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البريطانية في  
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British University  
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## **Exploring Successful implementation of Sustainable Construction Management Practices in Dubai (UAE)**

دراسة التطبيق الناجح لأساليب إدارة الإنشاءات المستدامة في دبي (الإمارات  
العربية المتحدة)

by

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of the requirements for the degree of  
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## **Abstract**

The rapid urbanisation and rising needs for upgrading style of management in growing countries such as UAE, to cope on with global environmental demands and tendencies, has been crafting real opportunities in adopting sustainable construction management approach and its useful applications.

Sustainability is a concept refers to fulfilling the needs of present generations without compromising the future ones. Rising devotion become trending in construction sector to consider the different dimensions of sustainability, including ecological, social, and economic, then incorporate them into stages and operations of construction works, to get on balanced sustainable and economical final product, serving the requirements of the community.

Sustainability as an agenda, which is extended deeply into the structure of society, economic viability and environmental revitalisation, which can improve project performance management process, through planned incorporation into existing management systems, and then it would be recognised as an opportunity to enhance construction management performance by improving effectiveness and competency of processes and outputs.

All parties involved in construction management must realise the importance of shifting in the processes, for sake of creating built environment from linear to cyclical approaches to achieve sustainable management. In other words, sustainable construction management must change the way that all construction activities carried out with.

A network of multiple corporate management systems based on the quality, environment, work safety, stakeholders, and knowledge of integrated system of sustainability is essential to meet holistic criteria of sustainability. By applying maturity roadmap called STEPS (Start-up, Take-off, Expansion, Progressive and Sustainability), it is possible to ensure continual sustainable corporate level of management. Besides the STURE (Stakeholders-Urban Evaluation) model represents the best possible approach to sustainable construction management, to a single or multiple construction projects, which optimises the sustainable demands of the clients and stakeholders.

Construction field is complex and fragmented, therefore tends to resist changes leading to sustainable development. Project managers and clients face barriers to sustainable management implementation, e.g. lack of sustainability measures, real and perceived conflict of interests, and inadequate expertise.

Adopting Sustainable construction management comprehend many opportunities, including environmental, legislative, social and even economic, which adds important value to the construction filed as process, operations and end-product.

This research studied the assumed crucial factors contributing in successful implementation of sustainable construction project management practices in Dubai by using quantitative methodology, conducted via surveying representing sample, amongst professional, within construction field of Dubai. The examined factors, which are adopting relative legislation supporting proper implementation, Incorporation of Sustainable practices at project and corporate levels and board of director adoption, developing and spreading knowledge management in relation to sustainability and sustainable construction management, and stakeholders' management and involvement in construction projects, were found significant and contributing fairly in attainment successful practice of sustainable construction management in Dubai.

## نبذة مختصرة

إن التوسع العمراني السريع والاحتياجات المتزايدة لرفع مستوى أسلوب الإدارة في البلدان النامية مثل دولة الإمارات العربية المتحدة، للتعامل مع المتطلبات والاتجاهات البيئية العالمية، أدى الى صياغة فرص حقيقية في اعتماد نهج إدارة البناء المستدام وتطبيقاته المفيدة.

الاستدامة هي مفهوم يشير إلى تلبية احتياجات الأجيال الحالية دون المساس بالأجيال المستقبلية. إن الاهتمام المتزايد بأساليب البناء المتقدمة أدى الى تصاعد الاهتمام بأبعاد الاستدامة بما في ذلك البيئية والاجتماعية والاقتصادية، ثم دمجها في مراحل وعمليات أعمال البناء، للحصول على منتج نهائي مستدام ومتوازن اقتصادياً بما يخدم احتياجات المجتمع.

الاستدامة هي أجنحة تمتد بعمق إلى هيكل المجتمع، بما يحقق الاستدامة الاقتصادية والمحافظة على البيئة، والتي يمكن أن تحسن عملية إدارة أداء المشاريع من خلال دمجها في أنظمة الإدارة القائمة، بما يؤدي الى الاعتراف بها كفرصة لتعزيز أداء إدارة البناء من خلال تحسين فعالية وكفاءة العمليات والمخرجات.

يجب على جميع الأطراف المشاركة في إدارة البناء أن تدرك أهمية التحول في العمليات الإنشائية من أجل خلق بيئة عمل تتحول من النهج البسيط التقليدي إلى النهج الدوري المدروس لتحقيق الإدارة المستدامة. وبعبارة أخرى، يجب أن تغير الإدارة المستدامة للبناء الطريقة التقليدية التي تنفذ بها جميع أنشطة البناء.

إن وجود شبكة من أنظمة إدارة الشركات المتعددة على أساس الجودة والبيئة وسلامة العمل والجهات المنخرطة ومعرفة نظام الاستدامة المتكامل هو أمر ضروري لتلبية معايير الاستدامة الشاملة. من خلال تطبيق نماذج تمثل خارطة التشغيل مثل "سبب" بما يعني (البدء، الانطلاق، التوسع، التقديمية والاستدامة) بحيث يصبح من الممكن ضمان استمرارية نهج الإدارة المستدامة على مستوى الشركة. بالإضافة الى جانب نموذج "ستور" الذي يعنى بالأطراف المنخرطة صاحبة المصلحة وتقييم التحضر والتطور المنهجي وبما يمثل أفضل نهج ممكن لإدارة البناء المستدام، سواء لمشاريع البناء المنفردة او المتعددة، والتي تعمل على تلبية المطالب المستدامة للعملاء وأصحاب المصلحة.

إن قطاع الإنشاءات بطبيعته معقد ومجزأ وبالتالي يميل الى مقاومة التغيرات التي تؤدي الى التنمية المستدامة وبالنتيجة يواجه مدراء المشاريع وأصحاب العمل عوائق عديدة تؤثر على تنفيذ وتطبيق الإدارة المستدامة مثل الافتقار الى إجراءات الاستدامة وتضارب المصالح وعدم توافر الخبرات المطلوبة. وبالمقابل اعتماد إدارة الإنشاءات المستدامة يحمل العديد من الفرص، بما في ذلك الفرص البيئية والتشريعية والاجتماعية وحتى الاقتصادية، مما يضيف قيمة مهمة إلى البناء من ناحية العمليات والبناء الناتج.

هذا البحث قام بدراسة العوامل المقترضة والمهمة التي تساهم في التنفيذ الناجح لتطبيقات إدارة مشاريع البناء المستدامة في دبي وذلك باستخدام منهجية دراسة كمية، تم إجراؤها عن طريق جمع المعلومات من عينة تشمل المحترفين في مجال الإنشاءات في دبي. العوامل المدروسة في هذا البحث هي اعتماد التشريعات المناسبة التي تدعم التنفيذ السليم، وإدماج تطبيقات الإدارة المستدامة على مستوى المشروع والشركات من خلال اعتمادها من مجلس الإدارة، وتطوير ونشر إدارة المعرفة فيما يتعلق بالاستدامة وإدارة الإنشاءات المستدامة، وإدارة الجهات المنخرطة وأصحاب المصلحة ومشاركتهم في مشاريع الإنشاءات بما يؤدي الى التطبيق الأفضل لإدارة البناء المستدام، وبالنتيجة تم في هذا البحث اثبات أهمية العوامل المذكورة في المساهمة في تحقق الممارسة الناجحة لإدارة البناء المستدامة في دبي.

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# 1. Introduction

- **Background:**

Sustainability is equivalent to durability of human being; it cares about current generation needs, but never compromises the next generations' right of living in suitable ecological system. The practical meaning of sustainability in construction sector is a comprehensive concept and dimensions, which are transformed into useful methods and practices engaged in construction phases, to sustain maintainable and durable buildings without compromising the features of luxury and cosiness of the facilities. Sustainability in construction filed pursues gratification of stakeholders, as it fulfils desires of the employers, customers and occupiers.

Lack of well consciousness of importance of sustainability, a lesser amount of incorporation of its conceptions and applications in construction field, and a need of implementing alternative sustainable solutions, put liability on the inventors and employers to produce sustainable products within established principles and approaches of sustainability, beginning with setting effective design during pre-construction phase, and utilizing effective construction techniques and effectual management style during execution buildings and infrastructural amenities.

Incorporating concept of sustainability in construction management is the key action toward development sustainable construction product. Reaching of green building product wouldn't be attained without creating a solid mechanism to adopt the sustainable concept into management tools and techniques, which are driving the construction process. Here it comes the importance of investigating and analysing the existing frameworks for sustainable construction management in order to derive a customised model that fit the organisation, programs, portfolios and projects, considering that each country, organisation and projects have their own unique criteria, which require a driving framework serving their needs toward accomplishing sustainable management practice.

**Aim:** The research aims to put focus on the concept of sustainability and sustainable construction management, and their importance in construction filed in Dubai. It highlights the conceptions and strategies to achieve sustainable end product, and establishes a framework of Management style, reaching to practical and Sustainable practice fitting construction sector in Dubai

**Objectives:**

- First objective: Set proper definition and KPIs of Sustainable Construction project and sustainability concept in construction filed.

- Second objective: to Highlight the factors, and methodologies reaching to sustainable construction project management practice, which are utilised for constructing sustainable buildings in Dubai.
- Third objective: Highlight the challenges and opportunities facing implementation of sustainable construction project management in construction filed in Dubai.
- Fourth Objective: Determine the influence of utilising sustainable project management practice on construction filed in Dubai

**Research Questions:**

1. What are the best definition and KPIs of Sustainable construction project and its link with sustainability concept in construction sector?
2. What are the key factors and methodologies needed to achieve sustainable construction management practice in construction sector in Dubai?
3. What are the challenges and opportunities facing applying sustainable project management in construction sector in Dubai?
4. What is the influence of implementing Sustainable project management practice on construction filed in Dubai?

## 2. Literature review

### 2.1 Introduction

Leading change toward sustainability, clearly illustrates, real change isn't only possible, and it can be strategically nurtured and implemented by following a path blazed by the "early adopters" of the sustainable business vision. (Doppelt Bob, 2017)

Population growth, economic development, and consumption of natural resources represent major challenges in our world. It's worthy to know that those factors are directly in strong relation and interaction with the Construction industry and its activities. (Ben Stubbs, 2008)

In the recent years, the awareness toward the environmental problems has been increased, especially in the construction field, in which buildings sector consuming huge amounts of energy and natural resources, eyeing to records, which show that 45% of world energy, and 50% of water are used by building sector, additionally the environmental record shows that building sector cause 23% of air pollution, 50% of greenhouse gas pollution, and 40% of water pollution. The previous recorded figures of impacts and effects which are caused by construction industry prove that the resulted solids disposals, water pollution, and gas wastes lead to negative threats on quality of life diversity, causing global warming, and polluting green and agriculture areas. (CIB and UNEB, 2002).

Today, integrating ecological considerations into construction field and maintaining harmony between buildings, and natural environment gives birth for new trend of buildings that achieve balance with environmental needs, which views the construction process as effective integrated components, that innovate designers and builders to attain results with maximum beauty, efficiency, and functionality considering relative effectiveness of materials, construction techniques, and operating procedures. (J.K.Yates, 2015)

Incorporating concept of sustainability with all its aspects into construction management practice is the key action needed to allow successful migrating toward sustainable construction management style, that focus on project constraints with added value of considering environmental impact in the functions of managements, and paying attention to sustainable aspects, when taking management decisions during preconstruction, construction and post construction stages. This would require understanding the requirements of

sustainability and its ingredients, then build it into construction management style, through tailoring suitable framework detailing the process of management, and map it with sustainable principles and actions ,leading to a style of sustainable management balancing between ,economic ,environmental and social impact that would be resulted through chain of command driven by structure of organisation and project individual needs and circumstances. (Holland Karin et al. 2011).However trending toward adoption sustainable management in construction organisations is linked strongly to the well of board of directors that's consolidated in companies' policies, in addition to implemented relevant legislations which is sourced by well of local Authorities to adopt sustainable end products, which are serving environmental tendency .

## **2.2 Sustainability:**

### **2.2.1 Definition and importance:**

The Brundtland Report of 1987 gives rise to Sustainability as a policy concept. It describes the tension among human desires to a better life on the first hand, while on the other hand it highlights the restrictions placed by nature. (Bartelmus Peter, 1994)

The question raised by Brundtland and her colleagues was: "How can the aspirations of the world's nations for a better life be reconciled with limited natural resources along with considering dangers of environmental degradation?" The Commission's answer was Sustainable development; which means" the development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The definition was over time reinterpreted as covering three relevant dimensions: social, economic and environmental. (Bartelmus Peter, 1994)

Thus, environmental concerns are essential, but the fundamental argument is economic and social welfare seen in an integrational fairness context. Since that time, the idea of sustainability has been experiencing three major dimensions, which should be in harmony: social, economic and environmental (Kuhlman Tom and Farrington John, 2010).

The need for long term solutions create the term of Sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" which is the most prominent concept during twenty-one centuries (Kim Jong-Jim et al. 1998). However, the concept of sustainability to be implemented requires clear defined principles that are integrated into practical management mechanism, allowing for realistic transition platform toward practices that are friendly to the environment, and at the same time taking care of social and economic aspects that each community is seeking for its prosperity and progressive toward modernisation.

### 2.2.2 Sustainability Practices vs. Construction Practices

Sustainable practices and construction practices are varying from perspective of Project management. Construction practices typically require well defined processes and activities in order to assess their efficiency, which is considered as construction codes and execution standards that are essentially used to control the construction and execution process. (J. Cole R, 2000)

Sustainable Practice is about considering environmental factors in construction process. Apparently there is an overall lack of understanding of the scope of environmental issues and their integration into the construction process. In general, there are three levels of sustainable practices: First level; which represents the principles that are described together as a global set of sustainability objectives, whereas the second level is about heuristics methodology, describing a set of regulations that are conveyed from sustainability principles. Then the final level is about characterising the specifications which are considered as detailed functional and observable measures for sustainability (Matar Mohamad M. et al. 2008).

The difficulties in understanding the differences between sustainability practices and construction practices prohibit proper implementation of sustainable construction standards in the industry, which give a need to develop rich study differentiate between both concepts, and draw the line to integrate and merge them into concept of sustainable construction practices through common management style.

## **2.3 Sustainable Construction -Conceptions and Dimensions**

### 2.3.1 Concept and basis of Sustainable Construction practice:

The terms green, high performance, eco building, and sustainable construction are used synonymously to describe building that are designed to have lower impacts on the environment; however, the term sustainable construction is the comprehensive concept which can be relied on.

Sustainable Construction is defined by CIB (Construction International du Batiment) as "creating and operating a healthy built environment based on resource efficiency and ecological design" (CIB and UNEB, 2002).

