Cairo's assistance and enjoyment.

Overview:

1. Total Area: 33.6 million square
2. End of development estimated population: 600,000
3. Plan:
 - a. 68,575 apartments'
 - b. 6,124 villas
4. They can sell undeveloped lands to third parties not to exceed 40% of the total area for residential projects

Expectations: that land will be:

- I. sold to individuals as separate housing, plots
 - II. Some will be sold to developers for commercial projects like Hotels, commercial centers and Schools
5. Construction of Madinaty started in 2006 moving through 8 phases of construction with each 3-4 years in duration.
 6. Project started in July 2006 and expected to be completed by 2026.
 7. Construction cost is estimated to be 60 Billion to 70 Billion

5.2 MADINATY SCORE BASED ON S.U.Z.C. GUIDELINES

Madinaty- New Cairo case study is used to validate the proposed guidelines in terms of being easy to use, applicable, achievable and on top, to ensure that it utilizes the solid wastes and grey and black water within the community ensuring natural resources usage optimization.

Upon evaluating Madinaty, which is the case study for this thesis research, based on the proposed guidelines for the S.U.Z.C. it turned out to be at a Silver color rating category with total score of 52 achieved points out of 100 credits for the S.U.Z.C.

5.2.1. For the Community Pre-requisites

A) Green Building

As Madinaty is aiming towards sustainability, as the owners are aware of the need of having a green building constructed on site acting as a model for sustainable buildings. Thus, Madinaty is designing its BRITISH SCHOOL IN MADINATY and The Mosque to abide to the green building concept.

These two buildings already have solar cells implemented on the roofs to warm the water entering the Air Conditioning System as well as to warm the water in the toilet taps. While also encouraging the reliance on sun light during the morning time to light the interiors of the school and the mosque; and encouraging the usage of LED lights any other time of the day, only if needed. In addition to that, having the trash bin separators available in a nearby area that is easily recognizable to occupants. Lastly, accounting for parking areas as well as greeneries all around the mosque and the school.

B) Traffic and Parking Management

Madinaty traffic and parking management is under the design of several principals including, but not limited to, including identifying the pedestrian walking areas and the vehicle roads while

including the necessary signs and barriers. In addition to including trees on both sides of the roads for decorative requirement as well as reducing the heat island effect. Furthermore, including street signs and labels about the maximum speed, the neighborhood number, bumps, driving signs and any other needed awareness or driving advices.

For the parking, assigned places in front of the buildings and schools are identified in addition to having a short-time waiting area in some of the neighborhoods roads. This waiting area is mainly located near trash bins where the collection truck is expected to have its job done without causing any congestion in the street or for any waiting car; since the trash bins are located near buildings.

Since Madinaty is not fully established, thus traffic and parking management for under construction conditions are being taken into consideration. These circumstances are focused on preventing any public area from being blocked due to construction trucks or work while also providing alternative plans for any expected to block route due to construction, and this should be presented in the truck routes plans. In addition to, fences and barriers with line markers are expected to be placed at any pedestrian walking area, for safety.

C) Efficient Land Usage

For the efficient land usage, Madinaty has developed its plan while ensuring that the land is effectively and efficiently used preventing any buildings jamming. While also following building orientation and massing principles to ensure that occupants are exposed to optimum sun radiations. In addition to scaling the nearby parking lots and spaces to accommodate one car of each apartment within the building or parking spaces for schools and in front of the Mosque to accommodate the users. Lastly, the inclusion of green areas like trees and parks all over the community to act as shades, decorative icons, pollution cleaners and reduction of heat island effects.

5.2.2. Madinaty abiding to Environmental Management

A) Solid Waste Management

- **Underground** Trash Bins System by an Italian Company Named (Ecologia) shown in figures 18 & 19.
- The system works as follows:
 - Big trash bins are located underground properly covered by a land surface and a small entry trash bin is placed on the street ground, this is which the citizens will throw their trash into and it will fall into the bigger one underneath
 - For Stage P1: Trash bins are sectioned in: Organics, Plastics and Metals.



Figure 18: Trash Bins in P1 stage in Madinaty



Figure 19: Trash Bins in P1 stage in Madinaty

Other stages in Madinaty have been replaced by another trash bins German company (for cost reduction purposes), removing the Glass Trash bin (as Madinaty Management Team concluded that the amount of Glass being collected over time is so minimal to have a full underground trash bin for it)



Figure 20: Other Trash Bin Systems in Madinaty

Specific Trash Collecting cars, shown in figure 21 (supplied from the Italian Company) when the car is reaching the trash bin, it has a controller that sends a signal to the trash bin street flooring to open up, allowing the inner bigger bin to be escalated upwards from the underground level to the street surface level using **Batteries that are charged via solar cells.**

- Each car is specified for a specific trash type, and the number of bin emptying rounds differ from an area to another according to the number of citizens in that area.



Figure 21: Madinaty Trash Bin Collection trucks

During Maintenance, the trash bins system has to be opened and controlled manually using the devices shown in the below figure, which will be connected to the solar cell column, as shown in figure

22. It is wirelessly connected to the underground battery, and it can give one signal at a time for ONE trash bin opening at a time.

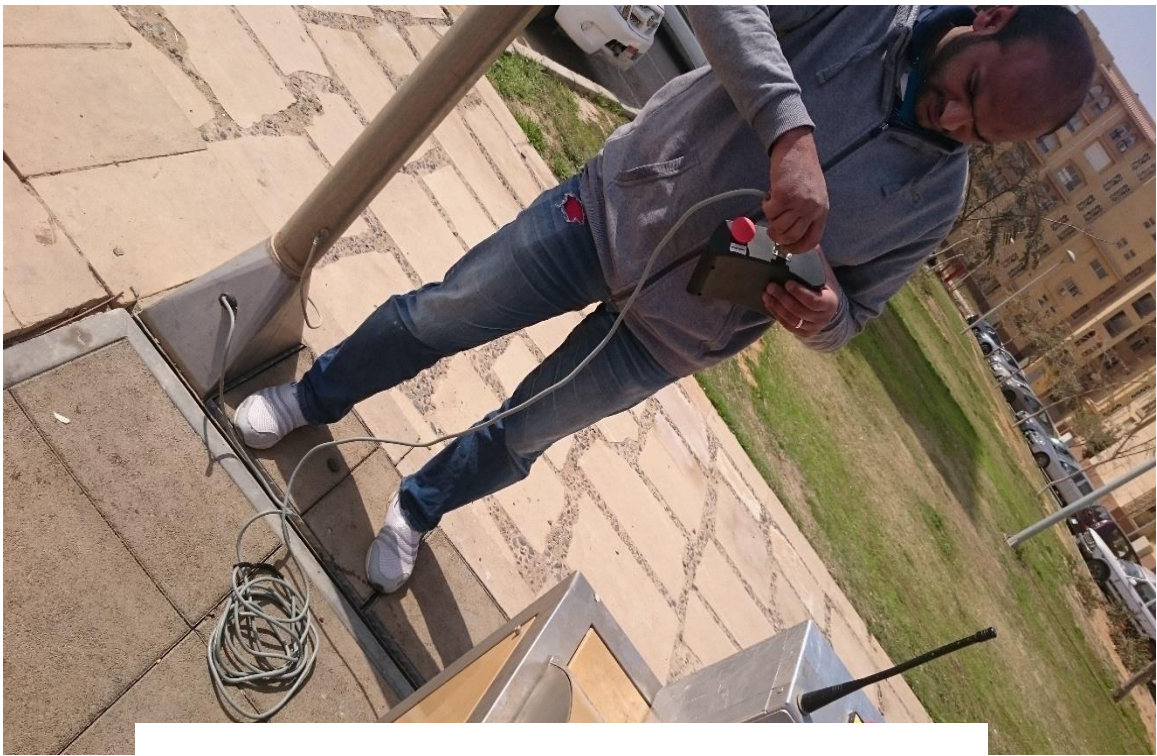


Figure 22: Madinaty Trash Bin Collection- During Maintenance

Main Points for the Solid Waste Management:

1. The waste segregation system starts within Homes and Villas. Citizens are asked to separate their wastes in trash bags colored in the same colors as the Trash bin codes.
 - a. Plastic & Metals → Blue
 - b. Organic Items → Light Green
 - c. Unsorted Wastes → Dark Yellow
 - It has to be thrown in the specified in front of building trash bins by any of the HOUSEHOLD PERSONS.
 - For Electronic Devices/ TVs' or even tires → Citizens are asked to place it in either a clear plastic bag or in a cardboard and locate it near the Trash bins. There is another specified car that keeps going around checking for such types of wastes for collection.

2. The Trash bins trucks has 2 employees in it (Driver and Assistant), and there are 3 specified trucks for each area (each number of buildings/villas).
 - a. It makes only 1 rotation per day, there are 3 trucks for each area, one for each type of wastes.
 - b. If it happens that one of the drivers is on a leave then any of the other two drivers has to take up his place. Thus he has to collect his own specified type of trash first, dump it in the land fill and then come back for another round to collected his absent colleague specified trash type, then dump it in the landfill.

Waste Water Treatment:

- The Toilet water to be treated for the Golf Area irrigation.
- The Temporarily constructed Water Treatment is designed for 15,000 Person.

However there is a plan to build a new big one serving 1.2 Million People.

- There are 3 Lines each with a tank of 1000 m3 capacity and at the back there is one tank (Tank#4) of 1000 m3 capacity still where the 3 other tanks pour the water into. This tank#4 is emptied 3 times a day, it has a float on the top of the water indicating if the tank is full to empty or not. And based on the current capacity this tank is emptied triple times per day. Figure 23 shows a sample for 2 tanks within the community.
- Cars do collect the water and take it for irrigation lands that do not have Automatic Irrigation System or sprinkles.
- **Drinking water/tab water is coming for a water line from El Sherouk.**

Madinaty Water Treatment System:



Figure 23: Madinaty- Water Storage Tanks

Step#1: Impurities Refinery:



Figure 24: Step#1: Impurities Refinery

Step#2: Sand Separation:



Figure 25: Step#2 Sand Separation Step#3: Irriation for Bacteria, with AIR DIFFUSERS



Figure 26: Step#3 Irriation for Bacteria, with AIR DIFFUSERS



Figure 27: Anaerobic container, nitrates is used to activated the bacteria



Figure 28: Grey Container Aerobic



Figure 29: Hydraulic to collect the sludge from the bottom of the container

Step#4: Chlorination:



Figure 30: Chlorine + Air Line to turn/stir the air

5.2.3. Madinaty Example on Energy Efficiency

- 1) Streets Solar Lightening Cells applied in several streets as shown in figure 31 and it is planned to convert all streets into solar lightening systems



Figure 31: Solar Cell Lightening System

5.3. MADINATY RATING BASED ON THE PROPOSED S.U.Z.C. GUIDELINES

Table 10: Proposed S.U.Z.C Guidelines vs Madinaty Rating

Y	N		Community Commitment	Possible Points	Madinaty Rating based on S.U.Z.C	
			3.6.1	Sustainable Landscape Management	36	
	x	S01	Pre-Requisite	Green Building		Planned to be Achieved
x		S02	Pre-Requisite	Traffic and Parking Management Plan		Planned to be Achieved
x		S03	Pre-Requisite	Efficient Land Use Plan		Planned to be Achieved
		S04	Cr.1	Open Areas/Parks, Model Farms and Local Food Production plan	6	2
x			Cr.1.1	children Playing area and/or family gathering area	2	2
	x		Cr.1.2	Restaurants and/or cafés	2	0
	x		Cr.1.3	Model farm and Local food production	2	0
		S05	Cr.2	Recreational Facilities Plan	6	2
x			Cr.2.1	Avoid Noise Pollution	2	0
	x		Cr.2.2	Outdoor recreational facility are to be independent or integrated with the community open parks	1==> 2	0
x			Cr.2.3	“Keeping Fit” corner to serve healthy food and drinks	2	2

Table 11: Proposed S.U.Z.C. Guidelines vs Madinaty Rating

Y	N	S06	Cr.3	Community Streets and parking management plan	24	Madinaty Rating	
			Cr.3.A	Transportation	6		
	x		Cr.3.A.1	Shaded shuttle buses waiting area	2	0	
	x		Cr.3.A.2	Shuttle buses are to account for removable ramp to be placed for any disabilities	2	0	
x			Cr.3.A.3	Alternative Transportation- Bicycle	2	2	
			Cr.3.B	Street Lanes	12		
	x		Cr.3.B.1	Street Networking Management- Lanes for Bicycles	2	0	
x			Cr.3.B.2	Street Networking Management- Walkability Pavements	2	2	
x			Cr.3.B.3	Streets network are to be designed as per the streets principals and guidelines of UAE	2	2	
							Reducing congestion, driving time and carbon footprint by interconnecting streets and blocks
x							Sheltered, protected and shaded pedestrian walking areas
							Pedestrian and vehicle curb division (pavement height and design)
x							Controlled Vehicle Speed
x							Street Elements Design
							Street Junction Design
x							Congestion Controlling Plans
x				Lanes Dimensions and Construction			
x				Streets cleaning are to take place during non-rush/non-congested hours	1	1	
	x			Streets safety- "push button" for pedestrians or cycles	1	0	

	x			Streets safety- "push button" for pedestrians or cycles	1	0
x				Streets Safety- Trash Bin on-the-pavement assigned place	1==>2	2
x				Streets heat island reduction Techniques	2	2
			Cr.3.C	Parking Management	6	
x			Cr.3.C.1	Traffic and Parking Management including disabled lane and a fire/ambulance lanes and bicycle stands.	Pre-Requisite	
	x		Cr.3.C.2	Parking Management: The construction of a multi-story parking garage building	2	0
x			Cr.3.C.3	Parking Management: Underground parking linked with better energy efficiency	2	2
	x		Cr.3.C.4	Parking Management: Undercover parking linked with better land use plan	2	0

Table 12: Proposed S.U.Z.C guidelines vs Madinaty Rating

Y	N		3.6.2.	Environmental Management	44	Madinaty Rating
		E01	Cr.1a	Energy Efficiency & Landscaping Plan	8	
x			Cr.1.1	Streets lights are to avoid light pollution, ensuring that lightening fixtures are running by solar panels. Check the BUG light rating “https://www.ies.org/pdf/education/ies-fol-addenda-1-%20bug-ratings.pdf”	Pre-Requisite	
x			Cr.1.2	Street Lightening: Centralized Solar Panels and LED lights	2	2
	x		Cr.1.3	Undercover car parking system with the installment of PV cells on the shades	2	0
			Cr.1b	Landscaping		
x			Cr.1.1.	Usage of native/ local plants	2	2
x			Cr.1.2.	Irrigation system is to be linked with treated waste water networking	2	2
		E02	Cr.2	Waste Water Plan	10	
x			Cr.3.1	Waste Water Management Plan	Pre-Requisite	
x			Cr.3.2	Grey Water Treatment Facility Plan	3	3
x			Cr.3.3	Municipal Waste Water Further Treatment Plan	3	3
	x		Cr.3.3	Rain Water Collection/ Treatment Facility	3	0
x			Cr.3.4	Replace potable water usage by on-site treated waste water	1	1
		E03	Cr.3	Solid Waste Management	12	
x			Cr.4.1	Solid Waste Management Plan	Pre-Requisite	
x			Cr.4.2	Proper waste collection methods	1==>2	2
x			Cr.4.3	Availability for Waste Collection Center	2	2
	x		Cr.4.4	On-site eco-processing-facilities and transfer stations	2	0
x			Cr.4.5	Following the zero waste concept in waste management	3	3
	x		Cr.4.6	Local Groceries Environmental Contribution	2	0
		E04	Cr.4	Material Selection Management Plan	8	
x			Cr.5.1	Recycling Contents	2==>4	2
x			Cr.5.2	Regional Materials (Locally Made)	1==>2	1
	x		Cr.5.3	SRI materials	2	0
		E05	Cr.5	Outdoor Environmental Quality Plan	6	
x			Cr.6.1	Smoking allowance in open air areas	2	2
x			Cr.6.2	Waste water quality for irrigation	2	2
x			Cr.6.3	Light and Visual Pollution	2	2