Traditional construction filed focuses mainly on project constraints including cost, quality, and time, but sustainable construction concept is a dynamic model serving and balancing relevant purposes that link human needs with the eco-systems health, so integration of sustainable concepts and construction filed results in paying attention to minimise environmental impacts, reduce



Consumption of resources, and generate healthy environment on the universal context, as seen in Figure 1: (Abdulrahman Ismail, and Hameed Aftab, 2013)

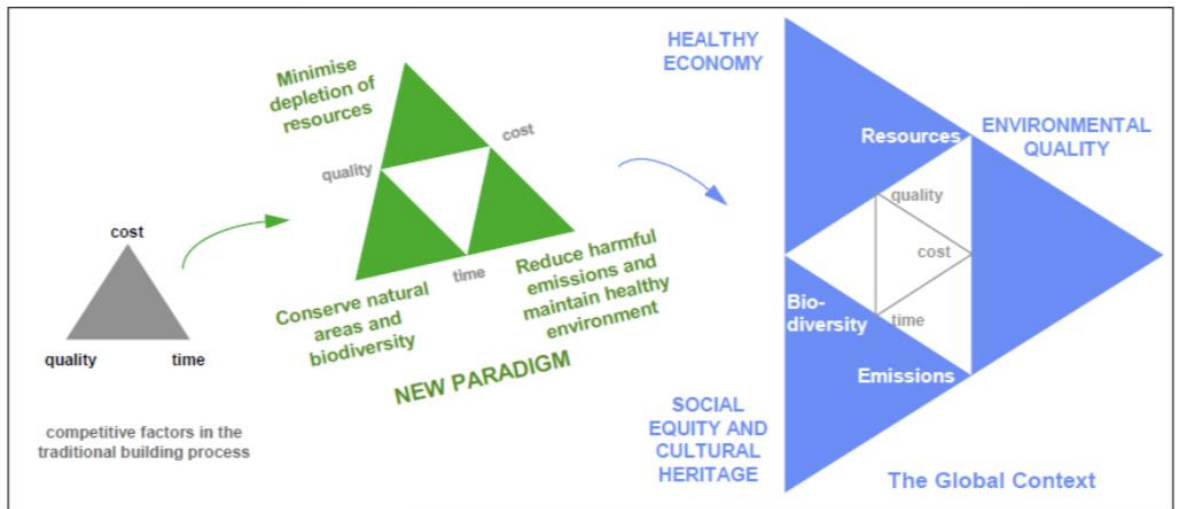


Figure1: The Concept of Sustainable Construction, explain how integrating sustainable concept with construction project constraints would result in desirable outcomes of social equity, improving environmental quality and drive to healthy economy.

By adopting sustainable construction approach, the usage of energy, water, raw materials, pollution, wastage, and running cost of the projects, will be significantly decreased, without lessening either comfort level or standards of healthy living for the occupants. (Yates J.K, 2015)

Materials selection factor as part of sustainable construction process, has high importance, in order to attain zero wastage practises, which can be achieved through picking closed loop materials, which is a conception, that are used for defining the way of sustaining the materials in a useful usage by reusing, recycling, and eliminating wastages of solids, liquids and gases for the final product or at completion of project life cycle. (CIB and UNEB, 2002)

There are several variables, which are engaged directly or indirectly in producing sustainable construction products, which are categorized into stable factors including place, such as positions, directions, geography, and vegetation, then climatic factors containing wind, sun, rain, and snow. Additionally, unstable elements, containing, design style of construction along with its characters, political and historical elements, besides eco-social and technological features. (Petkar Sanket, 2014)

Sustainability is all about that requirements of human kind are sustained at the present and in the future. Considering the fact that construction sector is one of the oldest fields, and broadly developing during the past eras with largest size of wastes, due to its processes, used methods and materials, then the requirements for moving toward trend of green buildings has become vital to

meet the expectations of stakeholders, and customers, thus creating sustainable buildings become crucial for construction sector to meet the persistent requirements of preserving the environment ,decreasing contamination ,and constructing sustainable products .

### 2.3.2 Dimensions of Sustainable Construction and construction management practice

Environment, economic, and social are the triangular dimensions for sustainable products in construction sector, which are interrelated with each other to deliver a consistent element. These dimensions are extremely linked with each other, because the ecological and economical sustainability cannot be obtainable without considering societal sustainability; remarking that economic sustainability is a precondition to get social sustainability. (Petkar Sanket, 2014)

The aforesaid triangular dimensions should be considered as one component, or strongly attached parts of a whole to provide the favourable advantages for the present and upcoming generations.

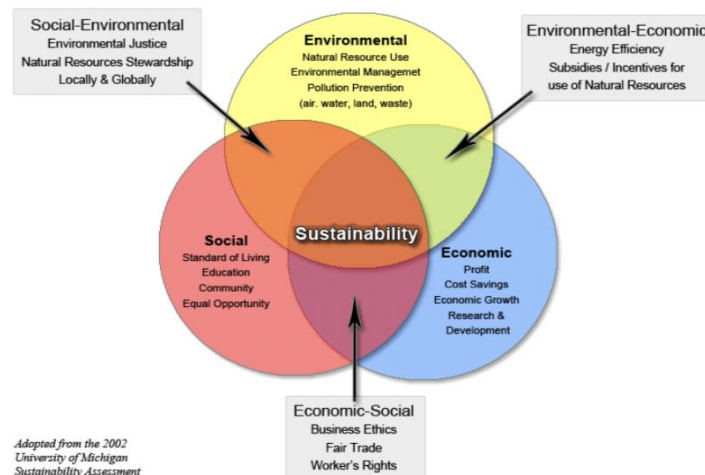


Figure 2: The dimensions of Sustainability Circle. Illustrates how integrating of environmental, social and economic dimension would result in sustainable product.

In this academic research the dimensions of sustainability are studied thoroughly, to establish their meanings and significance, and to develop clear understanding for the necessity of their integration to accomplish the goals of sustainable Construction management and practice:

Firstly, Environmental dimension, Since most of the managing members in construction projects are becoming increasingly aware of the environmental effects related to their activities, so it is useful to determine the origin of environmental problems in the construction area, whether its manufacturing, distribution, products, or

procurement, in order to achieve better and effective solutions during construction lifecycle, Then allowing an effective style of sustainable construction management to incorporate those environmental issues, which are biodiversity, energy usage, global warming, noise resources depletion, solid waste, and water use and air emissions. (Azapagic A, 2003). The ultimate purpose is to form ecological consciousness, and formulize ecosystem buildings, which eventually aims to minimize depletion of natural resources. Ecological properness would be achieved, for sustainable construction practice, via several steps including the followings:

- Decreasing the demand of energy for purposes of manufacturing, transferring and suppling materials.
- Decreasing the request on non-renewable materials, and escalating the efficiency of material usage.
- Reducing the negative impact on the health of human.
- Lessening wastages by utilizing recyclable materials,
- Using renewable and durable materials, which are ecological friendly.
- Removing toxic ingredients, used for producing materials
- Consider the influence of the activities of projects on the soil, water, air, flora and fauna. (Stubbs Ben, 2008)

Secondly Social Dimension, which is related to the construction of local societies, considering presents and future generations, take both employees and boarder communities' needs, aiming to make fair and more moral practices. By meeting those needs, the companies would recognize the real value of human, offering a healthy and safe work environment, and a valuable chance for the development of individuals and local community, the social dimension is charactering in; clients' satisfaction, stakeholder engagement, community collaboration, health and safety, work satisfaction, and management quality. (Azapagic A, 2003).

The sustainable construction approach in relation to social dimension can be attained, through consideration the important issues, as in followings:

- Estimating the impact on the current social agenda.
- Decreasing negative effects on life quality.
- Enhancing conditions of Health and safety for tenants of buildings.
- Adding moral values and meanings to the societies.
- Lessing the negative effects on residents, and publics. (Stubbs Ben, 2008)

Thirdly Economic dimension, Economic stability is essential for implementing sustainable construction management, because it is responsible for producing jobs opportunities and contributing in social welfare. Two types of economic concerns face construction projects: micro- and macro-economic. Micro-economic directly linked to

sales rates, cash flow distribution, and stakeholder value. Macro-economic issues linked to corporate output to national and international level of interaction, and contribution in producing job opportunities and Gross Domestic Products (GPD) (Azapagic A, 2003). The sustainable construction conception for economic dimension can be achieved, through putting in consideration the following aspects:

- Decreasing the cost, via enhancing the productivity and lessening the inputs of energy and raw materials.
- Generating new markets and chances for sales development.
- Enhancing the life cycle of the cost for the construction products, and lessening the cost of building operations and maintenance. (Stubbs Ben, 2008)

Environment, economy and society are interrelated subdivisions that are dependent to each other and affected by each other, so considering the interaction between them, and integrate them to produce sustainable construction products, would lead to perfect and comprehensive sustainable construction product, this only can be achieved by creating a solid sustainable construction project management style, through adopting dynamic framework set a comprehensive vision and actions to deal with all elements of sustainable dimensions starting from theories and ending with practical applications.

#### **2.4 Sustainable building and sustainable construction concepts (product and process)**

Sustainability concept is broadly diverse conception, as it is wide-ranging from regional/ national to individual levels and from particular countries / regions to various cultures and societies. The terms sustainable building, and sustainable construction are varying depending on involved stakeholders including their education, and cultural background. (Cole R.J and Lorch R, 2003).

Sustainable building concept is about focusing on the final product, while sustainable construction concept concentrates on the entire process, throughout its lifecycle reaching final product. This process includes pre-design, design, procurement, installation, service, repair, reconstruction, demolition, and recycling. (Persson Urban, 2008)

Agenda 21 for sustainable construction defined Sustainability as "provide the required performance with minimum adverse environmental impact, while encouraging improvements in economic, social and cultural aspects at local, regional, and global levels". (CIB and UNEB, 2002).

The term sustainable construction also defined by the same Agenda as "creating and operating a healthy built environment based on resource efficiency and ecological design" (CIB and UNEB, 2002). This term describes the interaction between the stakeholders, aesthetics concerns, materials, and the function. (CIB and UNEB, 2002).

The definition of sustainable construction describes the process over the lifecycle of the sustainable building; therefore, this concept is wider and more comprehensive than the definition of sustainable building, which is defined as "buildings that contribute to sustainable development". Sustainable Construction concept relates to a holistic sustainable building cycle, starting from production of raw material, going through planning for building and infrastructure, design, and construction, till final deconstruction and waste management. (CIB and UNEB, 2002).

### **2.5 Indicators of sustainable Construction:**

In the efforts of having systematic rating and assessment of construction process in terms of sustainability, in order to be matching with desired environmental standards, rating systems were developed to demonstrate and regulate defined standards for green buildings.

Rating systems and regulations for sustainable construction products are different according to the vision, structure, categories, levels, weighting, and certification processes aspects, which cause the main dissimilarities among them. Leed and Breeam, the most used systems around the world, however in Middle East the rating systems of green building are diverse from country to country, and including Localized systems as well such as, Estidama or PRS of Abu Dhabi, the Dubai Green Building Guide and Regulations, the Jordan Green Building Guide (JGBG), and Saba. (Shareef and Altan, 2016)

1. Leed: Leed was firstly adopted by Salgon in 2000, and it is about concept "Build green, everyone profits" then was followed with a common objective of " Everyone learns, works and lives in a green building within this generation" which is shared with USGBC community. The USGBC describes Leed as a method to define and measure green buildings in a durable, safe, sustainable design, and gauge the construction impact on the environment (Shareef and Altan, 2016). Leed system use rating points for each project, according to range of regulations and requirements that are adopted for the sustainable Construction product. Leed is available on every type of buildings including new and existing constructions, operations and maintenance, schools, retails, core and shell, health and homes. The Leed Rating system covers the key indicators of energy and atmosphere, material resource (MR) and indoor environmental quality, site selection (SS), water

efficiency (WE), Innovation in Design, and regional priority (Darus Zuhairuse Md et al. 2009).

2. Breema: Breema UK sustainability rating system is 10 years older than Leed, which is defined as a way that "sets the standard for the best practice in sustainable building design, construction, and operation" Breema system uses rating level depending on appointing an assessor for each construction project (Darus Zuhairuse Md et al. 2009). Breema is in use for all types of building includes health, data centres, courts, education buildings, offices, industrial buildings, retail, and homes. Breema Rating system covers the key indicators of site selection, ecology, water, energy, materials, indoor environmental quality (IEQ), waste, pollution, transportation, management and innovation. (Shareef and Altan, 2016)
3. Estidama (PRS): Estidama tool was developed by urban planning council(UPC) of Abu Dhabi and introduced in 2010, as " Pearl" tool, Pearl system is a hybrid combination of Leed and Breem systems within a regional local priority. The Pearl system use rating process starting from predesign phase to the completion of the construction process, in order to secure Pearl certificate that can be only achieved after completion of construction process with a minimum Building occupancy of 80% within two years (Awadh Omair, 2017). Pearl is in use for all types of buildings and functions including hotels, laboratories, health, courts, education buildings, offices, industrial buildings, retail, and homes. The Pearl Rating system covers key indicators of site selection, natural system, water, energy, materials, Indoor environmental quality (IEQ), and integrated design processes. Pearl system covers all construction phases including design, construction, and operation- to ensure stability through the life cycle of the project (Shareef and Altan, 2016).
4. Dubai Green Building Guide and Regulations: It's an alternative evaluation process and a regularity framework for sustainable development in city of Dubai, that was established in 2011 by Dubai Municipality as a pre-requesting tool to be adopted by construction companies, with no specific levels or points indicators, the regularity framework would support Dubai's long-term goal of leading a role of sustainability (Shareef and Altan, 2016). Dubai green building guide and regulations covers the categories of ecology and planning, resource effectiveness, building validity, energy, water, and waste (Dubai Municipality, 2011).
5. Jordan Green Building Guide (JGBG): This system is designed by Ministry of Public works and Housing (MPWH) in Jordan. In principle it shares the same objectives with other relevant green building codes of reducing the impacts of construction process on the surrounding environment. JGBG system use rating points as other regulation systems, but with different weight for each category, depending on the local priority. JGBG is divided into four levels based on earned points. JGBG covers most types of building such as, hotels, laboratories, health centres, hospitals, warehouses, and residential buildings. This Rating system covers the key indicators of site selection, water efficiency (WE), water, energy

efficiency, and material resources (MR), Indoor environmental quality (IEQ,) and Management process. (Shareef and Altan, 2016)

6. Saba: It is a computer based system, depends on a program rating tool for green buildings that was developed in 2009 in Jordan, Saba system uses rating points according to analytic hierarchy process, which is weighting according to the priority and contexts (Ali Hikmat H, and Nsairat Saba F, 2009). Saba is applied to residential buildings only, and covers common categories such as: WE, IEQ, SS, energy efficiency, MR, waste, pollution and economics (Shareef and Altan, 2016).

Table 1: Comparison between Green building rating systems, in terms of categories and weights that demonstrates the differences in areas of focusing /credibility, along with points are booked for each of them (Shareef and Altan, 2016)

<b>Compariosn between sustainable Buidling Rating Systems</b>									
<b>Leed</b>		<b>Bream</b>		<b>Pearl</b>		<b>JGBG</b>		<b>Saba</b>	
SS	23-6	Site selection and ecology	10	Site selection and natural system	9	Site selection	12-65	SS	10-3
WE	9-1	Water	6	Water	24	WE	15-81	WE	27-7
Energy efficency	31-9	Energy	19	Energy	24	Energy efficency	38-73	Energy efficency	23
MR	12-7	Materials	12-5	Materials	16	MR	14-23	MR	10-8
IEQ	13-6	IEQ	15	IEQ	21	IEQ	8-70	IEQ	11-8
Innovation	5-5	Waste	7-5	Integrated design process	6	Building management	9-88	Waste and pollution	6-4
RP (regional priority)	3-6	Pollution	10					Economics	10
		Transportation	8						
		Management	12						
		Innovation (additional)	0						
100%		100%		100%		100%		100%	
<b>Rating Levels</b>									
Certified		Pass		One Pearl		D		Not Green	
Silver		Good		Two Pearl		C		Green	
Gold		Very Good		Three Pearl		B		Very Green	
Platinum		Excellent		Four Pearl		A			
		Outstanding		Five Pearl					

## 2.6 Sustainable Construction Management

### 2.6.1 Sustainable construction management system

*"The job of management is to maintain working conditions before trying to improve them." (Lancaster Jim, 2017)*

Today, sustainability in construction filed has become essential factor to build successful projects, depending on systematic processes, through incorporating standards of high-quality, and cost effectiveness. Construction industry faces the task

of integrating sustainable standards in the design, planning and execution of the projects, in line with governmental, non-governmental and the environmental concerns.

Sustainability researches have focused mostly on design aspects, raw materials, and materials for the building, and their ability to use natural resources effectively including sun light and water, in addition to their ability to reduce toxic or dangerous pollution, then their suitability to be recycled, or reused. (Persson Urban, 2008)

Sustainable construction management teams are not dealing only with building design, but also phases of construction, usage, maintenance, and deconstruction process, in order to meet the issues that associated with rapid urbanization, and their impacts on social, environmental, and economical values, in addition to consider sustainable guidelines that can be incorporated during project lifecycle, reaching to final product by going through the whole processes from the early design stage to the end product. (Persson Urban, 2008)

However, Obstacles remain there to introduce sustainable products to project managers and clients, noting that most of them are laying under environmental aspects, cost implications, and insufficient skills, also in the construction industry the spread understanding is that sustainable structures are costing more than ordinary buildings in terms of investment expenses. The project stakeholders – clients and construction professionals- are not adequately aware about the fundamental relation between building and sustainability.

The distinction between sustainable building and sustainable construction should be expounded; where the first concept considers the final product, and the second one considers the way to final product (the process), then in order to manage such a process, it is required to adopt a management system or mechanism from perspective of process owner and project management team, then find a way to systematise this process by linking sustainability to performance and environmental aspects. (Persson Urban, 2008)

With increasing awareness of the need to apply sustainable ideas to the construction projects, and the expansion of companies into a more global context, the organisational decisions must represent not only economic impacts, but also it is very crucial to consider social and environmental impacts. Schuitmann Frank and Sunke Nicole, 2007).

Traditional project management, especially in the construction industry, focuses mainly on economics and is usually carried out using simple techniques such as a Gantt chart, the Critical Path Method (CPM), the Programme Evaluation and Review Technique (PERT), as well as network diagrams to establish and determine operations and priority relationships. (Schuitmann Frank and Sunke Nicole, 2007). The main shortcomings of those conventional techniques that they are general, because there is an infinite supply of staff and resources over the planning period without proper time and capacity planning, whereas the analyses are focused on time demands for the activities, which ignore the demands for resources, therefore, high challenges exist in most of



construction projects, when activities need only minimal resources. Besides those techniques are not designed to include factors other than time and cost, therefore they are not appropriate for usage in the new global trend of interest in adopting efficient construction management style, which is considering environmental and social issues. (Schuitmann Frank and Sunke Nicole, 2007), such planning techniques can be used to coordinate projects, including chosen processes and equipment, under resources restrictions.

In practical term, project sustainable management methodology focuses on project development, scheduling, and economic analysis for choice of project management, projects planning, as well as control and analytical management actions, which considers innovative quantitative methodology, and in general, the performance of the preparation and resource allocation during the project management can impact significantly the outcomes and achievement of the project objectives. (Schuitmann Frank and Sunke Nicole, 2007).

### 2.6.2 Sustainable project management definition and conceptual framework

Construction process is a complex task, with several different players each of them is involved in dealing with various activities during a certain period, needing the right quality standards at varying costs on a particular site. This requires a system to manage the process from various perspectives; the environmental, quality, work safety, stakeholders and knowledge management. (Persson Urban, 2009). This section links the sustainability issues in the construction management framework.

Sustainable project management: " is the planning, monitoring and controlling of project delivery and support processes, with consideration of the environmental, economic and social aspects of the life-cycle of the project's resources, processes, deliverable and effects, aimed at releasing benefits for stakeholders, and performed in a transparent, fair and ethical way that includes proactive stakeholder participation."

This definition refers to the three dimensions of sustainability environmental, social, and economic to project lifecycle, in addition to recognise resources, processes, delivery and effects, beside stakeholders' involvement and values dimensions (Gilbert Silvius A.J. and Schipper Ron P.J, 2014).

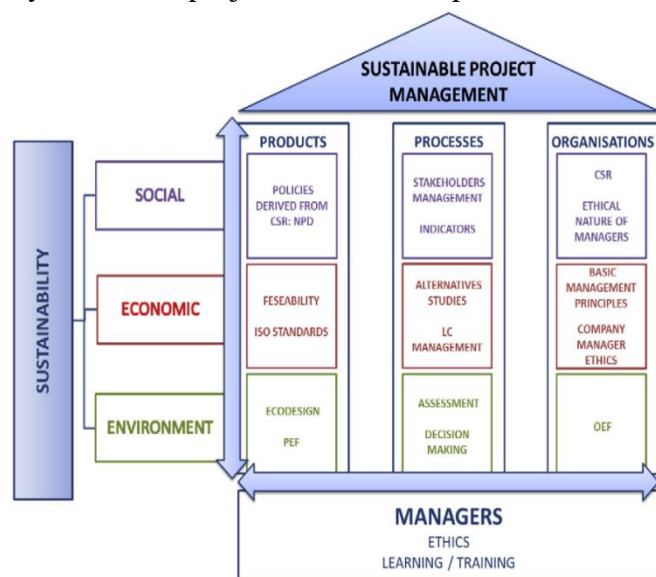


Figure 3: Integration of sustainable dimensions into sustainable project management, in line of developing product, adopting process and system of organizations (Marcelino-Sadaba Sara,

Sustainability has direct and indirect impacts on project management approach at different levels, so recognizing dimensions of sustainability is important to understand those impacts, to establish principles and processes for project management. The conceptual framework toward integrating sustainability into construction management can be summarized as in following procedures:

Firstly, expand in the scope of project management from time, budget and quality management; to environmental, social and economic impacts management.

Secondly, sustainable management requires a transition from a predictability and controllability approach to a dynamic, complexity and opportunity approach.

Thirdly, the consideration of sustainable management suggests changing the role and mind of project managers; from achieving desired results into taking responsibility in organization and society (Gilbert Silvius A.J. and Schipper Ron P.J, 2014).

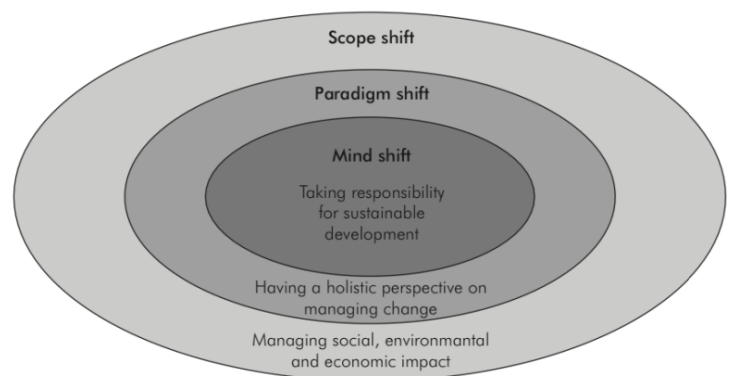


Figure 4: The conceptual framework for scope, paradigm and mind shifting in order implement sustainable management approach.

### 2.6.3 The Necessities of integrating Construction management and Sustainability

The characters of projects help companies to achieve long-term investments, and raise the necessity to comprehensive management understanding of the context of the projects, in order to ensure projects alignment with the company's objectives according to standard methodologies. (Project Management Institute, 2019)

Both internal and external environmental factors affect and influence the performance of the projects, such factors can boost or restrict project management choices and have an impact on the outcomes. Project managers need to balance the costs, schedule, economic, environmental, social factors of the project in order to attain ultimate project objectives and complete it successfully. (Lancaster Jim, 2017)

Sustainable Management for the Economic resources of the companies; means more than basic ROI (Return on Investment) of the project, it must be ensuring smooth blending into overall strategies of the company. (Project Management Institute, 2019)

The social Sustainable management requires understanding the specific project impact on the culture, processes and structure of the company, in addition to its influence on

the capabilities of human resources and performance of employees and their interacting with surrounding environment. (Project Management Institute, 2019)

Achieving perfect environmental sustainable management requires a mature use of resources, precise assessment of facilities and equipment, efficient contracts management, and solid manufacturing standards. (Project Management Institute, 2019)

The grown idea of incorporating sustainability into construction management, drive to think deeply in administrative aspects of management approach, however sustainable management is not a single task, it's a way to practice and perform the assigned job. (Eid Mohamed and Roger Talbot, 2001)

Well Integration between sustainability and construction management practices is an important juncture for the purpose of achieving sustainable construction. The construction process is one set of interlinked tasks, from early project design, initiating and planning to the execution, controlling and completion of the project, and then in conjunction with the outcomes of all these activities, the final product of construction is achieved (Matar Mohamad M et al. 2008).

Sustainability practices respect the final product without giving enough attention to construction process itself. However, it's entirely logical to assume that implementation of sustainable concept during the construction phases drives to more sustainable end products, which in result provides a standard description for construction project lifecycle, thus incorporating sustainability into management process would lead to comprehensive and sufficiently detailed approach to determine and assess the effect on final construction processes (Hill R.C and Bowen P.A, 1997).

#### 2.6.4 Corporate Sustainability Management

*"Those who think that sustainability is only a matter of pollution control, are missing the big picture... Focusing on sustainability require putting business strategies to a new test, take the entire planet as the context in which they do business" (Stuart L. Hart, 1997)*

Construction in nature is a complex process; with various players each of them is involved in addressing multiple activities, over a given period of time, targeting to achieve certain level of quality within budgeted cost on a given place (Engeret Sabrina et al, 2015). This requires a system to manage the process from different perspectives and concerns, which deals with the stakeholders' management, quality, safety, environment, and knowledge management issues, and link them to sustainability issues. (Persson Urban, 2009)

Corporate sustainability is commonly known as triple bottom line that considers environmental, social and economic aspects of the product, including their positive and negative impacts. The concept of corporate sustainability is often symbolized by triple P (Planet, People and Profit), which drive companies to create greater values in the long

term operations and reduce risk probabilities by integrating environmental matters (Planet), social issues (People) and economic dimensions (Profit). (Stuart L. Hart, 1997)

To effectively implement a corporate sustainable management strategy into construction field, it is a must to be emerged from the vision and plan of the corporate level, then to be integrated with it. Corporate sustainability in construction management is not an addition, it is an essential part that must to be seen as an "umbrella" that help construction filed to integrate the management of economic, environmental, and social aspects together. (Azapagic A, 2003)

According to Environmental Management System (EMS) ISO 1996 the implementation of sustainable management system consists of five stages:

- 1- Sustainable Policy Development.
- 2- Planning.
- 3- Implementation.
- 4- Communication.
- 5- Review and corrective action.

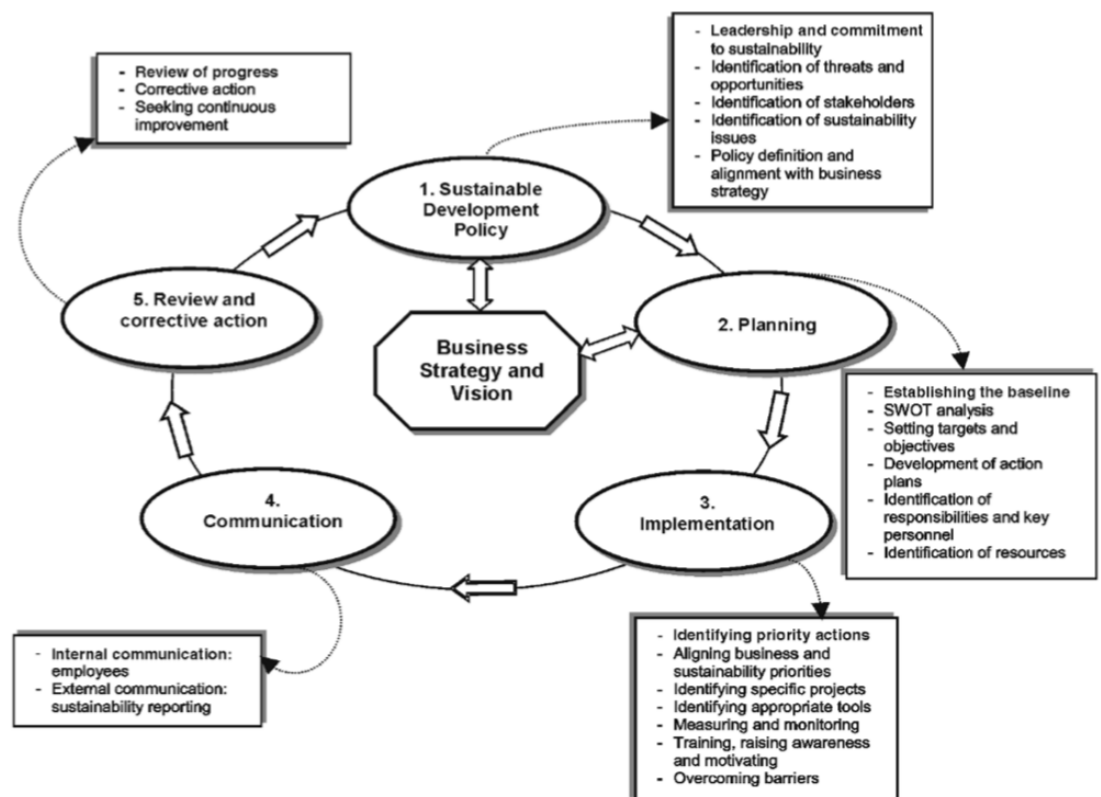


Figure 5: Implementation process of sustainable management system, including developing sustainable policy, planning, implementation communication, review and corrective actions.