Table 13: Proposed S.U.Z.C guidelines vs Madinaty Rating

Y	N		IV.	Green Team	20	Madinaty Rating
		G01	Cr.1	Education Plan	6	
x			Cr.1.1	Awareness programs, Workshops and competitions	Pre-Requisite	
x			Cr.1.2	Sportive Competitions	2	
	x		Cr.1.3	Different and diverse Awareness modes As Community on-going electronic Magazine and on the shuttle buses	2	
	x		Cr.1.4	Education sessions on Penalty and Rewards	2	
		G02	Cr.2	Champion/ Expert Role	2	
	x		Cr.2.1	Delegated for monitoring on-community activities, educational sessions, penalties and reward	1	
	x		Cr.2.2	Delegated for green team members training for extended hand of support within the community	1	
		G03	Cr.3	Innovation Plan	8	
	x		Cr.3.1	Encourage innovative workshops and competitions	Pre-Requisite	
	x		Cr.3.2	Apply "Activity or Event for a cause" of raising money to award the winning innovative person	2	
x			Cr.3.3	Innovation for Energy Savings	2	2
x			Cr.3.4	Innovation for Water Management	2	2
x			Cr.3.5	Innovation for solid waste management	2	2
		G04	Cr.4	Preventive Maintenance Team	4	
	x		Cr.4.1	Being available for any maintenance emergency	1	
	x		Cr.4.2	Having a mechanical and electrical maintenance planning sheet	2	
x			Cr.4.3	Conducting weekly performance assessment sheets	1	

Table 14: S.U.Z.C Owners Guidelines vs Madinaty Rating- OW.1 Buildings

Y	N	Proposed Buildings and Facilities guidelines for Owners	Possible Points
x		Traffic and Parking Management	Pre-Requisite
x		Waste Water Management	Pre-Requisite
x		Solid Waste Sorting and Management	Pre-Requisite
x		Efficient Land Usage	Pre-Requisite
x		Green Acts	Pre-Requisite
		I. In-community building construction design scheme Guidelines	NA
x		I.1 Building Passive Design Approach	
x		I.2 Orientation	
x		I.3 Form, Typology and Design	
x		I.4 Landscaping Design	
x		I.5 Ventilation either wind or natural air	
x		I.6 Thermal Comfort, Solar Heat Gain, Shading and Glazing	
x		I.7 Thermal Zoning is the building location in terms of solar radiation i.e. is it a short term building occupancy or long term one.	
x		I.8 Material Selection	
x		I.9 Roof Construction design to decrease cooling load	

Table 15: S.U.Z.C Owners Guidelines vs Madinaty Rating- OW.3 School

Y	N	III.	In-Community Schools Guidelines	
x		III.1	School orientation and massing “similar to the building massing and orientation in the previous section”	Done
x		III.2	Innovative and challenging learning environment	In Action
x		III.3	Green Activities and workshops like Earth Day and Planting Day	In Action
x		III.4	Teaching can be done on projectors rather than white boards	In Plan
x		III.5	The usage of online learning tools rather than using notebooks	In Plan

Table 16: S.U.Z.C Owners Guidelines vs Madinaty Rating- OW.5 Mosque

Y	N	V.	In-Community Mosque and/or Church Guidelines	
x		V.1	Worship buildings are to use energy produced from solar panels	Done
x		V.2	Increase of green area	Done
x		V.3	Material Selection like SRI	In Plan
x		V.4	Individual grey water treatment plan, if possible	Done

CONCLUSION

Madinaty- New Cairo, a designed to be sustainable community, is used as a case study to validate the proposed guidelines. The outcomes of this section are, Madinaty has designed the British School and the Mosque to be Green Buildings as per the guidelines pre-requisite#1. While also, proposing a traffic and parking management plan that ensures no road congestion as per S.U.Z.C. guidelines pre-requisite#2. In addition to, having the community design with weighted proportions of land usage for infrastructure vs green areas vs parking spots designed in accordance with the serving area, as per the proposed guidelines pre-requisite#3.

Madinaty-New Cairo was also evaluated based on the proposed guidelines points and credits and it resulted in achieving 54 credits out of the proposed 100 credits. This qualifies Madinaty to a Bronze rating, as per the proposed rating system within S.U.Z.C.

CHAPTER 6: CONCLUSIONS & RECOMMENDATIONS

6.1 CONCLUSIONS

As natural resources are being abused nowadays to satisfy the growing population worldwide, especially in urban communities due to urbanization. In addition to responding to some people's greed's of needing more resources in terms of services and products more than they really need. This started to result in increasing the level of poverty, the gap between the rich and the poor and the weakening and diversification of communities. Accordingly threatening the future of the upcoming generations from finding the needed resources to satisfy their daily needs. This concludes that reaching a sustainable urban community is very important for the current generation and the upcoming ones as it ensures a stable, pollution free and fruitful future in terms of the availability of natural resources.

Reaching a solution for protecting natural resources by reducing the need of extracting new raw materials to use by reusing or recycling already manufactured materials, helps in managing solid wastes. However, after further studying the urban community and the effect it can have on the environment, **wastes** are not the only source for abusing resources, it is accompanied by **energy** and **Water**. Hence, developing guidelines for sustainable urban communities that, if followed, ensures saving resources under the main three pillars affecting the environment. This also guarantees having a cleaner air quality, better lifestyle and accordingly work productivity and economic level. In a nut shell, establishing guidelines following **zero pollution** concept serving urban communities to be sustainable is the objective of this thesis.

The proposed S.U.Z.C guidelines has a total of 100 credits, which are used as hypothetical measures to the proposed solutions to evaluate sustainability from design to infrastructure and operation. The 100 credits are divided into three main sections, 36 credits for Sustainable Site Management which has 3 main pre-requisites, green building, traffic and parking management and efficient land usage. In addition to other elective points with corresponding credits about parking planes, transportation, street lanes and walkability and bicycle lanes. The second main section of the highest credits number of 44 credits is the Environmental Management which includes a novel approach about a zero pollution sustainable urban community. This section ensures reaching a zero solid waste approach, zero net water approach, zero noise pollution and zero air polluting emissions. The last section holds 20 credits under the Green Team which is another new integration within the proposed S.U.Z.C community. The green team is not only about an on-community champion but also it focuses on education and awareness, encourages innovation and has a team for on-community protective and corrective maintenance.

The proposed S.U.Z.C is not only about the previous sections serving the community itself but also proposed guidelines for the buildings investing owners either residential or commercial buildings within the community. This will encourage the investing owners to act sustainably as the proposed community aims at. In addition to that, there is a community rating system with corresponding credits counts that qualifies the community to bronze, silver, gold or platinum certification. Furthermore, another rating system is for the building owners within the community who are encouraged to abide to their corresponding section of focus pre-requisites to receive a 20% discount on the operation cost; with addition of corresponding operational costs discounts if they meet other proposed elective points within their scope and/ or introducing innovative ideas that further supports the proposed sustainable S.U.Z.C.

The proposed sustainable urban zero pollution community (S.U.Z.C.) were compared by the most famous and widely used rating systems for communities known, LEED-ND which is mostly applicable for new communities. Yet S.U.Z.C guidelines are applicable for both developed and

developing countries, new and existing communities and that is the main difference between LEED-ND and the proposed guidelines. In addition to including zero pollution concept in S.U.Z.C. guidelines which is a novel approach, not included in LEED-ND, combining resources savings and utilization for solid waste, water, energy and land.

After the guidelines are proposed, implementing them on a case study, taken to be Madinaty-New Cairo, which is a promising urban community with a sustainable future, in this thesis, helps in ensuring the flexibility and easiness of integration within a community and abiding to under a reasonable cost. The findings in this section was that Madinaty is heading towards sustainability as intended. Starting by designing the British School and The Mosque within the community to be green buildings, then by having a congestion free traffic and parking management plan including under construction plan since Madinaty community is not fully developed yet. In addition to having an efficient land usage plan with balanced portion of buildings, green areas and corresponding parking places. Furthermore, Madinaty has its own waste water treatment plant within the community that ensure zero net water, as a novel approach proposal in this thesis. Madinaty was also rated based on the proposed guidelines rating system for the community and it reached 54 points out of 100 which qualifies it to a Bronze Certification.

Madinaty- New Cairo is a real life case study that is of a benefit to the current living occupants' in addition to being an example for sustainable neighborhoods and a learning tool for reference to any neighborhood investing owner and residents.

The limitations of this thesis is that the proposed guidelines credits are all assumed measures for a SMART (simple, **measurable**, attainable, realistic and time-bound) concept. However, the hypothetically assumed numbers should be referred to and studied later on for a non-hypothetical rating system. Lastly, the proposed guidelines are applicable for urban communities only, that does not include any industrial buildings within.

6.2. RECOMMENDATIONS

1. The comparative analysis could be applied with further Sustainable Urban Communities rating tools for a varied analysis.
2. Integrating further entertainment facilities within the community like Aqua Parks that can work using the treated water; as well as any on-community fountains.
3. Try implementing a similar system for Rural Communities, with reference to the model farms and local food production section in this thesis.
4. Proposing a second modified version of the guidelines with a non-hypothetical rating system that should be acknowledged and credible to evaluate accordingly.
5. Evaluating Madinaty buildings owners based on the proposed S.U.Z.C. owners rating system

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APPENDICIES

APPENDIX I-

A NOVEL APPROACH TOWARDS A SUSTAINABLE ECOTOURISM COMMUNITY

A Novel Approach towards a Sustainable Ecotourism Community

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ABSTRACT:

As tourism industry is one of the main industrial focuses nowadays as it has grown almost by 40% since 1960 till date and it is expected to represent almost 25% of the globe's population in 5 years. It has many benefits economically by getting introduced to foreign currencies and better market share; and socially by providing more job opportunities and better lifestyles yet the environmental point of view is not yet a focus, in other words in line with the industry growth huge amount of natural resources are being consumed so as to cover for the needs of the current tourists. Thus there is a need for the introduction of a novel approach that will integrate ecotourism and sustainability by introducing and implementing the zero waste strategy which will ensure conservation of natural resources with safe and environmentally friendly acts, activities and waste full utilization methods following cradle-to-cradle concept as it will be shown in the paper.

Key words: *Tourism, Sustainability, Eco-tourism, Zero Waste Strategy, Cradle-to-Cradle concept, Sustainable Eco-Tourism*

INTRODUCTION:

Tourism industry is counted as a fast growing industry which started in the early 1960s; it is being improved as time passes by and sustainability acts are being introduced and acted upon. Figure 1 shows a tracking of the number of international tourists; just to show how fast tourism industry has evolved in almost half a century. There was an increase in the level of tourism since the year 1960 till 2008 and a projection for 2020 as indicated by the world tourism organization. Several reasons led to this rise in tourism starting with the fact that it is a new industry being introduced or known of; but also it led to rising the living standards of the community travelled to citizens as well as tourists when taking longer holidays and travelling to distant parts of the world, getting exposed to new cultures and sharing the tourists' own culture. In addition to advances in transport technology for example the jumbo jet allow for relatively inexpensive long-distance travel. All of this raised marketing propaganda to the visited places via Television, movies and social media. leading to a well-financed advertising campaigns and thus promoting travelling. (Campus Sustainability, 2015)

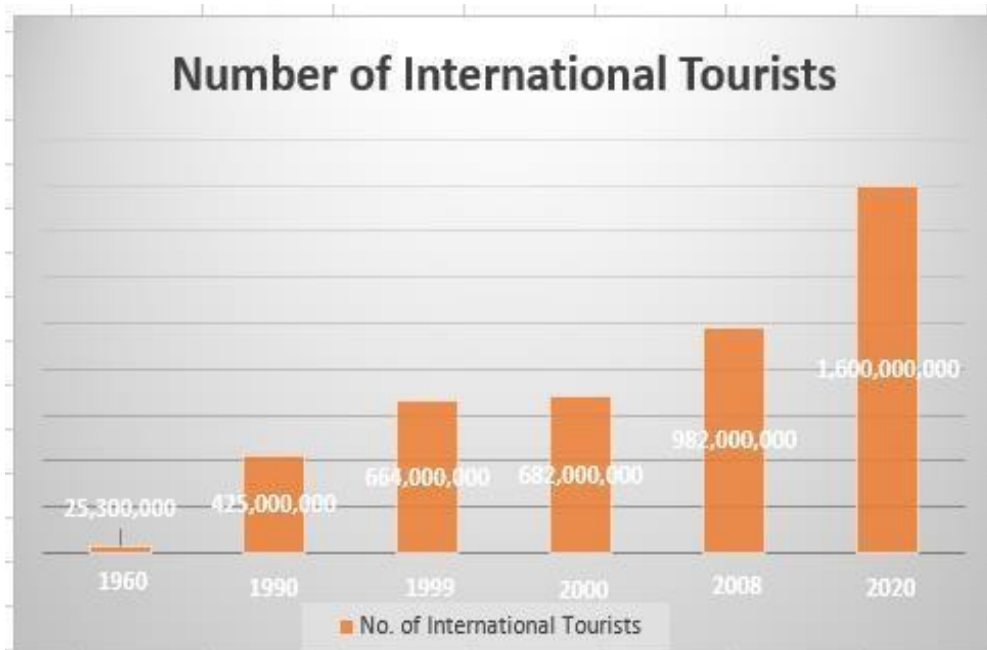


Figure 1: Number of International Tourists as mentioned by the world tourism organization

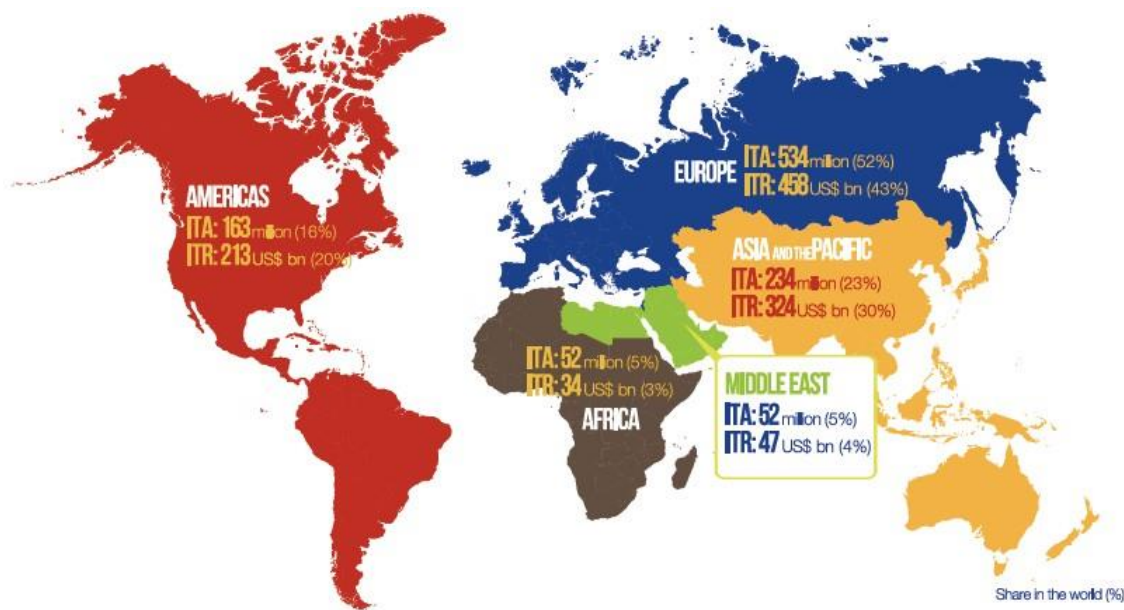


Figure 2: The number of tourists' arrival (UNWTO Tourism Highlights, 2013).

As shown in Figure 1 that by 2020 the number of international tourists will reach around 1.6 billion, which is almost representing 23% of the world's population and this shows how fast this industry is growing and in parallel how fast and massive is the consumption of natural resources so as to meet the needed industry growth and this will be seen first in the European countries, then Asian and Pacific then Americas and lastly Africa and Middle East as shown in Figure 2 depending on the number of International tourists arrival in 2013. The impact of that can have the negatives outweighing the positives in the sense that the increase of tourism industry will decrease the level of unemployment and will raise the country's economy with the increase of visiting tourists while spreading the culture and traditions which are focused under social and economic points of view however, the wide immediate, unstudied and unprepared for increase in 50 years as referred to earlier in this thesis research is leading to massive consumption of natural resources like water, energy and materials which is affecting the environment, being the number one source of tourism existence and reliance and the least of importance to be paid

attention at and focused on by each and everyone in the community starting with citizens, government members and even visiting tourists.