1. Sustainable development Policy, is defined as the first phase of corporate sustainable management, which includes set of values, statements of principles that determine social, economic, environmental, and stakeholder responsibilities, however before implementing sustainable policy the following steps have to be employed (Azapagic A, 2003):

a. Establishing Leadership and Commitment to sustainability: CEO, board Directors and senior management team play a key role in setting up and implementing the principles of sustainable management into the various levels of the company. Senior management is responsible for projecting an efficient and stable construction management practice, by creating a framework that reflects how the sustainable strategies integrate economic, social, and environmental aspects (Azapagic Adisa and Perdan Slobodan, 2003). High management level is directly responsible to sustain well reputation of the company, thus demonstrating and adopting sustainable management helps executive directors to manage and create confidence between the organization and internal & external stakeholders (Azapagic A, 2003).

b. Classifies Threats and Opportunities: The primary step in developing sustainable management system is recognition of threats related to unsustainable practices and opportunities sourced from considering sustainable applies for the construction process, reaching to the benefits from sustainable management, in order to evaluate and set realistic priorities and goals. (Harmesen Jan, and Powell Joseph B, 2010) Threats and opportunities can include technical, logistic, social, environmental, economic or other aspects leading to possibly financial threats or opportunity. (Azapagic A, 2003)

c. Identification of Stakeholders: Stakeholder's engagement is an integral part in practicing successful sustainable management (Azapagic A, 2003). An effective construction management requires a clear understanding for the interests, concerns and expectations of various engaged stakeholders within a clear time framework, then to understand fully the stand of stakeholders, so full analysis for them should be done for the purpose of highlighting current and future needs, in order to realize sustainable development priorities (Mathur, V.N. et al. 2008).

d. Detecting of Sustainability issues: Finding the issues and concerns is important to set some effective resolutions, thus identifying the issues linked to Sustainability dimensions including social, economic, and environmental is an important step (Azapagic A, 2003). There are many ways of confining the concerns including direct consultation with Project stakeholders and having pilot analysis to the business activities, that would lead to better highlighting and understanding to the nature of issues (SA of Regional Spatial Strategies and local Development Documents' (OPDM), 2008).

2. Sustainable Planning: This concept means Establishing a baseline reference, which is set to measure the economic, social and environmental issues, comparing to sustainable indicators, in order to allow specific analysis for the whole dimensions of

the construction project (Azapagic A, 2003), ensuring that there are reliable measurement levels of sustainability. This indicator should be quantitative and measurable to assist decision makers to take proper judgement taking into consideration the sustainable issues (Leon-Soriano Raul, et al. 2010). For sake of maintaining effective sustainable planning, systemic steps should be employed as follows:

a. Comprehensive Sustainable SWOT (Strength, Weakness, Opportunities, and Threats): Deep investigation should be conducted in order to identify strengths and weakness, as well as threats and opportunities are facing the companies (Azapagic A, 2003), in order to have full picture of surrounding conditions for effective implementing of Sustainable Construction Management (Dyson Robert G, 2002).

b. Setting objectives and targets is important to implement corporate sustainability strategies, so it would be clear, what is the direction of company and how company will go further in adopting the style of sustainable construction management (Azapagic A, 2003). Sustainable management objectives and targets must be clear, and measurable, also they should be realistic, but challenging and connected to a recognised time scale, in addition it is importance to identify the challenges and obstacles are laid in the way of achieving these goals (Moldan Bedrich, et al. 2011).

c. Developing action plan is the practical step toward implementation of sustainable strategies (Azapagic A, 2003), such plan must take into consideration the identified objectives, targets and SWOT analysis, with clear definition of the responsibilities matrix to achieve the planned activities within specific time frame (Centre for Environment and Sustainability (GMV), 2016).

d. Identifying personnel and assigning responsibilities for implementing Sustainable management to the structure of the organizations and projects is key and useful step, in order to practically put the sustainable policy and plan into action, allowing managers to ensure applying sustainable management to ongoing operations and activities with clear tasks and obligations for each of them (Azapagic A, 2003). However, Board of directors could assign these responsibilities to a dedicated team to ensure adopting sustainable construction management system, who help to employ and assist the planning and evaluation of sustainable management system implementation into the body of organization (Moldan Bedrich et al. 2011).

3. Implementation of sustainable construction Management practice: This is the most important phase to bring sustainable policy and plan into reality, which consists of identifying and aligning sustainable priorities to the business needs, leading construction projects to become sustainable, by providing practical mechanism of monitoring and reporting system to control (Azapagic A, 2003). Turning into sustainable construction management isn't overnight job; it needs to gradual transference of the cultural background of the personnel and stakeholders, within mid to long term time scale.

Effective implying of sustainable construction management can be reached through following steps:

- a. Identifying priority actions: Selection of priority measures for construction projects should focus on main issues of sustainability, which were identified during policy development, (Azapagic A, 2003) in order to evolve right ordered actions driving to implement correct management practice (Yin Rumin and Cheng Vincent, 2005).
- b. Aligning to business needs and sustainability priorities: sustainable construction management system should focus on the hotspots for every business area (Yin Rumin and Cheng Vincent, 2005), such as, production, transportation, contracting activities, products, employee, etc., however the detailed action plans, and clear responsibilities matrix should be aligned to the escalating and changing business needs, then being prioritised correctly (Azapagic A, 2003). Many good practical examples of aligning sustainability practice to the business needs can be given, such as moving toward utilizing green source of energy, rather than depending on fossil fuels, which help to maintain long lasting source of energy that costing less, and friendly to the environment.
- c. Identifying appropriate tools: Various types of tools can be used to implement the plans of sustainability strategies (Azapagic A, 2003). Basically there are two types of practises; the initial one is the tools purposed to encourage cultural changes among the organisation, and the second ones are set to control, assess and improve level of sustainability implementation. The tools for leading of cultural changes are altering corporate strategies through modifying management programs and using official risk management steps (Baumgartner R, 2003). Indicators of Sustainability is utilized to gauge the overall level of sustainability adopting among the projects and ensure that the targets and goals set in the policy are aligned into practical procedures and business tools used to measure the different characteristics of business outputs (Azapagic A, 2003), in addition to other commonly used tools by the companies to manage sufficient level of sustainability in the operations; such as life cycle assessment to determine the impact of “hot spots” on the life cycle of project(Baumgartner R, 2003).
- d. Measuring and monitoring: measuring and monitoring is a formal way of ensuring the accomplishment of sustainable management goals and objectives (Azapagic A, 2003). Continuous monitoring of the sustainable progress will help to achieve an excellent indication of the sustainable direction; either toward or beyond strategies of sustainability (Project Management Institute, 2019).
- e. Training, raising awareness and motivating: the general understanding of the importance of sustainability is important to help in development and

implementation sustainable management through the organization structure of the company and personnel (Azapagic A, 2003). Therefore, conscientiousness and training are necessary to take sustainability strategies seriously, and incorporate them into construction practice. It also requires encouraging of the employees to be inspired in order to come up with innovative ideas reaching to improve the overall productivity. (Jabbour Charbel Jose Chiappetta, and Santos Fernando Almmada, 2008).

- f. Overcoming barriers: successful implementation of sustainable construction management system requires awareness about barriers at early stage (Azapagic A, 2003), in order to be able to tackle them effectively, such as staff resistance, time, resources and financial barriers, in addition to cultural barriers (Shareef Sundus L. and Altan Hasim, 2016).

4. Communication: In order to reach to advancement of sustainable process, as well as success of construction management, the effective communication is necessary to create internal and external reporting systems(Azapagic A, 2003), which describe and compare the performance of company with its sustainable development objectives, and highlight challenges, leading to utilize it as marketing tool to emphasis the sustainable achievements, then by result driving to higher transparency between companies' management structure and stakeholders. (Azapagic Adisa and Perdan Slobodan, 2003)

For the organizations there are two ways and directions of communications: Internal and External. Internal communication refers to the internal reporting system for the progress of employing sustainability in terms of indicators and relevant accomplishments (Azapagic A, 2003). The reporting channels are adopted between various levels of organization structure, in order to highlight the achievements and latest update about implementing sustainability standards (Salvioni Daniela M. and Bosetti Luisa, 2014).from other hand External communication is essential, as companies are constantly require to communicate with external stakeholders to show them the results of their performance, which can be achieved through active periodic reporting system includes, CEO's vision and strategy, company structure, management system and governance structure, in addition to sustainability indicators: economic, social, and environmental impacts (Azapagic A, 2003). Regular approaching of external stakeholders maintains high transparency in reporting relevant indicators and viewing the challenges and opportunities, which companies are facing and to instantly responding to emergent risks and burdens (Salvioni Daniela M. and Bosetti Luisa, 2014).

5. Review and corrective action: This is the final phase of applying corporate construction sustainable management system. It requires reviewing of the achievements as per the sustainable policy, and confirming whether the set



objectives are attained or not (Azapagic A, 2003). The review period should be regular and may vary from three months to one year. The reviewed outputs should clearly indicate if the objectives are fulfilled or not. The review process should be utilized to get enough feedback and enforce corrective measures for continuously improving sustainability strategy, ultimately it helps senior management to answer practical questions about performance, and imply remedial actions in order to enhance implementing sustainability (Mosher Margo and Smith Lorraine, 2015).

Corporate level is the most important in enforcing and incorporating desired target of sustainable projects management, as creating vision and policy of the organization is the corner stone in spreading the concept of sustainable management to its business units, programs, portfolio and projects, thus having solid well by board of directors, that is streamed by realising the countless benefits of sustainable practice is the real spark toward successful incorporating sustainable management.

#### 2.6.5 Implementation principles and strategy of corporate sustainable construction management: Model framework

In the way of reaching effective sustainable management, the organizations must be basing their Sustainability management strategies on strong principles; so that sustainability can be seen as a comprehensive goal that includes all aspects of the company Vision and its relationships (DANCIU Victor, 2013). Those principles can be characterised as follows:

Firstly, sustainability needs to develop and change ego-centred direction of market dominance, so the target of achieving highest, biggest and best returns to be aligned with more sustainability goals.

Secondly, the successful sustainable management must be capable of simultaneously managing the short and long terms perspectives.

Thirdly, sustainability management should have strong connection with all construction activities, as well as being prepared and ready for changing market; in order to find lasting sustainable routs for challenges and opportunities those impact company strategies (Asif Mohammad, et al. 2010).

Sustainability can be incorporated into construction process through an Integrated Management System (IMS), such as strategy can offer high consistency and needful clarifications to deal with the various issues associated with corporate sustainability management, in terms of evaluation and assessment

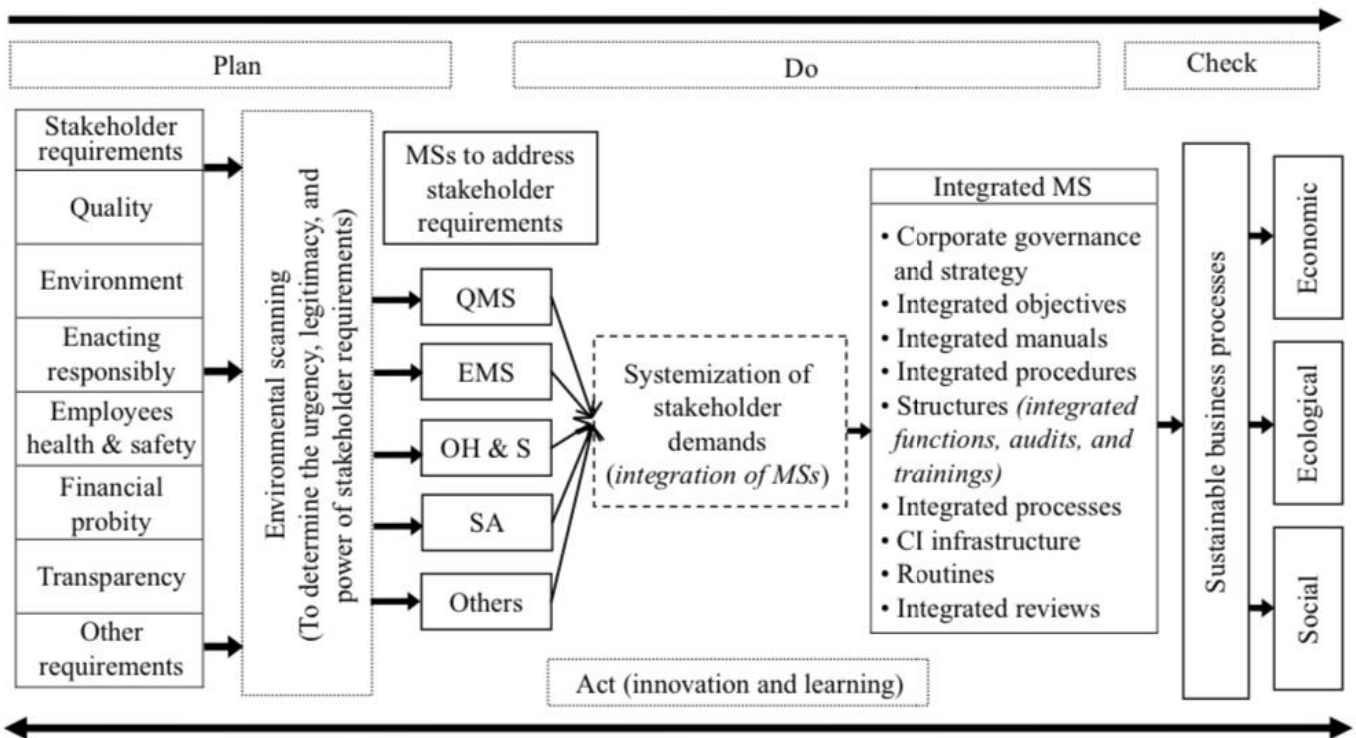


Figure 6: A Conceptual Strategy framework for corporate sustainability, through IMS in the stages of Plan, do and check (Asif Mohammad, et al. 2010).

Implementing integration management system IMS for sustainability in construction field can be fulfilled through integration between various aspects starting with stakeholders, as Sustainability implementation begins with the identification and expectation of key stakeholders (Svensson Goran et al. 2010). There are a great number of primary and secondary stakeholders, which is putting pressures on companies to find a proper communication plan for dealing with them, thus, in general, it's necessary to validate requirements and relative power of the various stakeholders involved in influencing the company, in order to put proper engagement plan (Asif Mohammad, et al. 2010).

Also a detailed environmental scan can assist the project managers in determining what is important, what is not important, and the level of urgency and priority to different issues, which includes an analysis of strengths, weaknesses, opportunities and threats (SWOT), and assessment of stakeholders. Environmental scan is considered a tool to identify and prioritize the demands of key stakeholders within a limited resources context. Furthermore, a number of different Management Systems (MSs) can be used by the companies to satisfy key stakeholders interests (Svensson Goran et al. 2010). The quality management standers (ISO 9001), the environmental management (ISO 14001), quality and environmental auditing (ISO 19011), and customer satisfaction and complaints systems (ISO 10001, 10002, 10003) are among the most common

of standardized Management Systems. Project managers may choose to enforce or validate internal MSs separately according to stakeholders' requests; however, the potential effect of implementing different MS is generating competing priorities, mutual incompatibilities and confusion. Corporate MSs modify organization through several levels: tactical, strategic, and operation changes, at the strategical level it provides a mechanism to increase interaction with stakeholders (DANCIU Victor, 2013). Tactically, it focuses on the development of management procedures, and tools of evaluation. At the operational level, it supports working instructions and activities; through promoting effectiveness, saving resources and decreasing employees confusing. (Asif Mohammad, et al. 2010)

The most important in order to maintain continuous improvement of innovation, effective Implementation of continuous learning is required across the different dimensions of sustainability. Else as a drive force of sustainable management, the sustainability experts must incorporate processes into organization and ensure continuous training (Asif Mohammad, et al. 2010). Innovation must be integrated with the company's procedures, database, instruction of work and other key documents, which require focusing on employees' abilities and experiences, to handle expected and unexpected company's sustainability challenges. (DANCIU Victor, 2013)

In conclusion, structure and procedures for sustainable management are generated around PDCA cycle (Plan, Do, Check and Act), which is essentially a routine of constant improvement in various dimensions of sustainable management to deliver, maintain and retain continuous advancement ,Noting that The main purpose for incorporating sustainable management into the companies is to guide discourse on how sustainability implementation can be structured within organization's context and requirements as essential element.

### **2.6.6 Process Approach of incorporating Sustainability to management process**

Sustainability as an agenda that's extended deeply into the structure of society, economic viability and environmental revitalization, which can improve project performance and management process by proper incorporation, so it is recognized as opportunity to enhance construction management performance by improving effectiveness and efficiency (Bal Monika, et al. 2014). Project management Institute's (PMI) Project management Body of Knowledge (PMBOK Guide) and the Office Government Commerce's projects in Controlled Environments (PRINCE2), are two widely used frameworks for project management processes. (Aghmohammadi Mahdi and Yakhchali Siamak, 2017). The processes approach to incorporate sustainability to project

management listed in (PMBOK Guide) processes framework is summarised as follows:

1. Stakeholder's management: management of stakeholders is a key aspect and become increasingly important in sustainable practices. Precipitation of stakeholders is necessary in the project to be a measure of the project's sustainability. On the other hand, decisions must be taken at different levels of society; national and international organizations, and individuals to adopt more sustainable policies (Mavi Reza Kiani and Standing Craig, 2018).

From the sustainability perspective, the first challenge in construction management process, is focusing on stakeholder management and balancing their interests for economic benefits against environmental and social objectives.

Proposing a framework of stakeholder participation in sustainable project management is a great contribution, for whom are involved inside or outside the organization, so that they can provide additional perspective to the triple P (planet, People, Profit), then the Risks and impacts could be sourced from the projects will be distributed among interest of stakeholders. (Marcelino-Sadaba Sara et al. 2015)

2. Life cycle management: Almost all of the sustainability components around the project are based on the lifecycle, there are several life cycles involved in the projects, which are connected through project management practices with sustainability principles (Hellweg and Rebitzer G, 2007). These life cycles are Project life cycle, which is the life cycle in which the idea is created, developed and implemented, Process/assess life cycle, which is the life cycle in which the idea consisting the design development, construction, and implementation, and Product life cycle, which is the life cycle in which the idea deliverable produces in-comes and return.

However, there is an overlap between the project life cycles and building life cycle in construction projects, this overlap takes place in the stages of design and construction, but term "life" is widely used in construction field to provide detailed evaluation of designed products, which is not appropriate for design stage. (Marcelino-Sadaba Sara et al. 2015).

3. Sustainability assessment: Sustainability assessment must be planned clearly to evaluate and define objectives, values, and requirements and it can be extended to both decision making and project processes, in order to achieve sustainable outcomes. Assessment tools are methods can be used to promote company policies, as well as create comprehensive framework for sustainability. Those tools can be classified into three categories: indicators, product related tool and integrated assessment tools.

Sustainability assessment is still an initial management process in projects where practices are being adjusted for new context and situations (Pope Jenny et al. 2004).

Decision making process is related directly to the sustainability assessment process, in fact sustainability assessment is a key tool to decision making, which is various process depending on the legal structures, and in general the governmental pressures and it is always complicated and highly influenced by context (Epstien Marc J and Buhovac Adriana Rejc, 2014). Some strategies techniques for decision making are:

- a. Process of analytic hierarchy: This is used to assess the weight of sustainability indicators at various levels of management system.
- b. Target distance and system analytic network process: Integration these techniques into decision making will support the development of new products that are more sustainable.
- c. Cognitive maps: Cognitive reasoning maps explain the dynamic and relationships between the different decisions and incorporate them in the project objectives.
- d. Decisions windows: Decisions windows is purposed to evaluate the relationships between management sub decisions and sustainable principles (Marcelino-Sadaba Sara et al. 2015).

In conclusion the process of decision making is always complicated and highly influenced by context.

4. Risk management: In order to manage the project effectively, risk management is considered a critical factor that help in preventing or eliminating risks. In the way of incorporating sustainability risk management, solid techniques and theories can be adopted to resolve conflicts around the project, including environmental, social, economic, operational and strategic issues (Epstien Marc J and Buhovac Adriana Rejc, 2014). It is clear that construction companies can't ignore the economic risk, sudden rises in raw material cost, currency change and local taxes, which are the common causes of economic risk, so recognizing the resources, which threat the long term environmental stability and impact project life cycle, can decrease the risks impact (Yilmaz Ayse and Flouris Traint, 2010). As a consequence of work conditions, social risks are characterized as challenges for stakeholders, thus due to incorporating sustainability, the need for proper social risk management is required to control social risk effectively. As stakeholders are main sources of uncertainty, a broad framework for project risk management to analyse stakeholder issues is crucially required. A corporative approach of sustainable risk management acts as a useful tool for encouraging stakeholders, through risk quantification and identification to reduce risks. (Bal Monika et al. 2014).
5. Value management: Incorporation of sustainability into Value management of construction field will enable achieving the objective of generating better economic return, while providing social and environmental performance (Bal Monika, et al. 2014). Value management provides opportunities in the procurement of sustainable materials and design, in order to minimize social, economic, impacts. Sustainable value management system can be

modified and implemented to coordinate stakeholders' interests, and establish appropriate strategies to move toward accepted sustainable long-term solutions (Epstien Marc J and Buhovac Adriana Rejc, 2014).

6. Waste management: Waste management allows smooth implementation of construction process, besides it's aligned with the two principles of sustainability, to reduce pollution and minimize resources consumption. Waste management includes; waste collection transportation, storage, processing, recovery and disposal that are characterized as comprehensive and integrated system, which is promoting sustainable development (Ismam Jannatun Naemah and Ismail Zulhabri, 2014). Waste management as part of sustainable construction management, is considered to be more complicated, because in each process and phase of construction it is possible to be generating; either physical wastes formed from material during construction stages, or non-physical wastes caused by poor management as cost overrun and time overrun (Nagapan Sasitharan et al. 2012). In the way of implementing construction waste management, it is very necessary to manage three main interrelated components: labour, material and machinery. Moreover, waste management fundamental principles are based on recycling, reusing and reducing materials, which organizations and governments should adopt to encourage and direct involved stakeholders to use as part of managing and treating process wastes (Ismam Jannatun Naemah and Ismail Zulhabri, 2014).
7. Materials and resources management: It is a conceptual framework for the systematic control of material products movement from sourcing rough materials to production, then during construction lifecycle (Michaud William, 2009). The environmental, social and economic dimensions of sustainability, encompass sustainable material management as essential part, however since there is a conflict among society's interests to protect the environment, then the increased demand for efficient materials is linked to the economics and improved quality of life. (Fiksel Joseph, 2006).

### **2.6.7 Knowledge areas of Sustainable Construction Management**

Sustainable construction management means much more than creating ecological building, it incorporates sustainable practices and construction applies, in order to reduce the environmental, social, and economic impacts of construction activities during its lifecycle.

Combining sustainability tools and practices with Construction project management, through the lifecycle of project management process, including project start up, planning, execution, controlling and project closure, which are the 5 phases are listed by ten project management areas in PMBOK by Project Management Institute (PMI) (Project Management Institute (PMI), 2019).

Those areas of project management bring the project management system to life and ensure that the construction project meets the criteria of success (Tharp, J., 2012).

Table 2: Sustainable management practice at project level, explain the project required deliverables during the project cycle for social, economic and environmental aspects in order to imply sustainable management practice at project level and during project life cycle.

PM Processes	Triple Bottom line	Social	Economic	Environmental
1. Initiating		Initiation	Initiation	
2. Planning		Project plan development Scope planning Scope definition Activity definition Activity Sequencing Activity duration estimating Schedule development Resource planning  Quality planning Organizational planning Staff acquisition Communication planning Risk management planning Risk Identification Qualitative risk analysis Quantitative risk analysis  Risk response planning	Project plan development Scope planning Scope definition Activity definition Activity Sequencing Activity duration estimating Schedule development Resource planning Cost estimating Quality planning Organizational planning  Communication planning Risk management planning Risk Identification Qualitative risk analysis Quantitative risk analysis  Risk response planning Procurement planning	Project plan development Scope planning Scope definition Activity definition Activity Sequencing Activity duration estimating Schedule development  Quality planning  Risk Identification Qualitative risk analysis Quantitative risk analysis  Risk response planning Procurement planning
3. Executing		Project plan execution Quality assurance Team development	Project plan execution Quality assurance  Information distribution Source selection	Project plan execution  Quality assurance   Source selection
4. Controlling		Integrated change control Scope verification	Integrated change control Scope verification	Integrated change control Scope verification

	Scope change control Schedual control	Scope change control Schedual control Cost control Quality control	Scope change control Schedual control
	Performance reporting Risk monitoring and control	Performance reporting Risk monitoring and control	Performance reporting Risk monitoring and control
5. Closing	The closing process is not directly related to the sustainability because it mainly consists of paper work and documentations of the legal aspects as well as the analysis of the targets achievement and the lessons learned.		

## **2.6.8 Strategic models to implement sustainability in project management**

### **2.6.8.1 STEPS Maturity roadmap:**

Sustainability implementation into construction management requires skills and knowledge of the project team to be deeper and wider in term of environmental concerns. A knowledge area of Sustainable construction management skills is closely linked to organization stability (Robinson H.S. et al. 2006). The STEPS (Start-up, Take-off, Extension, Progressive, and Sustainability) from maturity roadmap are forming a suggested approach and strategy to execute sustainable management activities, with respect to tacit knowledge of a construction organization. (Persson Urban, 2009)



The maturity roadmap of STEPS is a systematic framework to evaluate the measures and activities involved in and to analyse implantation efforts, in order to meet organizational sustainability goals. The five stages of STEPS are:

Figure 7: The 5 stages of implementing STEPS maturity model, used to evaluate activities and actions engaged in sustainable management practice.

1. Start-up: This is about raising the awareness of improving business. Which can be attained through understanding knowledge management concept, including different perspectives and its realistic impacts, and Appreciating the advantages of knowledge management theory (Persson Urban, 2009), beside realising the knowledge management potentials in construction value, in addition of Setting the knowledge management need to willingness (Robinson H.S. et al. 2006).



2. Take-off: This is about developing knowledge and working management concept, including tools, structure, obstacles, and risks (Persson Urban, 2009). This stage is formed of systematic steps, including Creating knowledge management objectives, evaluating of strategic options, developing a knowledge management plan with working definition to promote consensus, establishing leadership and tools to be identified, then supporting it by consulting, and Identifying barriers and risks associated with possible changes (Robinson H.S. et al. 2006).
3. Expansion: which is all about enhancing the visibility of leadership, identifying risks and challenges, and then improving them (Robinson H.S. et al. 2006). Expansion stage is characterised by Developing the plan of knowledge management and connect it to particular organization objectives, in addition to improving the visibility of knowledge management and asset distribution of knowledge management leader (budget, infrastructure and staff), then ending with Implementing the level of knowledge management initiative to other construction units (Persson Urban, 2009).
4. Progressive: This is about improving management activities performance, and tracking performance to check implementation level of knowledge management strategy, which includes the steps of incorporating knowledge management practices into the strategic assessment process of tracking and evaluating knowledge sources, such as the balance Scorecard and the quality model (Robinson H.S. et al. 2006). In addition to Establishing standards and goals for evaluating impacts and justifying knowledge management on knowledge assets. Then Introducing rewards and opportunities to improve the work of the knowledge management, reaching to Improve visibility and communication with knowledge management activities (Persson Urban, 2009).
5. Sustainability: Which is about sustaining the quality of knowledge management activities, to be normal routine, including the aspects of Knowledge management related to all organizational goals (Persson Urban, 2009), besides spreading Knowledge management practices throughout the organization in order to be widely interested in the corporate culture, production process and the behaviour of the staff, ending with Comprehensive reporting on the quality of corporate sustainability practices. (Seow Christopher et al. 2006).

### 2.6.8.2 STURE- a Sustainable management model approach

Stakeholder-Urban, Evaluation Model \_ STURE \_ model was developed as an evaluation model to the efficiency of sustainable construction management practice; it started out as a project management gauge for environmental construction, then was enhanced and improved with additional features of sustainability, as seen in the figure (Persson Urban, et al. 2008):

STURE can be described as an Integrated Project Level Objectives Assessment; nevertheless, if sustainability requirements for ongoing projects were created, then it would also be considered as a prototype for sustainable assessment approach (Persson Urban, 2009). This model is an effective way to systematize the sustainability concerns of construction works in accordance with Environmental Management System Standards, in conjunction with Stakeholder Management.