Tourism industry has so many activities being done within it -- as shown in figure 3, like transportation modes wither by air, cruise or cars, entertainment like theatres, sports arenas, recreational areas and some other facilities like banks, gas station, accommodation, hospitals, real estates, infrastructure and banks which all do require raw materials being usually extracted from the natural resources leading to an imbalance in the ecosystem. So, tourism industry is just like any industry with advantages and disadvantages that is reflecting not only the industry itself; but on the community standards and lifestyle. Some of tourism advantages are flourishing the needs recreation of proper infrastructure (roads, facilities, health care and services) development, as well as being a major source of economy in some countries while generating foreign currency exchange, increasing job opportunities level and thus leading to more destination marketing and attractions.

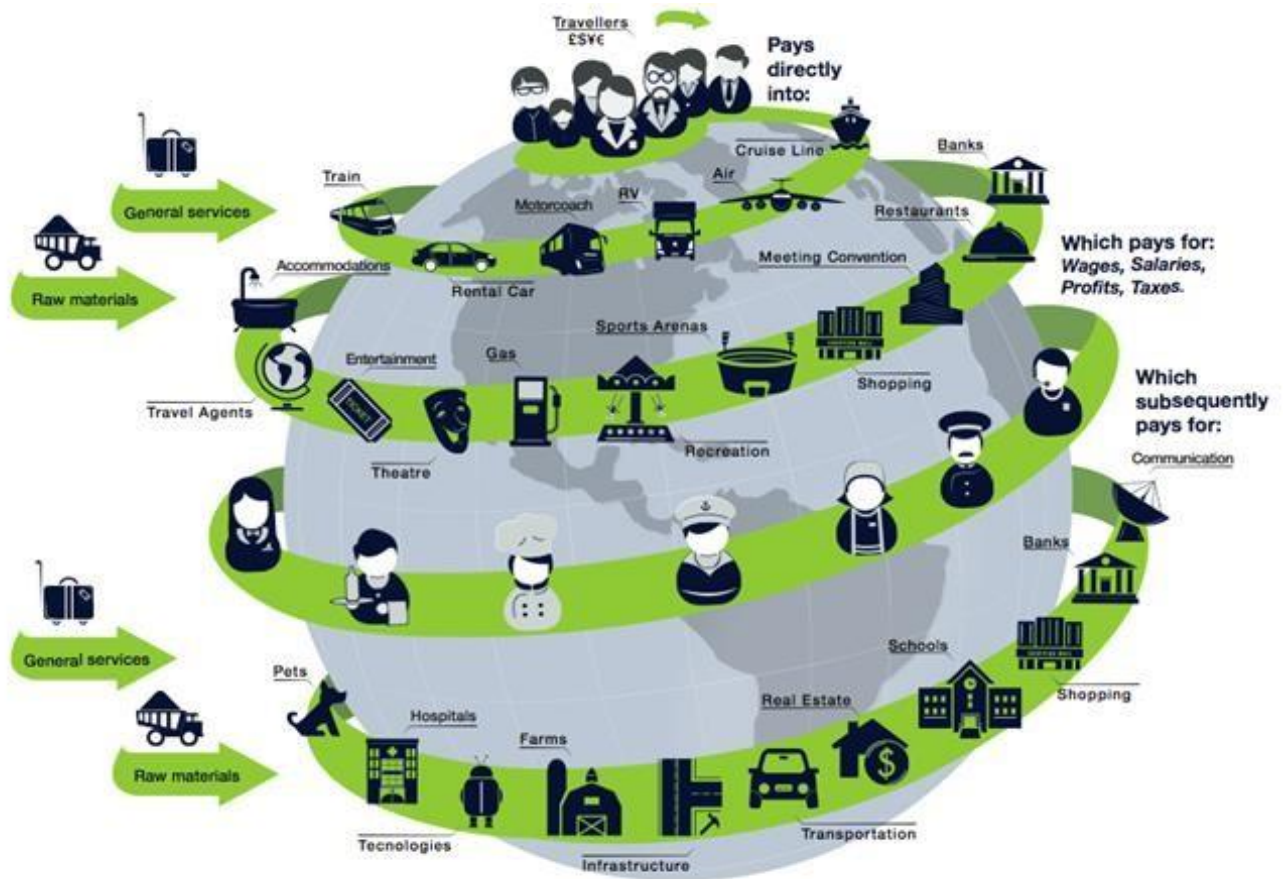


Figure 3: How Money travels within a Touristic Environment (World Travel and Tourism Council, 2015)

Saying how tourism industry is such a rapidly increasing industry will reflect negatively on the surrounding community and environmental level for instance recreational development can be concentrated like being focused on the touristic areas to perfectly serve the tourists when it is not reaching the local people; same applies to health services and other facilities. Also, the market is unstable and it depends on the USD price in the market. In addition to that, if tourism is not sustainably managed, it can lead to cultural and wildlife destruction; not just that but also tourism industry started affecting marginal employment level like hiring low skilled people with low wage just to cover for the

need of employees with the rise of tourism; most of the higher management is outside hiring i.e. different nationality apart from having seasonal employment levels. (Tourism Development, 2015)

Saying this, with such an increase in the tourism industry and abuse of natural resources this will lead to an unbalance in the ecosystem, as the environment will not be able to cope with a rapid increase in high number of tourists in such a short period of time with an unbalance of resources usages. Stating how important tourism industry is and how fast it is flourishing while affecting the surrounding environment with the community social levels and standards, this leads to identifying the need to having a sustainable tourism so as not only to protect the current living and surrounding environment but also ensuring the availability of the needed resources for the future generations as the word sustainable reflects. So, some of the suggested mitigations working towards having a sustainable tourism are avoiding getting involved in environmental depletion acts while raising awareness within the community members and invest in trainings and educational experiences to the hired employees. Also, ensuring that the cultural experience is shared with the tourists so as it adds more community values and checking for more community adding value acts while also focusing on other industries that might be a source of income to back up the drop that might happen from tourism industry and lastly acting in transparency and communication between the government and community members.

But before getting into what is sustainable tourism, types, definitions, how to reach it and what to be done, identifying first tourism stakeholders will assist in identifying who is leading this fast growing industry, what is their future plan and how sustainable are they communicating. Figure 3 shows all of the stakeholders involved in the tourism industry starting with Government, Investors, vendors, NGO's, Infrastructures, hotels and resorts, community citizens, Customers and Tourists, Media with all its types, attractions either natural or religious or infrastructures or places to visit, tour operators and guides and lastly suppliers of food, liquor and forms of entertainment. So in a nut shell, everyone within a community starting with a higher governmental level to local citizens, domestic or international tourists, marketing and media tools, investors either private one hotel investor or a resort investor, either a food supplier or a transportation person, engineers for infrastructure of buildings and transportation roads and bridges engineers all are in a linked chain working either in parallel or preceding one another to finish a job that mainly depends on a proper image and marketing.

Tourism sustainability is a complex system that is connected with the social systems, the environmental access of resources and the ecology through the touristic activities and acts being done. Tourism is one of the largest industries that lie on services and productions giving a high economy return back on share. (Fennell, 1999)

As much as it sounds impressive to find all of these community members working together and in line so as to deliver a specific representable and attractive image for the tourism industry in each, so as to attract more tourists; as much as it reflects a huge concern of communication methods between different community levels like government and local citizens of different backgrounds, economical standards and intentions. In addition to that this sizes the previously mentioned tourism industry environmental problem and concern about abusing the environment and natural resources; so having a common established ground of definitions about the environment, environmental impacts not only to the surrounding nature but to the local citizens lifestyle and future generations as well as the long term negative effective on the country's economy when all of its resources are abused and there is no other replacement for further touristic attractions.

It is very critical that all of these members have defined international guidelines for a properly established and ethically managed touristic industry which focuses on the 3 pillars of sustainability known as economic, social and environment (which is the least point of focus amongst stakeholders and tourists) so as to reach the desired outcome of having a better environment, lifestyle and a safely

guaranteed availability of resources for the future generations out of this entertaining and economy generating industry.

The tourism industry is consuming a massive amount of natural resources that is why integrating the conservation of resources (water, energy & materials) is needed nowadays specially with this growing industry. Thus the objective refers to the need for integrating sustainability with eco-tourism applying the zero waste strategy. This novel approach aims at establishing a common ground of the guidelines on the conservation of natural resources and saving the environment while achieving the needed success and economic level aimed for by such a growing industry like tourism.

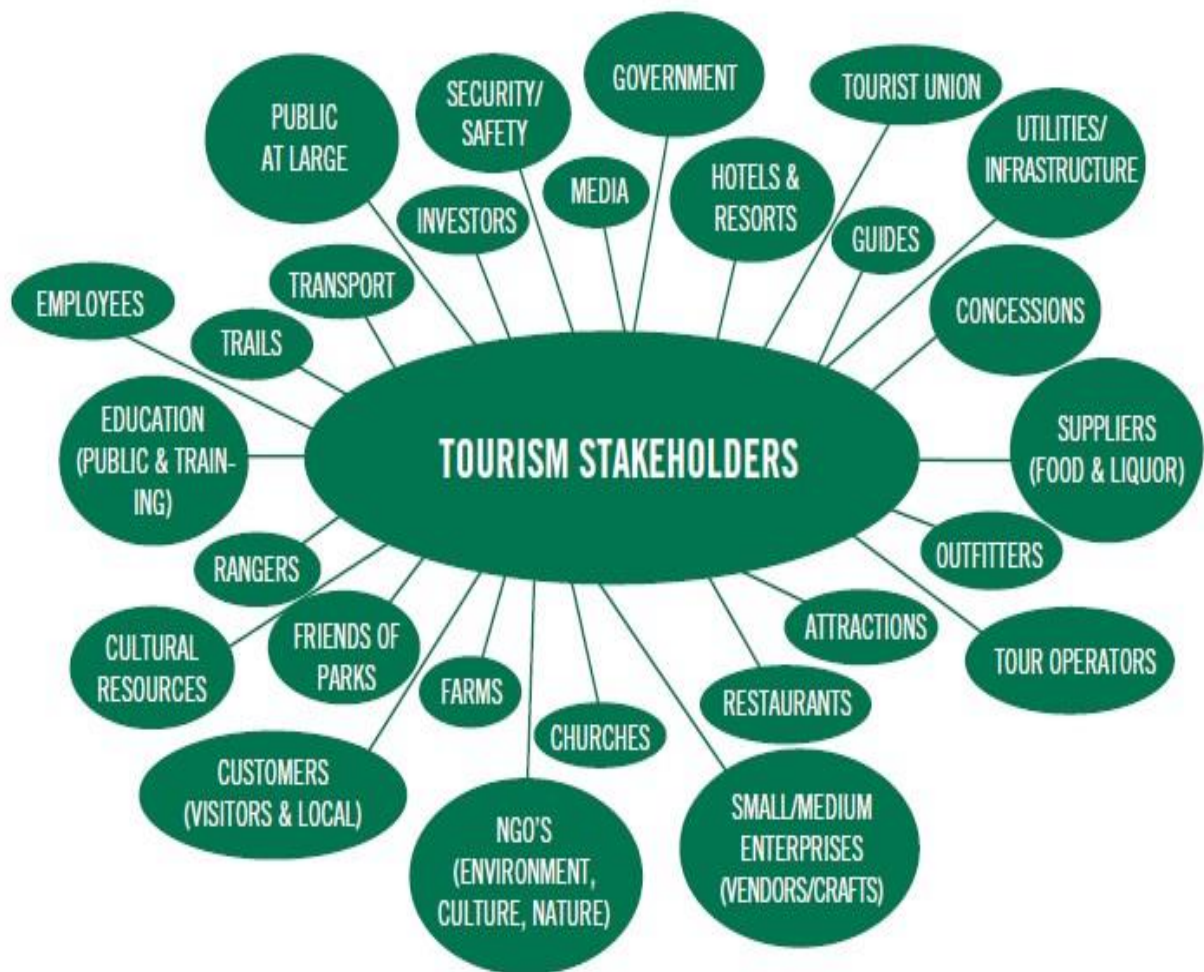


Figure 4: Stakeholders in the Tourism Industry. (Eileen, et al. 2005)

(G. Eileen, L. Kristin, M. Seleni and S. Kaddu, "Linking Tourism, Communities and Conservation: A Tourism Assessment Process, 2005)

TOURISM TYPES AND DEFINITIONS: (Sustainable Tourism)

Before getting more into sustainable tourism approach, some definitions about tourism industry needs to be identified so as to have a clear study of the available tourism

types and design the proper methodology for reaching the needed sustainable tourism community.

Tourism:

- Defined as the activity of travelling or visiting other places either internationally or nationally either for work, study or leisure. It aims at promoting other places to visit and see while encouraging different cultural activities and inputs with the enhancement of economic standards for the travelled-to country.

Geo-Tourism:

- *Geo-Tourism is defined by the National Geographic as synonym to sustainable Tourism however it reflects more on the location geography and it aims at promoting the place by “the sense of the place” rather than the touristic and industrial efforts.*
- *National Geographic defined geo-tourism as “Tourism that sustains or enhances the geographical character of a place — its environment, heritage, aesthetics, culture, and the well-being of its residents. Geo-tourism is sustainable tourism energized. It sustains, but it can also enhance—by means of restorative and constructive forms of tourism that fit the nature of the destination” (National-Geographic, 2008-2010)*

Responsible Tourism:

- *Responsible tourism is defining tourism as an Industry that consumes the resources in a more responsible way and thus generating a bigger economic benefit. Not only that but it also shows the cultural sensitivity responsibility by the respect of hosts and tourists to the place they are visiting in terms of its natural resources reservations in line with cultural and traditional acts.*

Sustainable Tourism:

Defined as a continuous process involving all stakeholders participation for a continual monitoring that works towards improving/ introducing new corrective methods whenever is needed so as to reach a sustainable tourism.

- *UNWTO defined Sustainable Tourism as the act of “meeting the needs of the present and the host regions while protecting and enhancing opportunities for the future. It is defined as a leading to management of all resources in such a way that is economic, social and aesthetic needs can be fulfilled while maintain cultural integrity, essential ecological processes, biological diversity and life support systems” (UNWTO, 1998) (Atamhenwan, 2015)*
- *UNWTO defined sustainable Tourism in 2005 as “the tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities”. (UNWTO, 2005) (Atamhenwan, 2015)*
- *Weaver defined sustainable tourism as the “wise usage and conservation of resources in order to ensure their long term viability; it involves the maximization of the positive impacts of tourism and the minimization of the negative impacts at the same time” (Weaver, 2006) (Atamhenwan, 2015)*

- Stoddard et al defined sustainable tourism as “a developing tourism industry in such a way that the natural environment is protected and local cultures are preserved, for the benefit of the present and future generations of host communities and tourists, as well as tourism businesses” (Stoddard et al, 2008) (Atamhenwan, 2015)
- Goeldner and Ritchie defined sustainable tourism as “a development that creates a balance by providing high quality experiences for visitors and maximizing the benefits of tourism for stakeholders in a destination, without compromising the social, environmental and cultural integrity of the destination” (Goeldner and Ritchie, 2008) (Atamhenwan, 2015)

Aims at promoting sustainability acts and practices by it will reflect on the respect and responsibility towards the socio-cultural reality and this will lead to an increase the level of touristic satisfaction. It is more concerned about economic community level as a first focus which will be based on a better environment as a second supporting focus. Figure 4 shows the evolution of sustainable tourism and the forms of tourism which started by discrepancies leading to disrespect of the sustainable development principals within a form of tourism, to the move of slight integration between sustainable tourism and forms of tourism sustainable development principals till reaching the ideal expected situation where sustainable tourism and the sustainable development forms of tourism meets and integrate.