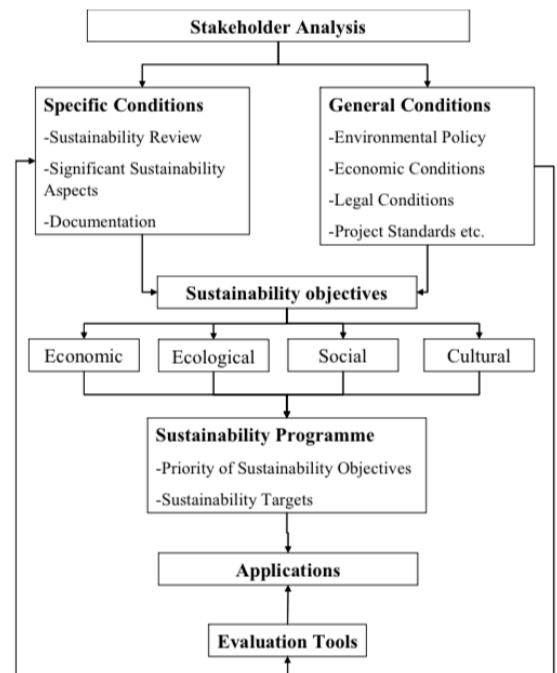


Figure 8: STURE model approach, explains steps of STURE model including stakeholders' analysis and considering general and specific conditions that set in line with sustainability objectives which are incorporated in programs by setting targets and priority reaching to better application.

STURE model optimizes the sustainability objectives and priorities for projects, in attempt to organize different aspects of sustainable construction management (Azapagic A, 2003), based on stakeholders' desires and expectations, noting that STURE model is supported by literature studies on involved stakeholders, sustainability and environmental management systems issues.

The international environmental management system code, ISO 14001:2004 is the base and cornerstones for creating and structuring STURE model (Persson Urban, 2009).

STURE model can be defined in four steps:

1. Stakeholder analysis: Stakeholder analysis is to identify the parties, who are involved along their interests, influence and claims. It is not enough to focus on the official project organization structures (Persson Urban, 2009), it's also important to analyze, evaluate and determine the importance of informal and formal communication between stakeholders and relative project members of management. The evaluation of stakeholders should consider determining both external and internal possible stakeholders, considering the project claims of each stakeholder, if they are supports or opponent the objective of the project,

as well as Evaluating the interests and power of each stakeholder to influence project decisions making (Azapagic A, 2003).

2. STURE conditions: STURE conditions are classified into two categories; general and specific conditions. The general conditions are about the practices of the organization and the project related issues for the entities that are directly linked to operating process (Persson Urban, 2009). It includes stakeholder's environmental policy, goals of general environmental management system, in addition to requirements relating to appropriate economic activities, social impacts and overall project standard approaches and plans. The specific conditions, includes elements of sustainability analysis, aspects and decisions, which are taken during construction process (Azapagic A, 2003).
3. The sustainability program: This is an outcome of the general and specific conditions. It includes setting realistic Sustainability objectives, which outlines the path of sustainable perspective by optimizing the general and specific STURE conditions in terms of three –fold framework in regard to the nature of the construction project, the site and the interests of the internal and external stakeholders (Persson Urban, 2009). Then organizing priorities for sustainable objectives in the relative best order, in order to serve demands during the construction process. Ending with setting Sustainability targets which are defined by comprehensive observable units. These measurable targets can be tested through standards adapted to the project. However, the targets can be flexibly modified during the construction development to serve project arisen criteria (Azapagic A, 2003).
4. Applications: STURE allows of different applications related to construction process to be applied. The sustainability is used in the application as a basic requirement for operation, maintenance, input to the environmental management system, and input into the users and stakeholders (Persson Urban, 2009). Through linking sustainable management process with organization plan, the available information of sustainability can be utilized as a guideline to sustainable measures, sustainability decisions, and analytical techniques and components have been used in construction process. In order to make right decisions among different alternatives and options, the sustainability program is considered as valuable input to MCA, EIA, LCC, CBA and other evaluation tools, that are intended to maintain continuous construction management (Azapagic A, 2003).

STURE is an effective evaluation model linking knowledge and project with sustainability management in order to get effective application of sustainable project management ensuring wider coverage and efficient result during course of implementation.

## 2.7 Sustainable construction management Indicators, challenges and opportunities

### 2.7.1 Sustainable construction management indicators:

The aim of Sustainable Construction Challenges process is to evaluate and present the creative strategies and ideas of sustainability (Furneaux, Craig w. et al. 2010). The International Initiative for a Sustainable Built Environment (iiSBE) has been coordinating and playing important role during World Sustainability Conferences since 1998. Each sustainable Construction challenges recognize and measures their Quality through a specific assessment of construction Sustainability tools. The key indicators are defined by iiSBE, are chosen in a way to be appropriate for different context to apply; also each project can use any accepted assessment tool depending on its region, however more attention has to be given to the key indicators, since comparing outcomes obtained by different tools is very difficult. (Araujo Catarina, et al. 2013).

Table 3: Sustainable construction management indicators, gives some examples of indicators have been selected in relation to the three dimensions of sustainability. (Furneaux, Craig w. et al. 2010).

Diminision	Selected Indicators
• Environmental KPIs	
1. Emissions	Air Emission. Water Emission. Impact on biodiversity.
2. Resource utilization	Energy and fuel Utilization. Water utilization.
3. Waste	Waste removed from the site and waste water.
• Economic KPIs	
1. Quality	Product reliability and durability. Conformance to specification. Scrap and rework. Defects rate.
2. Cost	Material cost. Overhead cost. Labor cost. construction cost.
3. Delivery	On time delivery. Delivery lead time. Cycle time. Schedule attainment.
4. Flexibility	Product flexibility. Process flexibility. New products development. Technology flexibility.
• Social KPIs	
1. employee	Training and development. Health and safety.

	Job satisfaction and working hours.
	Community satisfaction.
2. Supplier	Pay
	Equality and diversity.
	Supplier initiative.

### 2.7.2 Sustainable construction management Challenges, (Threats) and Opportunities:

Sustainable construction management faces many challenges; such challenges are mainly sourced as a result of the need to get better balance among the main dimensions of sustainability. Sustainable Construction management must reach to the appropriate level of balance between environmental, social and economic performance in order to be efficient in approach and outcomes. (Balo Daniel, 2003).

The different challenges which face the sustainable construction management are split into six fields based on the level of involvement in the projects operations and process, which can be explained as follows (Ogunde Ayodeji et al. 2017):

1. Project Manager Factor: The PM who is in charge for management process has wide domain of taking decisions by using the appropriate skills and tools, in order to help achieving objectives of sustainability, hence the project sustainability success or failure is attributed to the abilities and potentials of PM, who is responsible for supervising scheduling, cost, performance, and time delivery. Any important decisions or client proposals can't be conveyed to other parties involved in the project without adequate involvement by the PM (Too Eric G. and Weaver Patrick, 2014). Management of the project requires effective project cost planning, and risk management of the project, which are equally important to establish proper procedural goals with clear objectives.
2. Client Factor: It can't be overemphasised the importance of the client contribution to the construction process either by individual or governmental parties. Most clients tend to shy away from decisions, or responsibilities which would affect project progress, also potential lack of financial banking, by the client, would lead to lake of resources allocating and supplying (Ogunde Ayodeji et al.2017).
3. Suppliers Factor: Suppliers either contractor or sub-contractor must be managed well to ensure success and smooth suppling of materials to run the project services and activities. The poor standards materials affect the quality of workmanship standard, which leads to intolerable wasting of used materials and incur additional costs for replacing them; resulting that the

delivered constructions products will not be complying with the required specifications (Ogunde Ayodeji et al. 2017).

4. Construction team Factor: Construction team comprise, managers, town planners, architects, builders, quantity surveyors and engineers...etc., who they have different responsibilities to imply sustainable management practices (Omran Abdelnaser, and Hussin Abdul AZIz, 2009), and ensure succeeding and maintaining the application of sustainable project management in required level and set values (Ogunde Ayodeji et al. 2017). They have to acquire proper sustainable knowledge and skills to make sure that they are well aware about their roles and achieve their set KPIs successfully.
5. Consultant Factor: Consultant assist in communicating the client interests to stakeholders, and ensuring that project specifications are implied as per required standards (Omran Abdelnaser, and Hussin Abdul AZIz, 2009), thus lack of deploying client messages and intentions through consultants, due to lack of communication would result in deviation from project intended goals (Ogunde Ayodeji et al. 2017).
6. External Factor: They are inevitable factors and classified into natural, political and labour resources. Succeeding of projects is highly depending on treating and reacting to those factors (Ogunde Ayodeji et al. 2017).

The Threats facing implementation of sustainable project management are laying in More restricted legislation hindering proper implementation ,in addition to Continued incomprehension of key sustainability issues and knowledge areas that affect sustainability, and fail to respond to governmental and another sustainability initiative practices (Omran Abdelnaser, and Hussin Abdul AZIz, 2009), besides Indescribable Conflicts with communities and pressure groups activities, as well as More loss of incomes because of higher environmental tax costs, and Lake of environmental and social information, which allows construction companies to criticise different claims, ending with Consumers loss due to failure of proper adoption of sustainable principles. (Azapagic A, 2003).

However, the opportunities of implementing sustainable project management are many and classified into many aspects.

Social aspect is about Improving employees performance , motivations and assess real achievements, leading to Increase The ability of attracting highly qualified employees to the organization , through continuous staff development, and demonstrating social responsibilities (Azapagic A, 2003), in addition to Enhance health and safety measures , leadings to lower cost ,and build confidence with governmental and non-governmental organizations, through facilitating accessibility and collaboration ,beside Improvement of communication and sustainability commitment to external stakeholders (Walker Helen, et al.2014).

Environmental perspective of benefits is mainly about Reducing environmental risk (reduce risk of pollution), and applying Environmental monitoring tools that enhance process management and source conservation, in addition to adopt effectively Enhanced EMS ISO: 14001 (Morrow David, and Rondinelli, 2002).

Legislative opportunity can be formed by Improving capacity to respond into changes, through adopting better planning, in addition to enhance policy and regularity ties by demonstrating environmental and social responsibilities, beside elevating ability to direct regularity bodies through a self-assessment of informed decisions (Walker Helen, et al.2014).

Economic opportunity can be attained via improving efficiency in production, and lifting up product quality by using clean technologies, which enhance production rates and reduce costs, besides obtaining highly improved end products, through utilising clean and cheap energy (Bon Ranko, and Hutchinson Keith, 2000).

However, there are many other opportunities, such as creating Sustainability leadership in the corporate group or sector, and encouraging improved partnerships with investors and clients, through strong economic, social, environmental and ethical records, which in result would lead to successful organizations, that are implementing right sustainable decisions (Azapagic A, 2003).

## **2.8. Conclusion:**

Sustainability term is an extremely problematic concept in all its forms; however, the economic, social, and environmental aspects considered in managing organisations have become an instrumental tool to shape and expand organisational management practice. In term of sustainability, such concept focuses on entities' structure and reinforces the notion which businesses must remain concentrated on at first place, rather than environmental system itself. Importantly to highlight, Mega projects developments, that are avoiding the demands of growing business, and prioritising making higher profits, and securing the financial viability of the business, rather than recognising environmental aspects will be trapped in the net of losing market competitiveness and ousting their products, reaching to unfavourable results of ignoring environmental and social equity, along with causing cost overrun.

The construction sector is a major sponsor to global climate change, and other essential environmental threats. However, the researcher doesn't see enough civil society or regulating demands forsake of reforming construction sector. Consequently, it is up to the construction industry itself to do the right thing and accept the needed radical reform, in the way of becoming more moral about taking proper managerial choices. In developing countries, the construction

sector has significant role to play for infrastructural and industrial growth, and fortunately, people are now finally realising the consequences of unsustainable construction and turning towards better and more responsible construction end product, through applying sustainable management in construction industry.

Stakeholders as a key operator of urbanisation, act a powerful role to take on sustainable practices. However, absence of explicit application framework, that integrates both sustainability and construction practices at corporate and operational level of the organizations is the key challenge, thus a solid sustainable management platform needs to be developed and customised for each organisation and even for each project to get on reliable results.

Corporate sustainable management is the top of pyramid and cornerstone for the efforts of incorporating sustainable management approach into lower levels of business units, programs, portfolios and projects, thus strong well of senior management supported by global tendency toward sustainability and local legislation will certainly be very essential in spreading sustainable management practices among the organizations and entities.

The broad definition of sustainability increases the complexity and variety of decisions must be implemented by the project team during construction process, for sake of implementation sustainable management. Information circulation among construction companies and inside their structures, transforms this information into knowledge needed to move the process toward sustainable management trend. The need to involve stakeholders in the sustainable construction management requests from the project management team adopting combined methods or tools, in relation to sustainability and improving quality aspects of the project process leading to sustainable buildings, through Using STURE's model approach, and STEPS maturity roadmap, which helps construction team to develop a structural framework of sustainability, environmental, and quality aspects, linked to the projects and stakeholders demands in form of technical solutions.



### 3. Research Methodology

#### 3.1. Literature Review Formulation

This dissertation was developed systematically by selecting the topic of exploring implementation sustainable construction management practices in Dubai, then setting clear boundaries of this research by specifying clear aim, questions and objectives, after then starting in long and exhaustive process of selecting relevant academic sources from internet, library and speciality websites, then translate them into serial and interconnected articles and passages about sustainability and sustainable construction management, which are framed within research established boundaries, highlighting the notion and problems of research, and offering obvious answers from critic's point view, ending with comprehensive formulation of literature review, which is in line with research objectives.

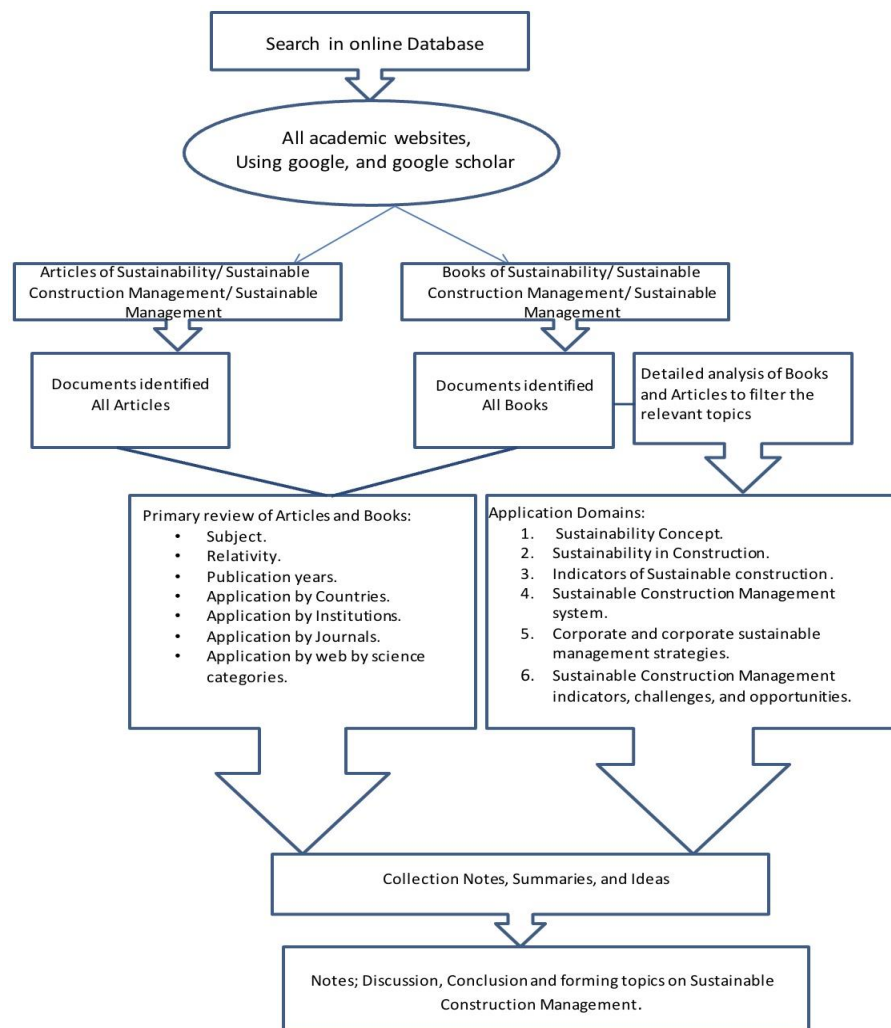


Figure 9: The systematic methodology of screening academic sources, online books and articles to formulate literature review to be in line with research objectives and answering research questions.

### 3.2. Adopted Research methodology

In thorough academic research, obtaining qualitative information is essential to develop descriptive analysis, simultaneously conducting quantitative research is essential to give a full interpretation of the data. In such case, a mixed methodology of researching should be used (Apuke, 2017). The research may conduct qualitative methods to collect descriptive information from relevant literature, survey analysis, and structured and non-structured interviews to achieve what is the data driving to conclude (Bryman & Bell 2011). Whereas quantitative methodology can be exploited to examine and prove huge theories. (Apuke, 2017)

Epistemology is an important concept in research process, which is about how the theoretical framework pattern and frame the way of relevant information being obtained and the nature of its analytical approach in a research (Creswell, 2014). The conception of positivism is considered as core part in research epistemology. Positivism highlights facts as impartially judged, set reality, which are founded and noticed impartially from the subjective point view of the researcher (Taylor et al. 2003). Therefore, the researcher has followed the methodology of collecting hard and soft data, then interprets them rationally, and in line of given feedback, which is utilized as a basis to answer the research questions. Therefore, in this academic research, the researcher has used quantitative research methodology to collect the relevant data, by using objective approach to gather and analyse the data in numerical and mathematical method, starting in getting opinions of selected sample about subject of the research. It begins by theory study to identify sustainability, and sustainable construction management, their concepts, theories methods, process, opportunities and threats and factors are necessitated to achieve successful sustainable construction management practice in Dubai, then from literature review and researcher's experience a questionnaire is developed for quantitative method to get relevant feedback, answering the research questions and drive to targeted findings, enabling processing and analysing the data to verify the research hypotheses.

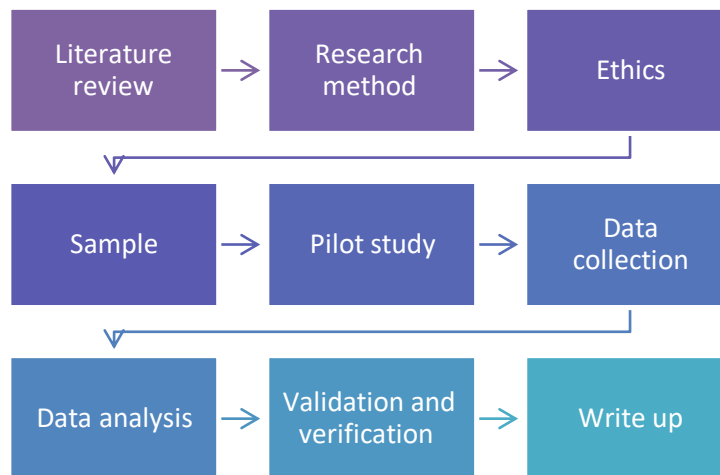


Figure 10: The process of developing the research, starting from formulation literature review in line with research objectives, then following with dependable research methodology, along with adherence in ethical approach in collecting Feedback from the selected sample, then piloting the study, and assembling data, then analyse and validate it in order to form the final writing.

### 3.3. Research Ethics:

An ethical approach was followed in sampling for this research, by ensuring widespread participation of the sample from the intended population, noting that the data and answers were recorded exactly as given by the participants. Moreover, the researcher took prior permissions from the management of companies and projects before distributing the questionnaire to convenient sample, who were asked to help in distributing this survey to their colleagues, after getting permissions of their corporates and projects heads, who are working in construction field to cover “snow ball” surveying strategy. The researcher followed systematic and transparent approach in collecting data, in line with moral limitations set for such academic research.

### 3.4. Research Sample:

Sample for quantitative method was selected from population of construction field in Dubai, in order to get relevant and precise feedback about the core of study of examining sustainable construction management practices in Dubai. The sample was selected based on combination of probability and non-probability approaches, by selecting simple random sample of construction specialist through publishing the related questionnaire on a website of project management speciality, and LinkedIn, in addition to using convenient and snowball sampling approaches, via distribution the questionnaire to work associates and in contact construction stakeholders, then ask them to distribute the questionnaire to their professional contacts, who are working in construction field.

Targeted Sample is purposed to be comprehensive ,diverse, and representative to the population in order to get on reliable feedback, that would rely on to attain representing and reliable conclusions can be generalised for bigger populations ,However a possible source of error could be generated from random sampling of the population by possibility of participating non-specialist in construction field, add to that using snow ball sampling technique could drive the survey to reach participants of similar companies , trades and department ,thus the researcher did all measures to get on higher numbers of initial participants at different levels of management in divergent specialities in construction field, who are working in different companies of dissimilar roles including contracting ,consulting, project management and employers, and selected a website whom members are from background of construction management ,so the feedback would be based on a sample of solid knowledge and experience in construction field in Dubai.

### 3.5. Pilot Study

Determining the feasibility of the research design can be done via piloting study before starting in data collection process. This is a preliminary, small-scale “rehearsal” in which testing for the methods and sample that are planned to be used for the research before it is conducted. Pilot study had been performed for quantitative study, by examining the used tools of analysis, through inspecting the set questionnaire, in order to make sure that listed survey questions are comprehensive and aligned to research questions and addressing the research hypothesis, which was done initially by the researcher, then was consulted with two professionals in construction field for final aligning and tuning.

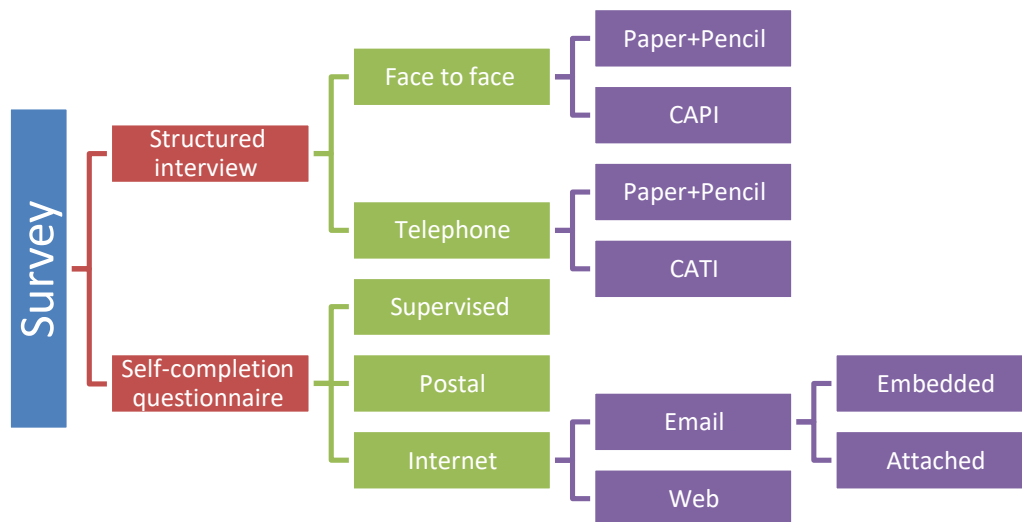


Figure 11: The type of methods could be used in research, which are a combination of structured interviews for qualitative method and self-completion questionnaire for quantitative analysis.

### 3.6. Data collection:

The Literature review stage was followed by data collection from formulated questionnaire to study sustainable management practices in construction field in UAE-Dubai.

The questionnaire was prepared starting with introduction part to give information regarding the research objectives. The survey was divided into six area of information with 39 items introduced in simple, short and direct wordings.

Part 1, was about the respondents' demographic information, while the succeeding part 2 was to verify the awareness of sustainably concept in construction projects. The following part 3 was set to understand level of current adopting of sustainable construction management practices in Dubai, then section 4 was about factors which are necessary and essential for successful implementing of sustainable construction management practices in Dubai, then part 5 was purposed to understand and highlight the opportunities and benefits of successful implementing sustainable construction management in Dubai, whereas section 6 was set to ask about general positive impact of sustainable construction management, and exploration of future look for positive effects of utilizing successful sustainable construction project management. . All parts of the questionnaire except section 1 were developed on Likert scale measure. Table 4, in below shows the Mapping of subject research with Questionnaire.

The researcher had developed the questionnaire online, through using Google form, then the link was distributed electronically. The questionnaire was published via online website, which is specialised in construction management in Dubai, via LinkedIn and by asking work mates ,colleagues and associates to answer and forward questionnaire to their contacts in construction companies ,in addition to addressing many members in several construction companies from contracting, consultancy and real state background to participate in the survey , and spread it to their work colleagues, who are involved fully or partially in construction operations and management in Dubai .After one week time of collecting data, which was recorded to the electronic form ,the researcher ended up the participation with 40 members, who partook in the survey and provided their feedback.

Table 4: Research boundaries, verify how research boundaries are mapped with quantitative methodology as translated in the questionnaire, it highlights area of required information linked with set questions to get on relevant feedback and findings that can be used for useful analysis and conclusion.

<b>Research Dimensions/ Subject of Research</b>	<b>Question</b>
<b>Section 2 : Explore awareness of Sustainability concept in construction filed.</b>	1. Sustainability has clear definition and applications in construction sector.
	2. You are sufficiently aware of rating systems, such as LLEED; for evaluating incorporating sustainability in construction sector.
	3. You are working in projects adhering with Dubai green building guidelines.
<b>Section 3 :Explore and understand level of current adopting of sustainable construction management practices in Dubai.</b>	4. Sustainability implementation in construction sector has lack of clear applying and management framework.
	5. Your organization is applying sustainable management approach at corporate level.
	6. You are working in construction projects are applying sustainable management approach.
	7. Integrating sustainability into construction management has become essential to manage construction projects.
	8. There are Clear guideline and strategy for implementation of sustainable construction management in your company.
	9. There are Clear guideline and strategy for implementation of sustainable construction management in your Projects.
	10. Authority relevant legislation in Dubai support implementation of sustainable construction management.
	11. Communities and pressure group support implementation sustainable management practice during construction operations.
	12. Stakeholders' detection, analysis and engagement are very important

	<p>to imply sustainable management practices.</p> <p>13. The project team you are working with has sufficient knowledge of sustainable management practices.</p> <p>14. Senior management/board of directors play key role in adopting sustainable construction management policy into organization.</p>
<p><b>Section 4 : Explore and confirms the factors are necessary for successful implementation of sustainable construction management in Dubai.</b></p>	<p>15. Successful implementation of project management requires development of Knowledge management associated with sustainability and ecological concerns in order to raise awareness and develop project team skills.</p>
	<p>16. Successful implementation of sustainable construction management requires adopting legislation encouraging adopting sustainability and sustainable practices in construction sector.</p>
	<p>17. Successful implementation of sustainable construction management requires adopting sustainable management principles and policy at corporate level of construction companies.</p>
	<p>18. Successful implementation of sustainable construction management requires adopting sustainable management principles at construction project level.</p>
	<p>19. Successful implementation of sustainable construction management at project levels require combining sustainability tools and practices with Construction project management, through the lifecycle of project management process, including project start up, planning, execution, controlling and project closure.</p>
<p>20. Successful implementation of sustainable construction management depends on successful</p>	

	<p>management of projects stakeholders.</p> <p>21. Successful implementation of sustainable construction management depends on competency of Project managers</p> <p>22. Successful implementation of sustainable construction management depends on skills and sustainable knowledge of construction Project team.</p> <p>23. Successful implementation of sustainable construction management depends on positive involvement of clients /employers in term of adopting applications of sustainability in projects specifications.</p> <p>24. Successful implementation of sustainable construction management depends on positive involvement of Consultants and PMCs in term of ensuring applications of sustainable management in construction field.</p> <p>25. Each project is unique in nature and requires specific sustainable management framework that is trailered from general principles and strategy applied at corporate levels.</p>
<p><b>Section 5: Highlight opportunities/Benefits resulted from Implementing sustainable construction management in Dubai.</b></p>	<p>26. Adopting Sustainable construction project management would result in good Economic opportunity through improving efficiency in production, and lifting up product quality by using clean technologies, which enhance production rates and reduce costs.</p> <p>27. Adopting Sustainable construction project management would result in reducing environmental risks, mainly in pollution of environment.</p> <p>28. Adopting Sustainable construction project management would result in improving Health and Safety measures taken in construction projects.</p>



	29. Adopting corporate sustainable construction management would be encouraging improved partnerships with investors and clients, through strong economic, social, environmental and ethical records.
	30. Adopting Sustainable construction project management would result in positive social impact via attracting high qualified employees who are seeking for innovative, continuous development and moral management approach.
	31. Adopting Sustainable construction project management would result in improving/reducing the time of projects development.
	32. Adopting Sustainable construction project management would result in improving quality of construction end products.
<p><b>Section 6: Highlight Current General Impact of Sustainable construction Management and possibility of promising positive future applications in Dubai.</b></p>	33. Sustainable Construction project management 'in general' has positive impact on construction project operations and end product
	34. Applying Sustainable construction management practices in Dubai has positive promising future for successful applications.