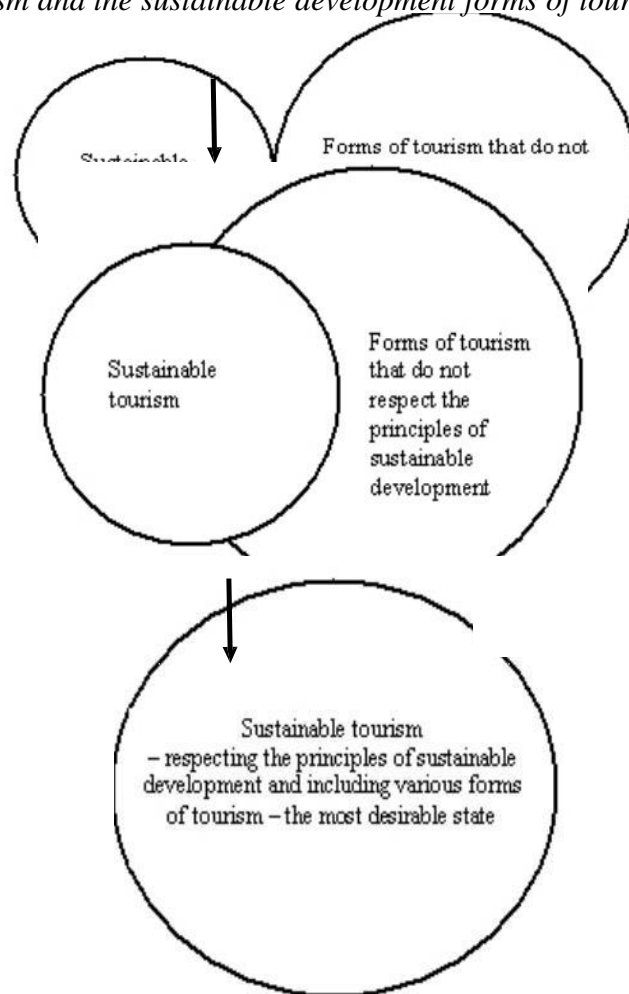


Figure 5: The Evolution of Sustainable Tourism and various Tourism forms (Butowski, 2012)

Eco-Tourism:

- *Eco-tourism is defined under a form of sustainable tourism and it aims at promoting the lower level visited areas with undistributed natural resources. It is more concerned about the environmental acts and activities regardless of their economic effect.*
- *Ecotourism Society defined Ecotourism as “a responsible travel to natural areas that conserve the natural environment and improve the living standards of local people” (Ecotourism Society, 1991 a, b) (CHEIA, 2013)*
- *Ecotourism Association of Australia defined Ecotourism as “Ecologically sustainable tourism that is protecting the natural environment and encourage understanding, appreciation and conservation of cultural elements” (Ecotourism Association of Australia, 1992) (CHEIA, 2013)*

Ross and Wall defined Ecotourism as “strategy for preserving natural areas while promoting sustainable development of the area” as shown in figure 5 where ecotourism is defined as the protection of natural resources as a primary focus which will then generate revenue, include local involvement and spreading environmental education that will lead to conservation of natural resources in line with economic development which all refills back in sustainable acts. (Ross and Wall, 1999) (CHEIA, 2013)

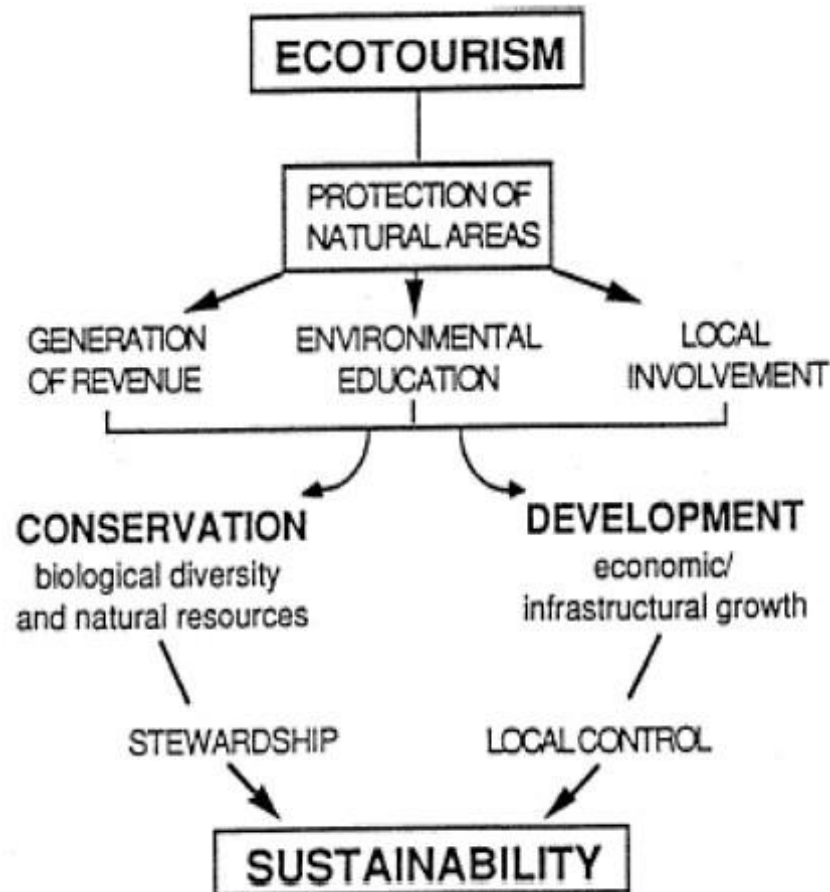


Figure 6: Perspective of Ecotourism (Roll, Wall, 1999) (CHEIA, 2013)

*All of these tourism terminologies is mainly identifying the type of travelling tourist as well as being an improvement from a generic word like tourism to a more specific commonly known vocabulary; most of the newly introduced terminologies should be driving to **green travel**, where the tourist is aware of his acts and is acting responsibly according to the environment. Green Travel While moving to studying the urge for having a green travel which might be reached through sustainable tourism, one should first study touristic attractions which attracts international tourists and makes them favor one place to another, facilities, transportation, activities or accommodation and ecotourism of the place or its sustainable level as stated in some sources are considered to be the most important reasons to privilege one place to travel to rather than the other place and on the other hand when these attractions are maintained while meeting the tourists' needs and serving the environment thus they will help in achieving the sustainable touristic goal. These attractions can be ideographic depending on how unique the place is, or organizational depending on the size of the attractions that this place occupies or cognitive relying on the feelings that a tourists gets upon visiting and being in that place. (Fennell, 1999)*

As there is a wide variety of definitions that are being introduced under tourism industry which are mentioned by different authors under different levels of understanding; this refers back to the need to establish a common ground of common definition and guidelines on the conservation of natural resources and saving the environment while achieving the needed success and economic level aimed for by such a growing industry like tourism, the new definition will be identified later in this thesis research as Sustainable Ecotourism applying the Zero Waste Strategy in order to conserve the natural resources.

Ecotourism and Sustainable Tourism:

Ecotourism and Sustainable tourism are the new terms being used in the tourism industry for a decade where some hotels, resorts and destinations claim to be environmentally friendly by using either of the previously mentioned words. However both words are not the same, they are related to the same objective of efficiently and effectively using the available natural resources without abusing the environment or affecting the availability of these unrecovered natural resources to the future generations.

Ecotourism is an old concern since 1990 linking between responsible tourism and how would it be said to be "Green" as well as it is considered to be a sustainable development tool as it is considered to benefit local people, spread the needed sustainability needed information to its visitors through awareness and conserve natural resources. Till 1991 when the International Ecotourism Society (TIES) introduced the first official definition to ecotourism to be a set of principals defined as "*Ecotourism is responsible travel to natural area that conserves the environment and sustains the wellbeing of local people*" while afterwards the International Union for Conservation of Nature (IUCN) defined ecotourism as "*An Environmentally responsible travel and visitation to relatively undistributed natural areas, in order to enjoy and appreciate nature (and any accompanying cultural features- both past and present) that promotes conservation, has low negative visitor impact, and provides for beneficially active socio-economic involvement of local population*". (Wood, 2002)

While ecotourism has begun as an idea of interest as further research has been taken in 1970 in Kenya to test the advantages of the economic wildlife tourism focusing on hunting animals and it led to banning this activity in 1977. Some biologists followed the ecotourism benefits on their areas of focus like rain forests, corals reefs and biological diversity studies in 1980s and this helped in launching specifications for scientists about remote zones through small businesses. In parallel there was an increase in the outdoor and environmental travel for camping and hiking by touristic companies who have introduced local groups named as (Conservation Groups) in the visited places of by raising funds for a cause. Accordingly these companies have argues that they have started ecotourism since long time ago by actions until the term Ecotourism was introduced and used by the business travelers and governments to promote the visiting areas. However, they were lacking the major focus of ecotourism principles known to include contribution for biodiversity conservation while sustaining the wellbeing of inhabitants, no environmental abuse by minimizing any nature environmental impacts and including educational and learning experiences sessions about conservation and ecotourism. Also, directing any revenues to be used for the natural areas conservation and rely on using the already built infrastructure which are going in harmony with the culture and nature. (Wood, 2002)

In 1997, the Association for Ecological Tourism in Europe established environmentally friendly oriented tour operations that led to the development of ecotourism guidelines and till date, ecotourism has many different meanings and synonyms like geo-tourism and pro-poor tourism which is benefiting the poor people in the society; yet no matter what definition synonyms ecotourism might have, they all share and aim towards the same objective of conserving the environment while raising sustainability awareness in between the tourists (Wood, 2002).

Figure (3) shows where Ecotourism lies within tourism sustainable forms as well as how ecotourism is mainly a primary from Nature tourism (which is based on natural scenery) and the part of rural tourism (which depends on rural travels) and other from cultural tourism (which is more focused about the culture). So ecotourism is a form of sustainable tourism acts, the major difference is that ecotourism is primarily aiming at saving the environment as the first objective while sustainable tourism is aiming at focusing on the economic return by saving the environment and this is to have a balance ecosystem as defined in the three known sustainability pillars economic, environment and social.

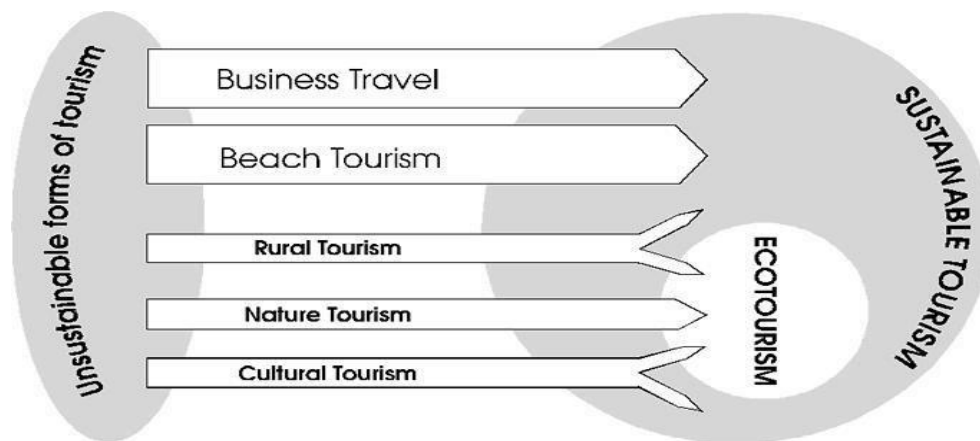


Figure 33: Ecotourism as a Sustainable Development Concept (United Nations Environment Programme, 2015)

ECOTOURISM REQUIREMENTS:

Six principals are being introduced by the International Ecotourism society (TES) that are used as guidelines for ecotourism community implementation. These principals include eliminating negative impacts on the nature, ensuring that local citizens provide positive experiences for the tourists, providing benefits to local people like economical and job opportunities, focusing on proper awareness to locals and educating tourists as well, revenues are to be spent on conserving the environment and

lastly raising political, social and environmental standards with host countries (The International Ecotourism Society, 2013).

These six principals are focused more about social and economic points with less focus and contribution to the environmental conservation and focus. In addition to that, the previously mentioned principals do not state clearly on how to apply each principals while taking into consideration different cultures or communities' different approaches.

ECOTOURISM CERTIFICATION:

As certifications are considered to be the guidelines to regulate the operations within an industry like tourism industry while setting succeeding in achieving previously identified guidelines that usually address quality, social operations and environmental concerns. The certifications are considered to be the role of governments and NGOs to identify and present to the industries to abide to; so as most of the governmental concerns are tending towards sustainability and as the aim of NGOs is to guide towards a better tomorrow which is sustainability in other words thus most of the identified certifications within the tourism industry are focused on that (World Tourism Organisation, 2003)

As Ecotourism is mentioned before to be a growing industry on an international level having to meet several demands that are summarized under social and environmental safety while adhering to several standards like raising cultural awareness, providing a positive and real experience and learning phase to visitors and inhabitants and financial or economic return back to the community as well as a stronger political standard. Thus to maintain the needed and appreciated results for Ecotourism while guiding to more sustainable acts, Ecotourism needs to be certified (Butsam, 2012).

Ecotourism being certified will assist the shareholders, citizens and visiting tourists in several ways. Apart from being a recognizable eco- certified place to promote or travel to, the certification also has the advantage for shareholders of being able to access new technology financing as well any sustainable acts financial funding needs. While for citizens and tourists, just ensuring that the place being visited is conserving the environment while guaranteeing a healthier and more prosperous journey that starts with awareness and goes through an educational memorable experience (Butsam, 2012)

ECOTOURISM CERTIFICATES:

Ecotourism certification started to take place in the early 2000s ever since the population started to massively increase and the natural resources are being depleted at a high rate leading to a wider increase in the gap between the rich and the poor while increasing the level of societal insecurities and rise in criminal levels.

I. International Mohonk Agreement:

Ecotourism certification started with the International Mohonk Agreement issued in 2000 which introduced and identified the principals of ecotourism and sustainable tourism certification. It linked sustainable tourism with ecotourism stating that it is the type of tourism minimizing social and economic impacts on the surrounding environment while having a better economic advantage coming back to the local community (Klintman, 2012).

II. Certification for Sustainable Tourism (CST)- Costa Rica:

CST is a certificate that is designed for the business sectors to differentiation the tourism sectors businesses based on their activity compliance with the nature, social and cultural managing of resources (Sustainable Tourism, 2014).

III. EarthCheck Certification:

Said to be the World's leading scientific benchmarking certification and tourism and travel advising group. EarthCheck provides consulting guidance and services to governments, destinations and businesses ensuring the delivery of a safe, environmentally friendly and clean destination tourism area (EarthCheck, 2015).

IV. Sustainable Tourism Eco-Certification Program (STEP):STEP is designed by the tourism industry in Colombia based on an environmental framework that studies sustainable acts within the touristic businesses while also being an assessment educational tool (Ecolabel Index, 2015).

V. Green Key Program in Mexico:

A program that has started in Mexico in 2008 introducing Ecotouristic acts and ideas for tourists and tourism industry to act green and be green (Sustainable Tourism, 2014).

VI. ECOTEL Certification:

ECOTEL is a certificate designed for hotels/resorts sustainability that was issued in 1994 yet it was just focused on social responsibility and pollution prevention. However now it is recognized for full sustainability acts. The certificate evaluates the hotels based on how they manage the wastes, energy consumption, water usage and management, environmental footprint and how much sustainable education is being taught to the employees and community through awareness and acts (HVS SUSTAINABILITY, 2015).

The mentioned ecotourism certification has helped in identifying the responsible acts that should be done by operators and visitors so as to earn the certification. From which the place has gained an advantage for being known as an Ecotouristic Certified place which will change any negative impacts being created by visitors or inhabitants leading to creating a sustainably developed Ecotouristic place (Butsam, 2012).

The problem is addressed through certifications which propose solutions however too many certifications concerning sustainable tourism are introduced and this leads to confusion to tourists on what is the need and difference between all of these certifications, which to follow, which is more

known, which has the better pay-back period and benefits. A lot of certifications being introduced, more confusion is being caused and loss of certification credibility is reached. In addition to that, most of the hotels and resorts tend to apply sometimes for any certification under the words “environmentally friends, sustainable or eco-industry” so as to use it as a marketing attraction to tourists.

However, they may not choose a certification that is really working towards the previously mentioned keywords in line with applying only once for such certification without any challenge to further enhance the hotel or resort facilities, services, activities and acts so as to renew the certification or apply for a higher graded one.

This refers back to the need to integrate ecotourism with sustainability applying zero waste strategy and this is to ensure natural resources conservation.

ECO-TOURISM & SUSTAINABILITY:

Ecotourism as defined as a form of Sustainable Tourism aiming at protecting the environment as well as building a strong economic log for a country while working towards a more developed community by contributing to biodiversity conservation, responsible actions from tourists and local communists to save the environment as well as promoting sustainability while ensuring an unforgettable learning experience. Ecotourism is working towards sustainable development which is known to be conserving or efficiently using the current resources to meet the current needs without affecting the availability of resources for the future generations. As much as this concept is getting clear to many developing and developed countries, as much as it is getting harder to be implemented as the gap between the rich and the poor is increasing within the community and different communities. And this is due to unethical acts by not offering job opportunities to the public or even teaching them to fit a job requirement, by pretending to act sustainably and gain more money in return yet not spending this money back on the community and by poor communication between community members and government members. As shown in figure 4 that ecotourism development is part of sustainable development only when the points of social, economic and environment, which are the 3 pillars of sustainability, are being fulfilled. As for social commitment the local culture should be maintained and promoted for through events and festivals, infrastructure should be modified to reflect the culture as this will be a major aspect to differentiate between one country and other is the different culture representation. Also the life style of communists and their attitudes towards the surrounding environment and with the tourists will reflect on the mind set and comfort level of citizens within the community.

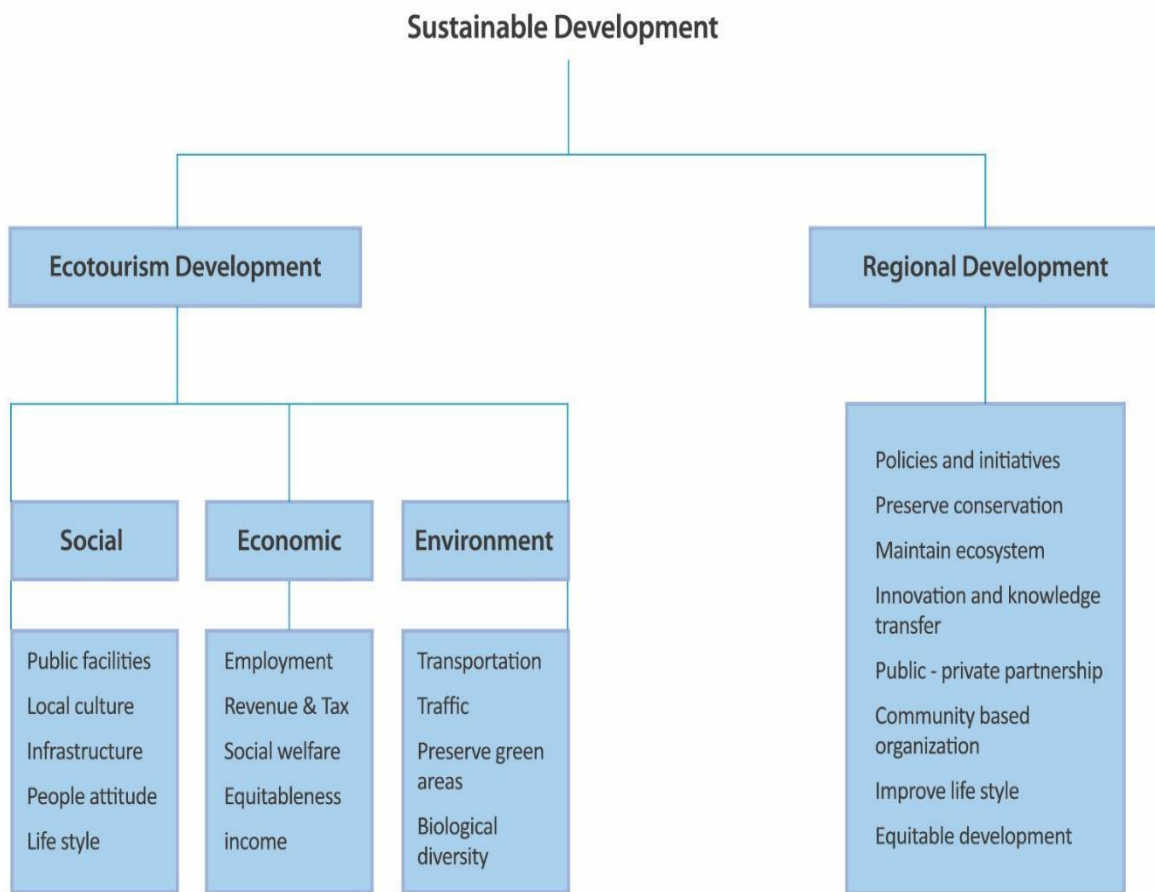


Figure 34: Ecotourism and Sustainable Development (Kiper, 2013)

On the other hand, economic standard is a major aspect to governments and local communities as per the taxes collected and income gained from ecotourism should be reflected back on enhancing the community lifestyle and living standards as well as providing more job opportunities to the public. Lastly the environmental commitment is to preserve the green areas, biodiversity and wildlife as well as offering services and transportation modes that don't harm back the environment.

IS ECOTOURISM REALLY SUSTAINABLE?

Ecotourism is working towards sustainability and sustainable development as described in the previous sections. More countries are working hard to be names as an Ecotourism destination and earn the corresponding certification however, this is mostly aimed for having higher economic earnings by both businesses and hotels. So is ecotourism really sustainable? The answer is No.

Nothing is perfectly done, and ecotourism is rather a new terminology being introduced into the touristic market in different format however it is mainly a buzz word for marketing a place rather than a word for action to save the surrounding area in the first place. Most, if not all, of the touristic areas that are claiming or working towards being Ecotouristic are implementing some of the needed actions to earn it like introducing new hotel regulations to conserve the environment, offering job opportunities, raising awareness and offering promotions however how do they protect the wildlife for instance, who is monitoring the Ecotouristic sustainable acts and measuring its performance or success so far? Is there any hotel/resort reporting a quality check for the achievement or maintaining the properly needed environmental level? What do the hotels/resorts do after earning the certification, do they work harder for another environmental certification or enhancing the number of points earned and the corresponding award level for instance moving from silver to gold to platinum award or do they just stop at earning the certification and raising marketing awareness about it for as long as they live? How long is the wildlife protected when claiming sustainable actions versus its protection when regular actions are being implemented? Is the difference worth it? The difference in understanding about ecotourism and sustainable actions from one person to another, from one community to another, how does that affect globally? All of these questions are left unanswered.

Policies and practices should be modified in order to fit for Ecotouristic global definitions and actions as most of the ecotourism activities are not being done exactly as stated by the specified and characteristics forming a universal cure it is rather fixing somewhere on the globe and causing environmental disturbance somewhere else where there is no proper environmental acts or follow up. Thus there should be much more follow up, more global awareness as per global standards implementing plans for development and natural resources conservation that does really ensure environmental and ecological integrity while providing the needed ecotourism experience (Kiper, 2013).

As ecotourism is a responsible act towards the environment and it has advantages when being professionally, ethically and responsibly applied as it is currently negatively affecting the environment. First of all the kind of marketing being done on a destination is aiming for just touristic economy and losing sight on other industries that might need investment to be another source of income, so what will happen if this country's touristic destinations are no longer number 1, wont it economically drop? Will it be too late to focus on another industry source of income? Won't it cause instability when a global economy issue occurs like a drop in the dollar's value? It will definitely affect all of the market however it shouldn't just be a single source of focus of international income.

Apart from economic point of view, converting landscapes to be a profitable land is a good point of view when the land is efficiently used as per the only needed space but not over estimated or over compromised land, in some cases residents might be asked to leave to another area as the one they are living on is counted as a natural landscape for instance. If the government didn't compensate these residents to live somewhere else, this will lead to an unbalance in the community lifestyle. Also, ecotourism could be widening the gap between the rich and the poor as it is aimed for high class people who can actually afford such travel expenses. So what happens is that these people are investing money in another country and being a reason for more job opportunities in these other countries however, these expenses are not being reflected back at their own country nor are they investing even in the form of taxes on their community by such travels so the gap between the rich and the poor is widened (Disadvantages of Ecotourism, 1999-2005).

ZERO WASTE STRATEGY AND ECO-TOURISM:

As touristic villages are part of the community aiming towards enhancing the environment as it is counted as the main resource behind tourists attraction, it also leads to an increase in the economy while providing more job opportunities as it gets into more sustainable actions as illustrated in figure 5 for instance and as a result it will positively and sustainably pay back to the community as it is

committed. A successful and sustainable touristic village shall be designed in a closed loop structure to eliminate the waste and pollution while using the available resources efficiently.

Having unequal and inefficient natural resources distribution leading to an imbalance in the ecosystem and negatively affecting the lifestyle of the current citizens; this raises the concern of working towards having sustainable acts to reach a sustainably balanced community and ecosystem starting with the most popular and dependent activities which is the Tourism Industry.

Sustainable acts has different forms of actions within the Tourism Industry as discussed earlier like studying the eco-tourism, sustainable tourism, sustainable development within tourism industry all of which are working towards managing the natural resources so that no gap in resources, deficiency in meeting the needs or widening the gap between rich and poor while increasing criminal and insecurity level within a community occurs. One of the new sustainability generated concepts is “zero waste” which is referring to studying the use of resources for long term efficiency. Zero waste can be achieved efficiently while following the Cradle to Cradle approach discussed.

The strategy behind the touristic villages is to follow cradle-to-cradle approach. As shown in figure 6 it is a close loop starting with the raw materials extraction from earth (cradle) till it is returned back sustainably to earth following a safe utilization process. This process starts with raw materials extraction going through the needed processing and manufacturing of materials then packaging to be transported to the corresponding factories or stores then used in homes and then the wastes are divided into recyclable or reusable wastes and disposable ones. The wastes are collected and sent to a transfer station which will check for the needed recycling ones to be done on-site else if any recyclable material cannot be done on-site then it will be sent to an off-site recycling. And this is to ensure to optimum and most efficient use of resources and reusing of products.

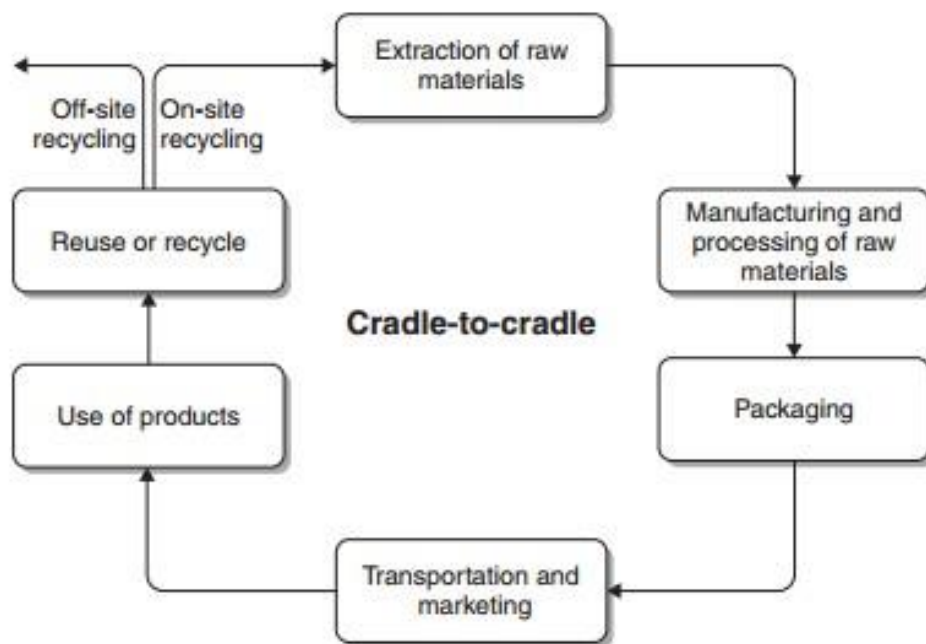


Figure 35: Cradle to Cradle Approach (El-Haggar, 2007)

As a method of testing and evaluating the environmental activities associated with any industry including tourism, a Life Cycle Assessment (LCA) has been developed based on the Cradle-to-Cradle approach. LCA is a tool that will assist in identifying all of the environmental effects resulting from the activity of raw materials usage, waste generation, going through processing all the way to recycling. The LCA encompasses the 7 R golden rules which are regulations which is the introduction of laws that will enforce environmental raw materials usage and waste utilization, reduce the raw materials used starting from the source, reuse the produced products in the same usage or a different one, recover energy from

the disposed wastes, recycle wastes, renovate the ongoing traditional waste management processes and rethink. Those rules being encompassed within the LCA ensure that the process is environmentally friendly and is aiming towards a minimal pollution level environment that could be claimed to be a zero waste environment. (El-Haggag, Sustainable Industrial Design and Waste Management, Cradle-to-Cradle for sustainable development), Sustainable Industrial Design and Waste Management, 2007

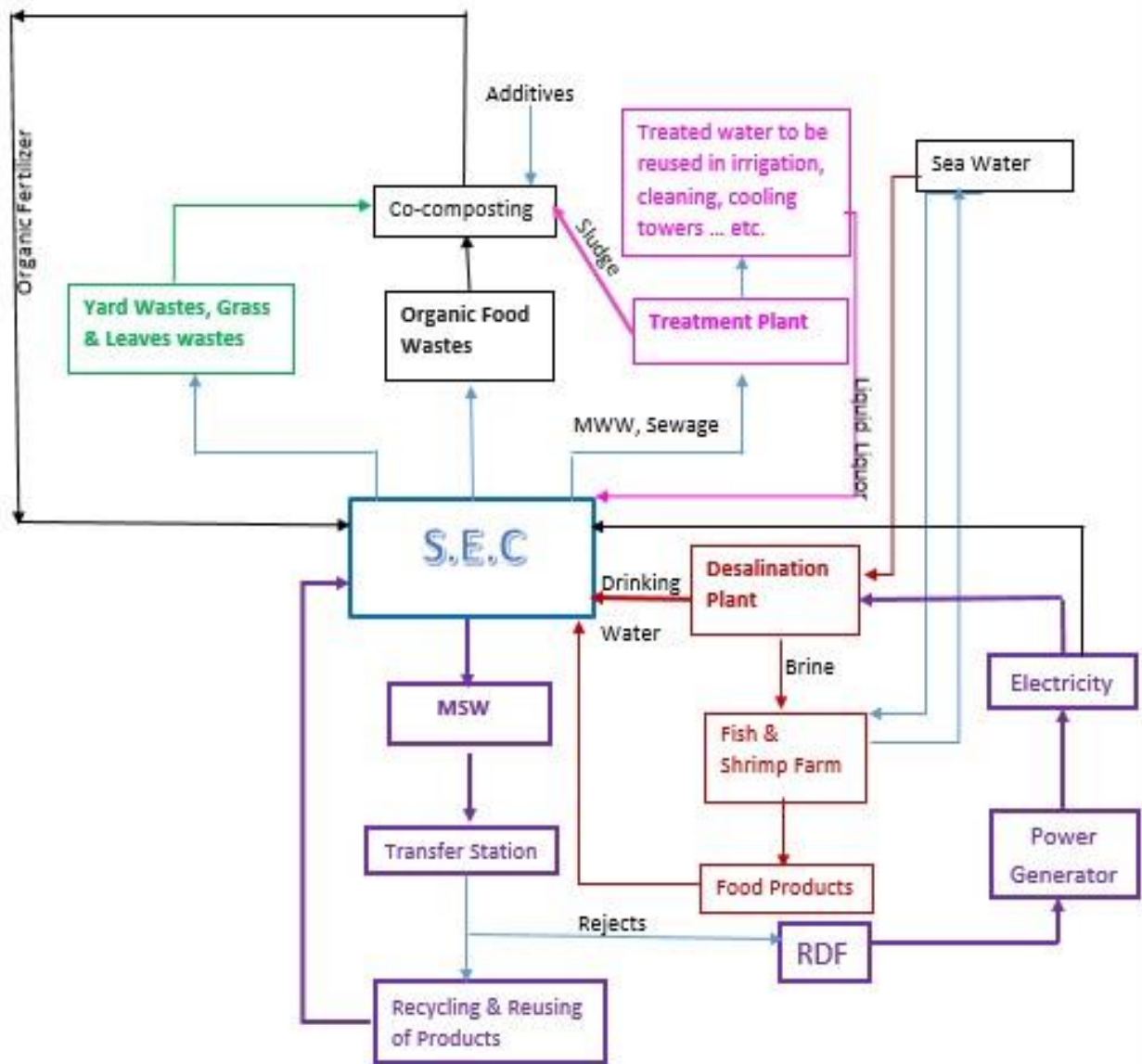


Figure 36: Sustainable Zero Waste Ecotourism Flowchart

SUSTAINABLE ZERO-WASTE ECOTOURISM:

Figure 10 shows the flowchart for a sustainable zero waste ecotourism which is aiming for zero waste where there is a closed loop since the start of materials extraction from nature to be used as services or products till they are recycled, reused or environmentally utilized in the environment. And this will lead to minimizing the level of natural resources extraction while safely and environmentally recycling or reusing them and thus preserving the environment. This kind of act will lead to a

sustainable community by saving the current irreplaceable natural resources and consequently ensuring the presence of natural resources to the upcoming generations. Lastly for Ecotourism as this flow chart is applied on a touristic resort which has all kinds of activities like entertainment, hosting, catering, transportation, amusement parks and recreational areas. so now the Ecotouristic area is aiming for saving the environment and natural resources first which is the main reason and attraction behind the establishment of this touristic area and secondly comes the economic payback or benefit.

This newly introduced concept of sustainability is aiming for environmental acts, economic benefits and better social standards in which more job opportunities will be available by the introduction of processes and manufacturing facilities to have several closed loops within the overall community close loop. Thus better lifestyles, lower level of unemployment and enhancing educational levels in which these employed community members will be introduced to trainings and leaning programs so as to have strong languages to communicate with tourists as well as the expected sustainable acts and modes of working that they shall follow so as to leave a positive impression and feedback to tourists. Saying that, there will be better awareness within the community and more marketing modes and tools so as to apply the needed for promoting environmentally friendly acts and services.

The flowchart introduces a cradle-to-cradle zero waste strategy model for a sustainable ecotourism community (S.E.C) which as shown in figure 10 has an on-site desalination plant. A desalination plant is a facility built on-site for the hotels or resorts have lack of fresh water availability and where also having pipelines that can transfer fresh water from a nearby site is costly; therefore a desalination plant is constructed on-site so as to process sea water and produce fresh and drinkable water. As it is known that sea water is high in salinity so the salt being produced from the desalination process will be used in fish & shrimp farms where additional sea water will be added to these marine lives which are living on high salinity sea water and they can be used as food products in S.E.C. And therefore having a closed loop for sea and drinking water from S.E.C. and back to S.E.C.

Also, S.E.C produces municipal solid wastes (MSW) which are defined to be the daily wastes; being divided in figure 10 as non-organic MSW and Organic food wastes. All of the wastes are collected from the S.E.C. where the non-organic MSW are being sent into a transfer station which is defined as waste management sites allowing for safe waste utilization systems unlike landfills. The collection trucks transfer/unload the wastes from a location to them. In a transfer station facility the wastes are further separated and larger trucks can send the segregated wastes into recycling facilities as shown in figure 10 that the recyclables or products and materials that can be reused are being transferred to their facility of specialty and after being recycled or modified for reusing; the products such as coat hangers and waste plastic bags are resent back to the S.E.C. and this aims at environmentally reusing the generated wastes (by recycling or reusing) also minimizing the amount of natural resources needed to produce new products and this all leads back to another closed loop of MSW from and to S.E.C. Lastly, out of some non-recyclable or non-reusable MSW like wood, plastics and paper for instance can be used in the production of Refused Derive Fuel (RDF) which is briefly an environmentally friendly low toxicity and high energy fuel recovered from wastes and it can be used as an energy source to run the machines in the desalination plant and returned back in the form of electricity to the S.E.C. and thus reducing the need of diesel or natural gases driven machinery in line to reducing the amount of energy being consumed in a process and thus ensuring a cleaner and healthier environment.

Municipal Liquor wastes, also known as sewage wastes are another type of wastes being produced in the S.E.C. This type of waste will be treated by sewage treatment processes to produce sludge and effluent or safe reusable water. The effluent can be used in irrigation systems, cleaning modes or for the AC's cooling towers while the sludge will be mixed with other organic waste for a co-composting process as described in the coming paragraph.

The organic food wastes in line with yard wastes, grass and leaves wastes will undergo a co-composting which is aerobic waste decomposition process where the waste is stacked in piles for fermentation using the sludge produced from the municipal liquor wastes (sewage wastes) loop

discussed before in addition to some additives like rock phosphate and potassium. which are to be added to adjust the desired output from the co-composting stage which are organic fertilizers that will be added on the golf land or green areas within the S.E.C so as to increase its fertility and this will be the forth closed loop within the S.E.C community.

The sustainable zero waste ecotourism community novel approach discussed is designed to serve the community for a healthier, safer and pollution less environment by applying cradle-to-cradle approach in all of the available waste production types and thus ensuring zero waste strategy is being applied. In other words, ensuring that the produced output wastes are being used as input products within S.E.C.

CONCLUSION:

Tourism is counted to be the primary source of living for most of the developed and developing countries due to the benefits it brings along from the economical side and social perspective. Yet it was thought by some shareholders that the natural resources are present in infinite amounts and thus giving themselves the right to consume as much as they want even in an unplanned manner of resources usage leading to an imbalance in the ecosystem. With the introduction of sustainability in 1992 shareholders started to reconsider their daily activities within a touristic community however, since sustainability and ecotourism are new concepts having millions of authors, writers, public figures and community concepts that all lead to a misleading or a vague concept and guidance. Thus there was a need to integrate the common practice of ecotourism with sustainability with ecotourism in a novel approach of using a zero waste strategy to have a fully environmentally friendly Sustainable Ecotouristic Community from the beginning of raw materials extraction from the nature going through environmental processing/ treatment and usages till safe/ environmental waste utilization, reusing or recycling of products. This is all tending to conserve the environment and the natural areas and resources ensuring that there will be no deficiency in natural resources for the upcoming generations.

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APPENDIX II-

BEYOND ZERO WASTE CONCEPT, A REVOLUTION FOR SUSTAINABLE COMMUNITY

BEYOND ZERO WASTE CONCEPT, A REVOLUTION FOR SUSTAINABLE COMMUNITY

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A BSTRACT

A community reflects a big number of citizens grouped in an area, sharing common characteristics, traditions, lifestyle and daily needs. People within a community will affect the area and surrounding citizens as per their daily acts and traditions as well as being affected by the surrounded environment too; meaning that the community and the people living within are interconnected where the action of one end will lead to a reaction in the other. Thus there is a need to introduce the concept of sustainable communities, which focuses on water, air quality, wastes, energy and materials being more of a marketing word nowadays to companies, industries, governments and communities. However, since natural resources are being abused to a big extend that currently some living categories cannot access. This leads to widening the gap between the rich and the poor thus diversifying the community. In addition to, negative actions are impacting the surrounding environment leading to an undesired living standards and lifestyle like the accumulation of wastes and the consequent rise of diseases and pollution.

In brief, the objective of this thesis research is to propose a zero waste practical approach for urban communities, hoping to reach a common ground of understanding. While also having defined set of actions towards having a balanced environment and ecosystem for a better, balance, pollution-free life and natural resources management for future generations' needs.

Key Words: Sustainable Community, Sustainability, Cradle-to-Cradle concept, Zero-Waste Concept, Waste Management

INTRODUCTION

A community is a public access place where there are common things shared together with the community members, it can sometimes be divided into sub-communities which are often interconnected formulating the traditions and habits of the bigger community. For instance an urban community can be divided into residential, medical, educational and business communities, when they are interconnected they align with the bigger community pre-defined image. It is important to understand the surrounding community as it is the place where a person belongs while sharing information and holding social interactions. This helps in ensuring easy communication between community members for a convenient living that will lead to a dynamic and interactive living aiming at enhancing the community. (Community Health and Development).

Urban Community is the most important type of communities as it is counted to be the biggest landscape area with a high density of population when compared with rural and other communities. As shown in figure 1, in the year 2000 the total population in urban areas worldwide was counted to cover 47% which is approximately 2.8 billion people and it is projected to increase by 2025 to 60% (University of Michigan, 2006). In addition of being a more stable community for both individuals and families while offering more job opportunities as it includes industries, businesses and commercials, leading to the need for different specializations for work. In other words, an urban community will then be diverse in habits, customs, traditions and religious beliefs as well as class levels extremes between community members (Mondal, 2015). Thus an urban community is the center of attention in any country and it should reflect more of sustainability acts, more of better lifestyle and economical standards.

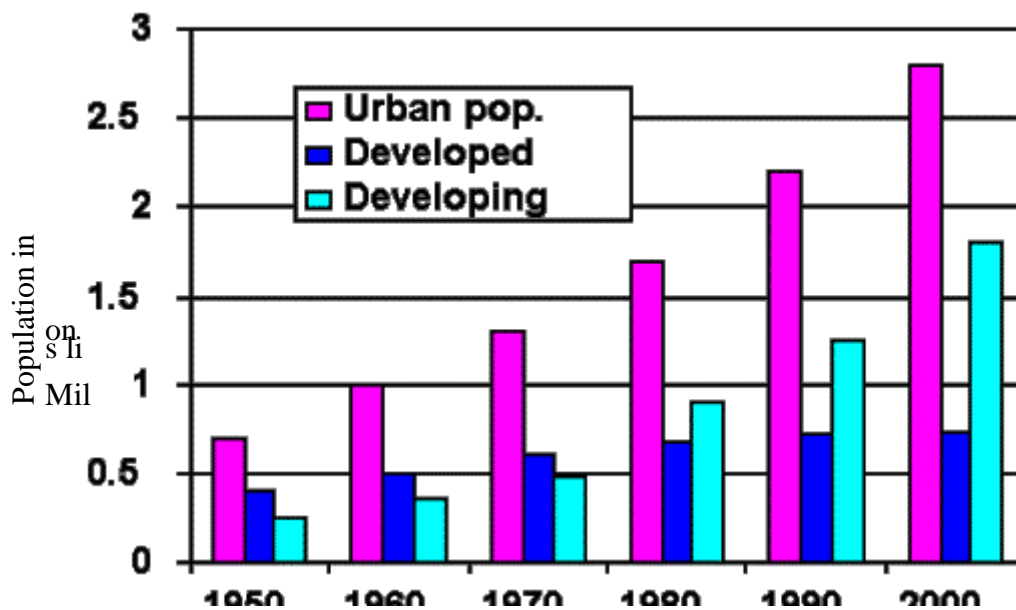


Figure 37: Urban Population Rate (University of Michigan, 2006)

IMPACTS OF URBAN COMMUNITY ON THE ENVIRONMENT

With the high level of urbanization and the urge of having a better lifestyle in line with the increase in the number of industries serving more daily needs thus natural resources are being not only used but consumed and abused so as to meet these exceeding needs. The produced products which are consumed by customers are facing a problem in environmental disposal leading to an increase in the environmental pollution in air, water, energy, material, land and soil. As time is passing and natural resources are being used each day more than the other, this will lead to a depletion of the available possessions gradually leading to a scarce society. This will not be able to meet the needs of the current so as to account for the future generations in addition to living an pollution-full environment.

In brief, currently urban communities are causing a threat on the surrounding environment that if maintained as is, this will lead to a more unstable ecosystem and community. That is why the introduction of sustainable community concept which reflects acts on land, water, air, energy and materials is important; however, the main focus of this thesis research will only be on waste management according to zero waste concept as it is considered the highest category of pollution and materials abusing mode in addition to its impact on land, water, air and soil.

So there is a need for a sustainable community according to (M. K. Smith) where citizens has to ensure their right of having:

1. Acceptable air and water quality.
2. Acceptable healthy food
3. Proper Life style
4. Acceptable Education Level in a lively culture.
5. Encouraging the inhabitants for a satisfying working level
6. Public Places safety, freedom of the citizens yet serving to their own rights and welfare.
7. Equality of rights and job opportunities should be present, regardless of the age, sex, religion, nationality and color.
8. Proper public transportation being accessible to each living standard citizen, also properly maintained for old people and disabled ones.

Reaching a sustainable community will lead to a better lifestyle that is full of secure and encouraging atmosphere for a more productive living. It will also lead to less urge to travel to somewhere less polluted or less dense.

WASTE CHARACTERISTICS

Wastes being defined as getting rid or throwing of used and no longer needed materials in trash bins. It is varying directly proportional on the population number in line with the enhancements technology is growing through and materials used to produce the needed product. Lately, as wastes started to accumulate in the streets and landfills as pollution level started to increase for example, visual pollution, air pollution which results from burning of wastes, land and soil pollution. This happens by the accumulation of wastes in landfill

left over for natural degradation which can take up to years, the rise of diseases resulting from the attraction of flying insects and animals to the “waste accumulated lands” and lastly, the most noticed and un-solved problem of natural resources depletion.

Communities are heading backwards by ignoring the negative effects waste accumulation and improper utilization is leading to. Thus there is a need to study sustainable communities, waste management process that when followed or abided to will lead to the enhancement of lifestyle.

URBAN COMMUNITY AND SUSTAINABILITY

As an urban community is considered to be the densest type of communities in comparison with rural, tourism and suburban communities. Urban communities are defined as big cities or towns in general that include all types of activities involving a full citizens' lifestyle on a regular basis unlike tourism industry for instance which is a seasonal community primarily present for entertainment and leisure. Urban communities should include but not be limited to residential areas, food, drinking, schools/ universities, work places, industries, factories, entertainment areas, shopping malls and resorts for tourism focus and leisure.

Saying that about urban communities and how densely populated they are, leads to introducing facts about waste generated in such high population cities. As technology is always in advancement in terms of products offered, different features and different materials being used for a non-corrosive product, non-scratchable material, and water resistant materials. For instance, this all leads to the introductory of new materials compositions that are studied on how to produce but not how to reuse or recycle thus they tend to be disposed leading to an increase in the level of wastes dumped in landfills for instance. In addition to the difference in society cultural levels and areas, the waste types will differ; when comparing the types of wastes/ waste composition and quantities found in moderate and rich areas, they tend to be different and slightly more than poor areas whose citizens have low access to products affordability and resources, this reflects back on the wastes characteristics, composition and density. Yet at the end of the day all types of wastes from different areas are being collected and disposed in the same manner regardless if they are in a poor or rich side of the urban community.

Mentioning the different types of wastes that are generated from an urban community in general and as shown in figure 2. An urban community includes residential areas, industries, commercials like stores, hotels and office buildings, institutional like schools and hospitals, Construction and Demolition wastes (C&D) which result from renovation sites, new construction sites or demolition of buildings. Also, municipal services wastes that result from cleaning the streets, landscaping, wastewater treatment and recreational areas and lastly, agriculture wastes like crops and greeneries. The types of waste generated are categorized as paper, plastics, cardboards, metals, food wastes, hazardous wastes, ashes, wood, steel, concrete, industrial process wastes and pesticides (Tadesse, 2004).

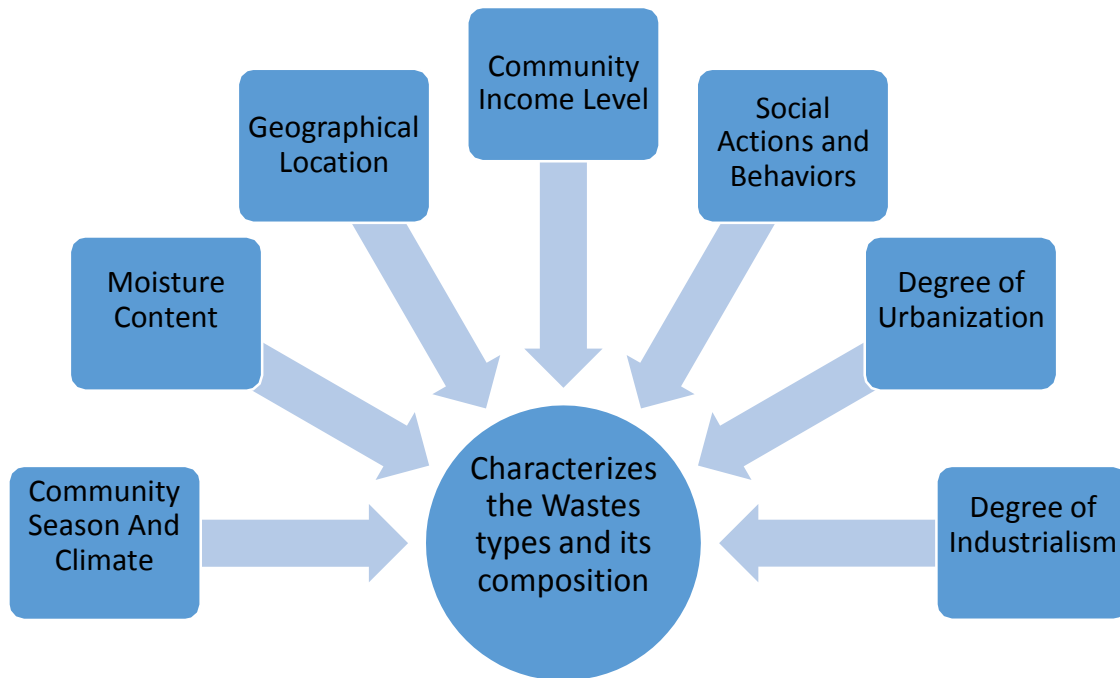


Figure 38: Urban Community Wastes characteristics, composition and density (Gaurav K. Singh, 2013)

Before analyzing how to utilize resource and waste management and after understanding the characteristics of waste types and composition as shown in figure 3; defining the sources of wastes in urban community is essential in understanding the types of wastes produced by each sub-community category and how sustainably they can be utilized. Industries with different types are consuming a lot of materials and producing massive amounts of wastes and rejects in return. In addition to commercial and business buildings which are famous with the leftover paper and cardboard wastes. Organic wastes are common types of wastes mainly in residential buildings, landscapes wastes and agricultural wastes for agricultural areas and lands, municipal services like street cleaning water and chemicals wastes types being disposed in drainages and lastly construction and demolition (C&D) wastes which are categorized in asphalt, bricks and wood.

A common misconception for many citizens, organizations and governments is that wastes are un-needed leftovers; however, the end of product waste can be used in the regeneration of another product or energy source input to another process. As the community is a closed loop where the inputs at one stage will be the output at another meanwhile after processing they can be the inputs again for another process as illustrated in Cradle-to-Cradle concept (El-Haggar). Afterwards, introducing a modified technique for wastes management will be proposed in this thesis research, but before doing that, understanding the most common waste management process will assist in identifying the current mindset of people and how to enhance the thinking strategy for a more sustainable acts.

TRADITIONAL WASTE MANAGEMENT

Figure 4 shows the most common waste management process that has been used worldwide in most of the developing and developed countries for decades. Starting with on-site handling meaning waste management or segregation at home or facilities and industries and it usually relies primarily on awareness and the presence of the needed tools and materials. These supportive tools are like storage containers, different trash bin bags colors referring to different types of wastes and in front of the building collector or container. Then the wastes collected will go to an on-site storage and processing that is divided into the collection process on how the wastes are collected and placed from home to the waste management facility and collection system which refers to the types of equipment used like collection trucks.

Moving on to the collection system which is the act of the trucks being on a schedule for specific number of daily/ frequency of collection rounds to collect the trash in the collector bins in front of the buildings or facilities. Wastes are being sent to transfer stations where it is separated under recycling or disposal which is the main rise of problems and easy task to do. This includes dumping of wastes in an open dumping site which is usually smaller than a landfill. The problem with open dumping is the creating of odor, attraction of insects and animals, insufficient usage of the land and surrounding ones.

Incineration is the second dumping process of burning garbage components, mainly combustible ones. As much as incineration helps in getting rid of un-needed wastes and producing heat for power from burning them. However, the problem with that is the generation of air pollution besides its cost of designing and building. Lastly is the composting of organic waste where there is natural degradation of wastes; as much as it could be counted as one of the best utilization methods yet the pH level, moisture content and carbon to nitrogen ratio should be maintained and managed so as to achieve the needed biodegradation results (Tadesse, 2004)

With reference to all the major problem remains unsolved, now with the problem of increasing number of population and high needs limits accordingly. Thus industries tend to use more of the natural resources to produce the needed amounts of good and services and this leads to abusing the available resources which are scarce. This leads to the introduction of a concept that is not new, however it has been considered more of a philosophy than a needed solution strategy that is doable in reaching a sustainable and environmentally friendly community via proper waste usage, re-usage and recycling; this concept is known as the Zero Waste Concept.

ZERO WASTE CONCEPT

Zero waste is a strategical goal or more of a philosophy and a principle of design that was introduced in the early 1970s having different definitions as per the level of understanding and awareness to different community members. However most of them are centered about the concept of recycling for a whole system or a full product lifecycle so as to minimize the produced wastes and accordingly maximize the recycled products. Zero Waste varies in how its definition is introduced for instance in the Japanese Industries zero waste is known as zero defected products. Other definition is that “zero waste is a practical theory on how to obtain maximum efficiency from the use of resources” as defined by the Zero Waste Institute [(European Regional Development Fund, 2015) & (GrassRoots Recycling Network, 2015)].

Zero waste started in 1970s by community recycling programs pioneers however it was considered as a design approach rather than a source of solutions for a better living. Later on in the early 2000s Zero Waste was referred to as a practical theory to maximize production efficiency. And by Mid 2001 Zero Waste in New Zealand had a future approach till 2020 defining it as an eliminating tool rather than a waste management method aiming at a change in the way material are introduced in a production process. In addition to defining how the materials are managed in the society and then how are they returned back into products, this is from the environmental standard. Looking at the economic point of view, Zero Waste is defined as a way to transform the present cost into a more value added resources that should be used by the industry. Last but not least, for the social point of view, Zero Waste will provide a self-sustained community that will provide job opportunities, better livings, and efficient lifestyle. This will better the current economic stands which will reflect on the surrounding social life within the community. Lastly, it is focused on excluding any concept for landfills, disposal fees and illiteracy of waste management while including environmental designs, educational programs within the schools, trainings and research studies, green regulations, branding for zero waste businesses and including resource recovery infrastructures (European Regional Development Fund, 2015).

As per the Institute for Zero Waste in Africa (2015) which identified the common zero waste beliefs among people giving wrong or misleading information about it, and maybe that is why Zero Waste concept is always seen as a philosophical concept rather than a design strategy.

- Redesigning products and packaging: Implementing a clear and clean design and production technique starting with the planning of natural resources usage till minimization of the recovered materials through the production process is one of zero waste aims.
- Producer Responsibility: The manufacturer is held responsible physically and financially for the “cannot be recycled” types of wastes; and this prevents or decreases the presence of waste in the incinerators or the landfills.

- **Infrastructural Investment:** Encouraging the community to invest in new resource recovery facilities instead of using the tax money in increasing the landfills or new incinerators.
- **Monetary Efficiency:** Applying taxes and introducing policies that makes that prevents any usage of natural resources by manufactures and finding an alternative way to produced products is a must.
- **Job Creation:** If the waste in the incinerators and landfills were usefully re-processed again to be reproduced in other forms of products, this would certainly help the society environmentally and economically by introducing almost 10 times more and new job opportunities.

ZERO WASTE CONCEPT AND CRADLE-TO-CRADLE

One of the new sustainability generated concepts is “**zero waste**” which is referring to studying the use of resources for long term efficiency. Zero waste can be achieved efficiently while following the Cradle to Cradle approach (El-Haggar, 2007).

The concept behind the sustainable urban communities is to follow cradle-to-cradle approach. As shown in figure 5 it is a close loop starting with the raw materials extraction from earth (cradle) till it is returned back sustainably to earth following a safe utilization process. This process starts with raw materials extraction going through the needed processing and manufacturing of materials then packaging to be transported to the corresponding factories or stores then used in homes and then the wastes are divided into recyclable or reusable wastes. The wastes are collected and sent to a transfer station which will check for the needed recycling ones to be done on-site, else if any recyclable material cannot be done on-site then it will be sent to an off-site recycling. And this is to ensure to optimum and most efficient use of resources and reusing of products.

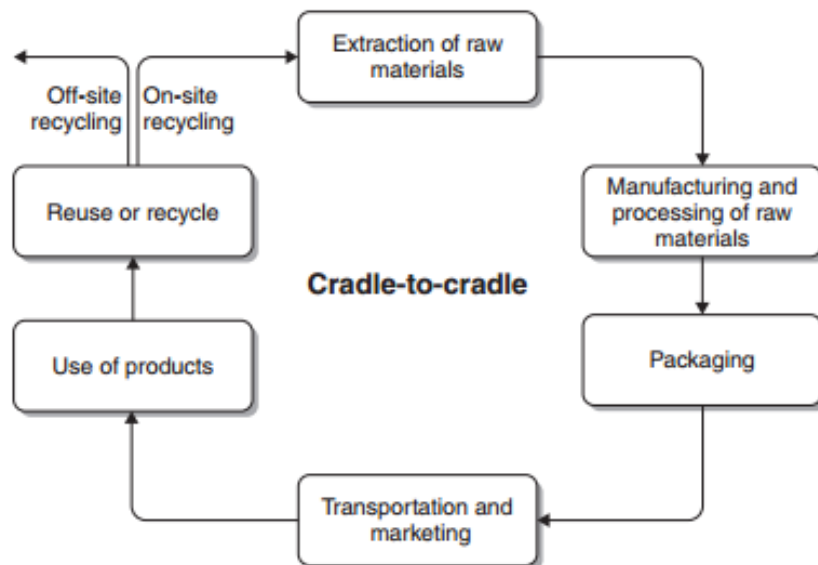


Figure 39: Cradle-to-Cradle Approach (El-Haggar)

CASE STUDIES

Some case studies showing how Zero Waste Concept has started and evolved in two different countries, Sweden and USA.

A. Sweden's Recycling Revolution (The Swedish Institute)

With a population less than 10 million person, starting with recycling 38% of household wastes, which are the daily usage products leftovers as bottles, organic food, cans and newspaper, in 1975 to being almost the largest and first country to recycle more than 99% of household wastes. Half of the household wastes that are collected are being burnt to be used as a source of energy, knowing that Sweden does import wastes from other countries so that it can increase its energy level production, while focusing on reusing materials in another form even so as to ensure less energy is being used in creating a new one from scratch.

Wastes are being separated into different categories like newspapers to be turned into paper mass, lightbulbs, batteries, glass, bottles to be reused as new items, metal, and even food wastes are to be separated into those being recycled, reused or composted to ensure that whichever is sufficient has been used as biogas or soil; while purifying the wasted water to a big extend to be potable.

B. Proctor & Gamble – USA (Business Sector Media, LLC, 2014)

As P&G has committed to produce sustainable brands, that by 2020 it will be sending zero wastes produced by manufacturing to landfills by applying zero waste concept which it defines as *“zero manufacturing waste disposed directly to landfill or incineration without energy recover by the site, except where local legal requirements specify that regulated wastes must be disposed in a landfill”*.

P&G is working towards improving packaging and design of the product by a “lifecycle thinking”, which is reflecting back on a sustainable brand which started through a consumer sustainability study which conducted that minority of consumers believe in any environmental named product and are willing to buy these products even at higher prices and lower performances. However the majority of consumers are not willing to go for this trade off specially when it comes to paying more for a commodity that will not meet their needs fully; thus P&G decided to enhance their product strategy to be from “sustainable and nice to have” to need to have”, an example to that is their study to producing a washing machine soap that would help users in washing using cold water without any decrease in performance while also converting 70% of washing machine load. Another lifecycle thinking approach is by reducing production process produced solid waste.

PROPOSED ZERO WASTE CONCEPT FOR URBAN SUSTAINABLE COMMUNITY

The flowchart in figure 6 introduces a cradle-to-cradle zero waste concept model for a sustainable zero waste Sustainable Urban Community (S.U.Z.C.) which produces municipal solid wastes (MSW) which are defined to be the daily wastes; being divided as non-organic MSW and Organic food wastes. All of the wastes are collected from the S.U.Z.C.. where the non-organic MSW are being sent into a transfer station which is defined as waste management sites allowing for safe waste utilization systems unlike landfills (El-Haggar). The collection trucks transfer/unload the wastes from a location to the transfer station. In a transfer station facility the wastes are further separated and larger trucks can send the segregated wastes into recycling facilities, that the recyclables or products and materials that can be reused are being transferred to their facility of specialty and after being recycled or modified for reusing; the products such as coat hangers and waste plastic bags are resent back to the S.U.Z.C.. and this aims at environmentally reusing the generated wastes (by recycling or reusing) also minimizing the amount of natural resources needed to produce new products and this all leads back to another closed loop of MSW from and to S.U.Z.C. as shown in figure 6.

Then the construction and demolition (C&D) wastes which result from destruction of an existing building in an existing community or the construction of new buildings in new and existing communities. The types of wastes extracted from this phase can be categorized as ceramics, marble, bricks, concrete in addition to many other materials that when processed can result in other construction and materials such as paving interlocks, bricks and plain concrete.

Municipal Liquor wastes, also known as sewage wastes are another type of wastes being produced in the S.U.Z.C.. This type of waste will be treated by sewage treatment processes to produce sludge and effluent or safe reusable water. The effluent can be used in irrigation systems, cleaning modes or for the AC's cooling towers while the sludge will be mixed with other organic waste for a co-composting process (El-Haggar, Sustainable Industrial Design and Waste Management, Cradle-to-Cradle for sustainable development) as described in figure 6.

Then the black water going to a Municipal Waste Water Treatment Plant (MWWTP), the organic food wastes in line with yard wastes, grass and leaves wastes will undergo co-composting. Co-composting is aerobic waste decomposition process where the waste is stacked in piles for fermentation using the sludge produced from the municipal liquor wastes (sewage wastes) loop discussed. These in addition to some additives like rock phosphate and potassium. which are to be added to adjust the desired output from the co-composting stage which are organic fertilizers. These organic fertilizers will be used for organic farming and can be added on the golf land or green areas within the S.U.Z.C. so as to increase its fertility and this will be the forth closed loop within the S.U.Z.C. community.

Lastly, for the grey water produced from the S.U.Z.C., it will undergo treatment so as to be re-used again in toilet flushing, and the excess of grey water with the excess of black water discussed earlier can undergo further treatment to be used for landscape and irrigation.

The sustainable zero waste community strategy discussed is designed to serve the community for a healthier, safer and pollution less environment by applying cradle-to-cradle approach in all of the available waste production types and thus ensuring zero waste approach is being applied. In other words, ensuring that the produced output wastes are being used as input products within S.U.Z.C.. thus saving natural resources, reducing waste accumulation level, introducing new job opportunities and enhancing the economic standards of the community as well as its lifestyle and lastly reducing pollution; all leading to serving the community and having a balanced eco-system.

CONCLUSION

As much as urban communities are grouping citizens from different areas under different fields, being a safe place for families to live in where they can find all of their needs provided in terms of services, food, transportation and products as much as this is causing an environmental threat in terms of water, energy, resources, materials and wastes accumulation. As population increases in a certain area specially without any prior design for the community to occupy the high population, this leads to the urge in extracting more natural resources to be able to provide the needed services, leading to abusing the resources and causing its scarcity.

Abusing natural resources means that it is a matter of time and these resources will not be available anymore for extraction and usage, leading to shortage of materials and lack of product sufficiency not only affecting the current population but also threatening the future ones. Thus there is a need to introduce the concept of sustainable community while integrating zero waste concept which is the main focus of this thesis research. The introduction of a proposed zero waste practical concept to conserve not only the waste but accordingly the water, air, materials, energy and natural resources in general.

As illustrated earlier in Figure 6 that reaching a sustainable urban community while applying the zero waste concept is an easy step worth studying and implementing. Looking at the urban community products from wastes from C&D, MSW, organic, yards and landscapes, grey and black water, all can be treated or undergo some processing steps resulting in a modified product mode like recycled products, organic fertilizers and treated water for irrigation and toilet flushing. By this, the urban sustainable community can be said to be a self-sustainable, closed-loop area that ensures the natural resources are put in appropriate first time usage and several re-usage and thus preventing their depletion.

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APPENDIX III:
MADINATY- NEW CAIRO
SUPPLEMENTARY DOCUMENTS

Appendix III is about Green Buildings in this thesis are integrated with the schools and worship are in this thesis based on Madinaty case study. Madinaty has the design for the school and mosque for being identified as green buildings.

1. British School Madinaty:



Figure 140: British School Madinaty

It consists of:

- 2 Chillers (450 TR Direct Fired Absorption Chiller with Lithium Bromide chemical)+ 2 Heaters currently working with **DIESEL**



Figure 2: High Capacity Chiller/ Large Tonnage Chiller (LTC)



Figure3: Diesel Heater for the LTC



Figure 4: Small Tonnage Chiller (STC) and piping

- 4 WATER TANKS (2 for hot water storage and 2 for cold water storage)

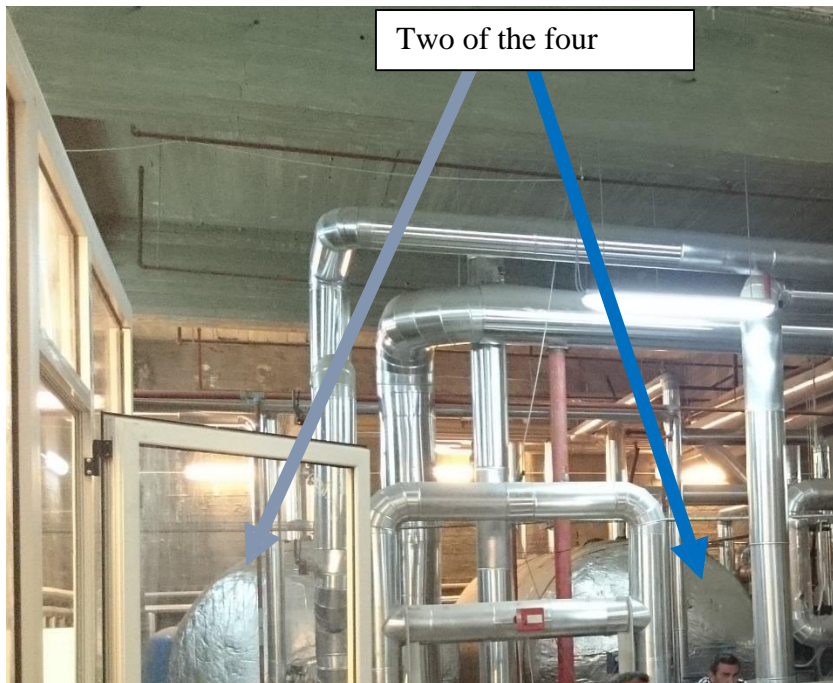


Figure 5: Water Tanks



Figure 6: Cooling Towers

- During Summer:
 - Water is heated via Solar Cells placed on the School roof
 - This hot water goes in pipes to the hot water storage tank
 - It should be ≥ 75 deg. Celsius for the Small Capacity Chiller to start running, producing cold water into the cold water storage tanks.
 - *If the hot water temperature is not sufficient enough, the heater (currently working with Diesel) will start up to heat the water.*
 - For higher capacity of cooling, the 450 TR Chiller starts running in parallel so as to heat water (as this type of chiller has its own heater), when it reaches the required temperature, it stops.
 - There are no FCU's in the school corridor (i.e. No Cooling or Heating in the Corridor)
- During Winter:
 - Only the Smaller capacity chiller runs with the Solar Panel Cells heating.

2. Swimming pool:

- Higher temperature water are used for the swimming pool heating and thus reducing the Diesel Heater usage for boiling water.
*** There is online system backup for the chiller data, it can be accessed by the customer on the computer and there is online monitoring & control from the Italian company in Italy ***
- There is a room which has a heater working with Diesel and pumps specifically for the swimming pool water heating.
- In the swimming pool area, the AC works only during the swimming training time. I have noticed that the ducts over the swimming pool ceiling are NOT covered even with a decorative ceiling. This with any extra humidification, water will condense on the ducts causing them to rust and thus affecting the efficiency of the Air Conditioning system that will required more heat and thus more Diesel to be used for heating...
- Also, I have observed water leakage from the ducts over the swimming pool ceiling.



Figure 7: Madinaty "In-School" Swimming Pool



Figure 8: Non- Decorative Ceiling Ducts



Figure 9: Swimming Pool Water Heater



Figure 41: Swimming Pool Heater Pumps



Figure 11: Diesel Container to run the Heater



Figure 12: Ceiling Suspended piping from the pool to the Heater room

3. Classrooms:



Figure 13: BSM Corridor <http://www.tbs-madinaty.com/album/Our%20School/index.html#madinaty17.jpg>



Figure 14: BSM Classroom <<http://www.tbs-madinaty.com/album/Our%20School/index.html#madinaty14.jpg>>

- The main thermostat is placed in the first classroom, partially managing for the following 3 classrooms.

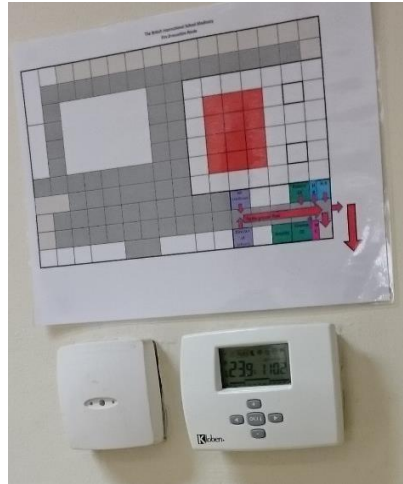


Figure 15: First Classroom Main Thermostat

- There is a temperature thermostat which is designed for input needed temperature according to the weekday and time. It is currently set for Low Air Supply during night time and higher during day time.
- The Temp. Thermostat has inside logos for Sun (Morning), Moon (Night Time), 1→7 (Weekdays starting Monday) and 24 dots (representing 24 hours per day).
- Humidity Sensor → Works according to the set point, if the humidity is less than the set point then it will give an order to the hot water valve to open to supply more water for the AC system.

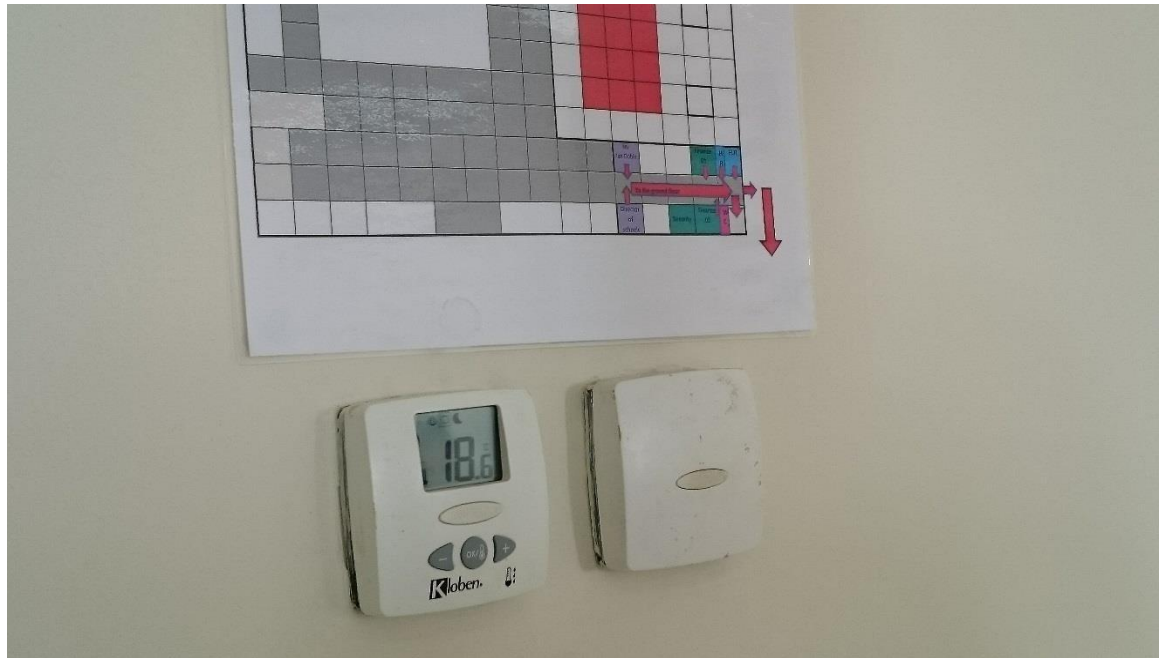


Figure 42: Other Classrooms Temperature & Humidity sensors

- The classroom ceiling has water pipes on top of it, so that the pipes are covered with the classroom ceiling.



4. Mosque:



Figure 17: Madinaty Mosque <<https://www.youtube.com/watch?v=5LsNrYyABuo>>

- There are 60 Solar Cells + 1 Heater + 2 small chiller with hot water.
- The chillers start up before the prayer with 1 hour and they are switched off after the prayer with 1 hour.
- Bathroom:
 - Hot water in the bathroom comes from the solar panel heated water.
- 1) On the Roof:
 - Solar Panels (they are composed of insulated tubes)

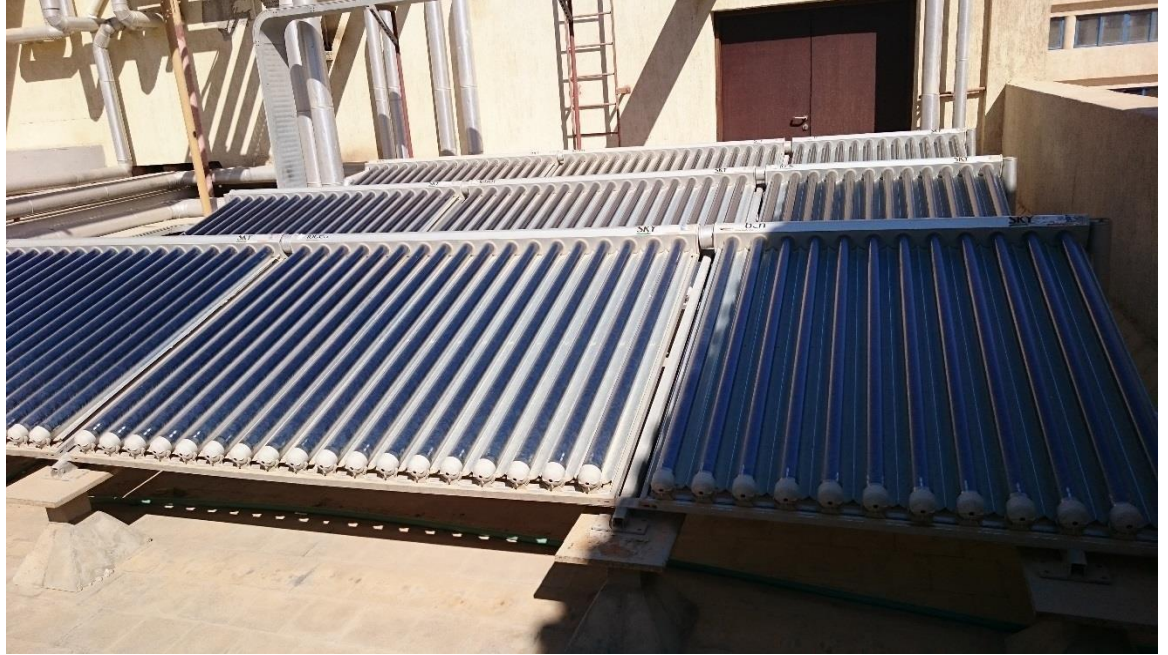
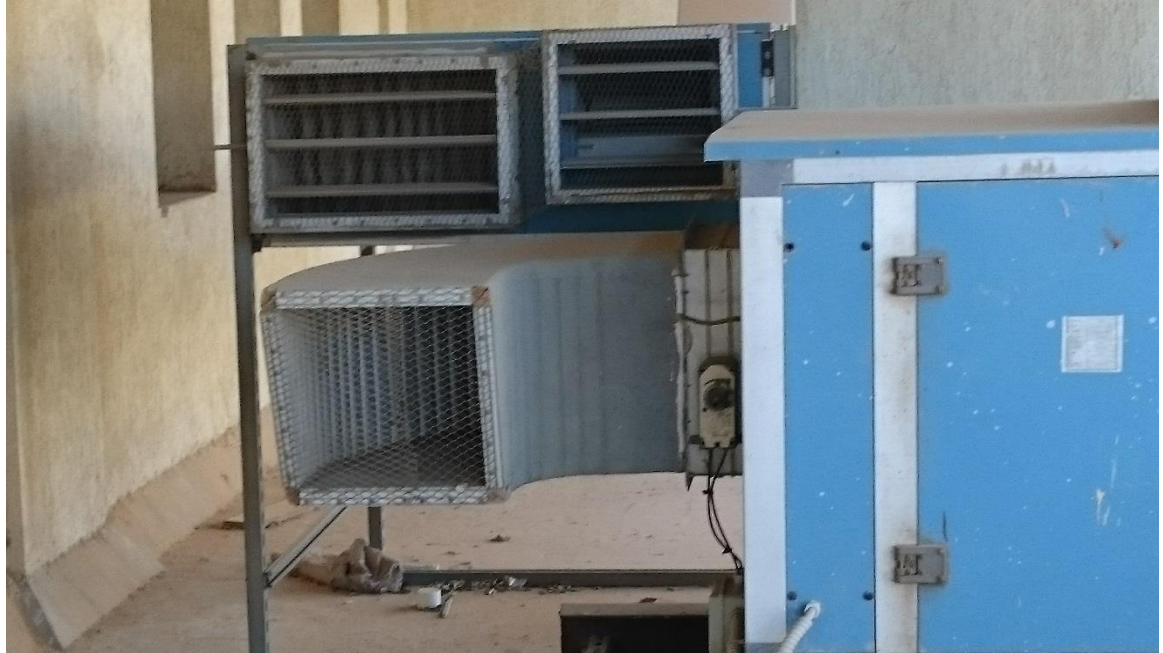




Figure18: On Roof Solar Pannels

- Regenerators (for Fresh Air Supply to enter my AHU)
- Air Ducts are P3 (AL+Foam) coating, they are from Italy and they are of high quality unlike the Steel ducts in Carrefour for instance. Those do not rust and no air condensation occurs on them



*Figure 19:
Regenerators*

- 8 AHU's → 2 for the Gym, 2 for the Theater and the others are for the big offices and classes.



*Figure 20: Air Handling
Units (AHUs)*

- Motors → They distribute water either cold or hot to the FCU's either to the Radiant (Ceiling) FCUs or the general in Class FCUs.
 - Blue Pumps → For the AHU's. They are 2 tubes pumps (same two tubes are filled with cold water in summer are the same ones filled with hot water in winter).
 - Silver Pumps → For the solar panel cells to circulate the water.
 - The roof is divided into 5 sections, each section of solar panels has its own silver colored pump.
 - If my water temperature >130 deg. Celcius, thus my Blue Big Tanks of Relief Valves do open to allow the hot air out, thus reducing pressure and hot temperature from the solar panels hot water.
 - The Relief Valves Tanks are used for safety measures, if the steam temperature inside the solar panels system increased 130 Degree Celsius then they will automatically open to release the hot gas and thus reducing hot temperature and pressure.



Figure 21: Solar Panels Motors and Pumps



Figure 22: Relief Valves

- Cooling Towers (outside the school):
 - 1 Big Cooling tower for the smaller capacity chiller
 - 2 small Cooling Towers for the bigger capacity chiller

APPENDIX IV: SUSTAINABLE COMMUNITY TOOLS