### 3.7. Research Hypotheses

This section will elaborate on measures that used for the independent and dependent variables in order to test the hypothesis generated in the conceptual framework section of this research.

- Dependent Variable:

The successful implementation of sustainable construction management in Dubai is the dependent variable, which is covered by area of information number 5& 6 of the questionnaire. The questionnaire of this section was prepared based on a 5 point Likert scale (1 to 5), where 5 stands for “strongly agree”, 4 “agree”, 3 “neutral”, 2 “disagree”, and 1 “strongly disagree”.

- Independent Variable:

The independent variables for this research are formulated and specified into four items ,which were examined generally and specifically in the Survey questions as listed in section 4 of table 4 ,which are about stakeholder management and involvements in applications of sustainable management, particularly for the most involved ones, with higher interest and influence stakeholders, such as Project manager, project team, Client, consultant and project management companies ,in addition to adopting proper relevant legislations, by Authorities, supporting successful implementation of sustainable construction management, besides applying sustainable management at corporate and project levels and finally development proper sustainable knowledge management among community and projects teams. The specific Hypothesis undertaken for this research are set with specific wordings as follows:

#### Hypothesis 1

H1: Successful implementation of sustainable construction management in Dubai requires adopting legislation encouraging implementing sustainable practices in construction field.

#### Hypothesis 2

H2: Successful implementation of sustainable construction management in Dubai needs development of knowledge management in term sustainability and sustainable practices among stakeholders.

#### Hypothesis 3

H3: Successful implementation of sustainable construction management in Dubai requires Incorporation at project and corporate level of organisations and board of directors' adoption.

#### Hypothesis 4

H4: Successful implementation of sustainable construction management in Dubai needs proper management of stakeholders' involvement and interference in construction processes and operations.

### 3.8. Conceptual framework:

Visual diagram ,as in figure 12, summarises the conceptual framework of research, in order to examine the hypotheses, which were understood from literature review and long experience of the researcher in construction field in Dubai, that interlink successful implementation of sustainable construction management with presumed factors, of supporting sustainable legislations, incorporating sustainable management at corporate and project

level , sustainable knowledge management among stakeholders and management of key involved stakeholders and adequate management of stakeholders' involvement.

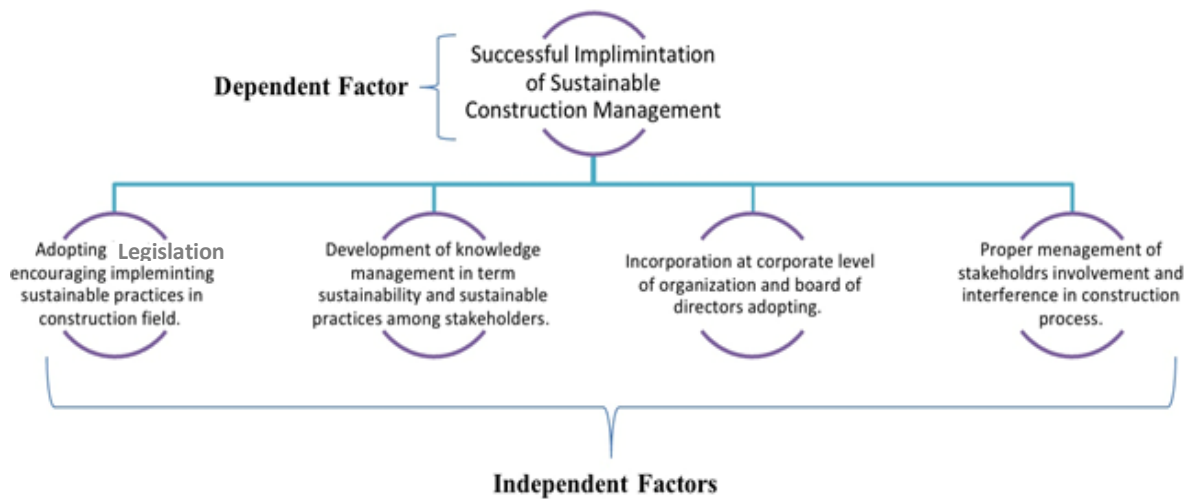


Figure 12: Dependent and Independents variables set for the research and linked to formulate the research hypotheses.

### 3.9. Validation and verification

Generally, validity is an indicator of how solid the research is. Particularly, validity is applied to the design and the methodology of the research. Validity is also important in collecting feedback and data, as it will mean by necessity that the findings are factually representing the case and problem that the researcher is targeting to measure its impact.

Validity is one of the main concerns with research. "Any research can be affected by different kinds of factors, which, while extraneous to the concerns of the research can invalidate the findings" (Seliger & Shohamy 1989).

Controlling all possible factors that maybe threaten the research's validity is a primary responsibility of every researcher. Generally, there are two types of validation, internal and external.

The internal validity is mainly related to the directions within the study itself, such as not controlling a design problem or issues with the research instruments, such as questionnaire or collecting data issues.

"Findings can be said to be internally invalid, because they may have been affected by factors other than those thought to have caused them, or because the interpretation of the data by the researcher is not clearly supportable" (Seliger & Shohamy, 1989).

External validity is the limit to which researcher can generalise the findings and results to a larger groups or other contextual cases. If research has deficiencies in external validity, then the findings cannot be spread to contexts other than the one which the research is studying. For example, if the research is considered for one ethnic group then generalize it to other ethnics or nations would be irrelevant and out of accurate context.

Verification is defined as the process of examining proving, making sure, and being confident. It is the researcher responsibilities to adopt verification strategies that ascertain the reliability and validity of data and information, for example ensuring methodological coherence, sampling sufficiency, developing a connection between sampling, data collection and analysis (Morse et al. 2016)

In this academic research both verification and validation were applied for conducted process and research findings. A systematic process of verifying consistent methodological approach, of getting relevant data for literature review, and mapping it with extracted hypotheses, then collecting data through piloted questionnaire that were distributed to the sample who are involved in construction sector, to answer research questions, and verify the set hypotheses, ending up with systematic, mathematical, analytical and critical discussion to the findings.

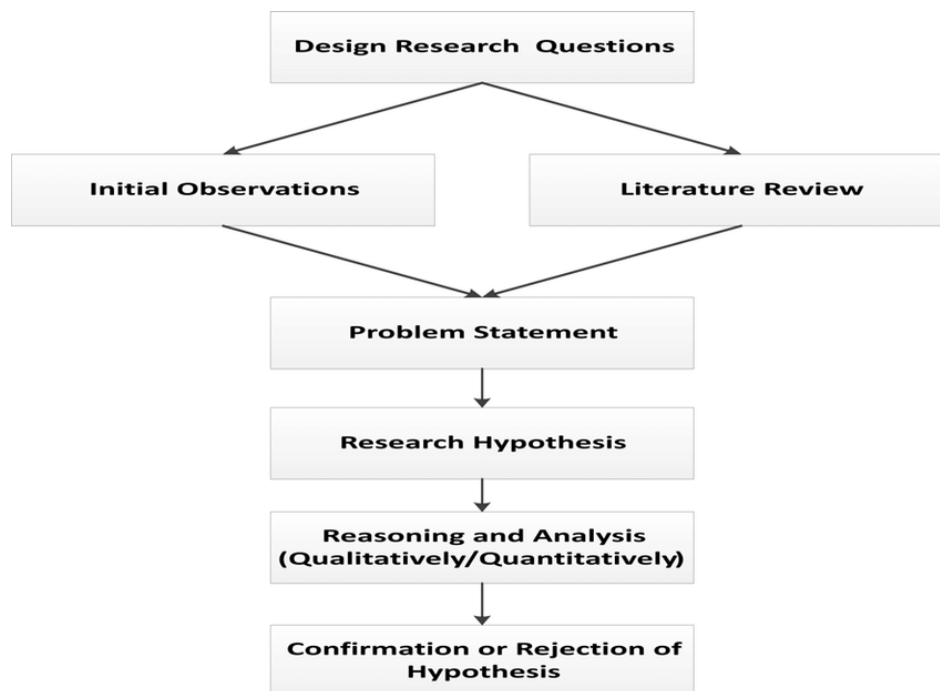


Figure 13: Research methodology and systematic procedures, from designing the research questions, going through literature review, then setting problem statement, setting research hypothesis, then reasoning and analysing the data, ending with confirming or rejecting research hypothesis.

## **4. Research Findings and Analysis.**

In the stage following conducting Survey, collecting data, and getting the answers of the questionnaire from 40 respondents of the sample, the step of evaluating the data is conducted by using statistical software, SPSS.

Analysis of data is very important to understand the statistical level of data reliability, and relationships between the dependent and independent variables, in order to be in a position of meaningful usage of them, and generalize the results to the population.

The first section is purposed to discuss the demographic information of the participants and analyse them rationally, getting conclusion about sample frame.

Then numerical examination is done, through Reliability test, which was conducted by SPSS software to confirm the consistency and reliability of recorded answers and data. After then, the data was subjected to correlation test, in order to determine the relationship between dependent variable of successful implementation of sustainable construction management in Dubai ,with the set factors of adopting legislation encouraging implementation of sustainable management, development of Sustainability knowledge management among stakeholders ,and incorporating sustainable management policy at corporate and project levels, and proper stakeholders management and involvement as independent variables. After then a regression test was conducted to confirm the strength and direction of relationships between dependent and independent variables, testing the assumed hypothesis of the research. The global dependent variable, which is successful implementation of sustainable construction management is reflected in term of sub criteria of ecological, HSE, economic, social and time benefits and general positive impact of applying sustainable construction management.

### **4.1. Demographic information.**

Demographic analysis was conducted based on the criteria set in the questionnaire to get sufficient data about nature, characteristics and distribution of sample, in order to analyse level of confidence about sample for being representative to the population.

The gender distribution is important to understand the percentage of participants' gender among the sample. The percentage of male participants was 87.5%, whereas the female was 12.5%. That can be read in conjunction with nature of works in construction field, which requires high physical efforts by staff and workers, thus the population of construction field is tending to have majority of male personnel, which is a global trend, but it is more obvious in the construction field in region of Middle East.

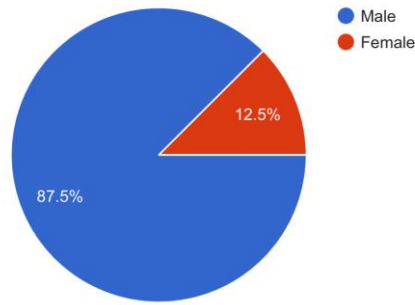


Figure14. Gender distribution of the participated sample.

The next demographic factor is about exploring the type of companies involved in construction field in Dubai, as part of construction projects of the participated sample .The majority of participants,67.5% was from contractor background ,which can be explained; that the number of contracting companies, and staff in construction field are representing the majority ,because the contractors are carrying on with direct execution of construction activities and controlling supply chain in micro management level., while PMC companies participants were 15% ,then consultants were 12.5%, which shows less numbers of members comparing to the contractors, as their roles in nature are mainly about supervising and managing contractors’ works and activities, which is requiring less level of staff, then finally 5% of participants were from client or employer companies, which usually represent the minimum staff in construction field, as their roles is related to high level overseeing of construction operations.

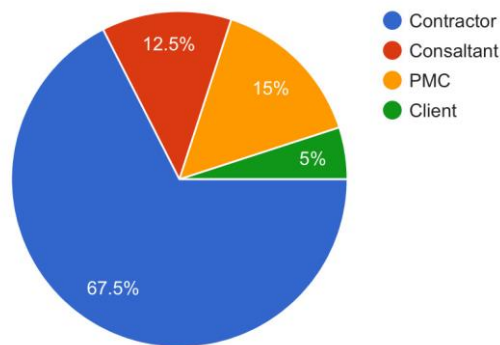


Figure 15: The distribution of sample based on type of construction firm.

Next level is exploring the capacity of staff for the organizations of participated sample .As resulted, 90% of the participants their companies have more than 500 staff, while only 10% their firms encompass relatively lesser numbers of employees , which indicates to the nature of Dubai construction market in term of broader construction field, that is containing large scale of construction projects, in addition to the nature of

global and multinational construction companies are working in Dubai construction market.

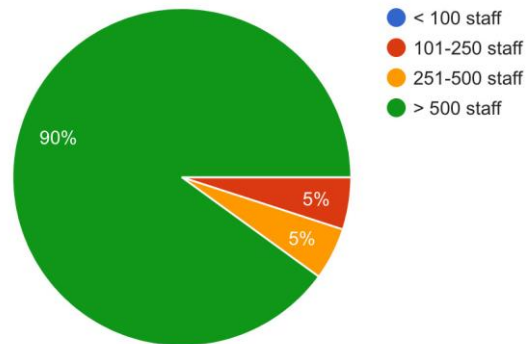


Figure 16: The distribution of sample based on size of construction firm.

The next level of demographic data is to highlight the level of management seniority of the participants. The sample shows that Senior management level represents 37.5% of the sample, while 45% are from medium level of management, and the least participants with 17.5% was from junior staff, which would give obvious indicators that majority of the participants have higher level of managerial experience in construction field, which would lead by necessity to more relevant and accurate decisions in answering questions of the survey about applications of sustainable construction management.

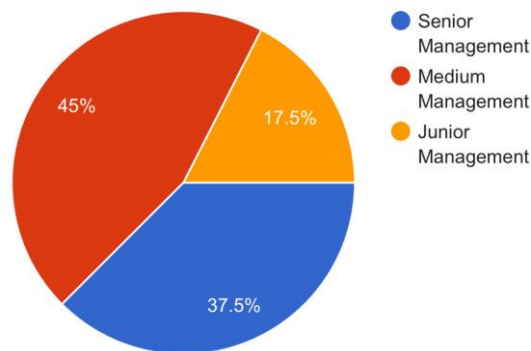


Figure 17: The distribution of sample based on seniority level in management in construction field.

Years of experience of involved participants shows that 20% of them have more than 20 years' experience in construction field, while majority of sample with 57.5% having experience from 11 to 20 ,and 17.5% having 6 to 10 years' experience, whereas minority of 5% are having less than 5 years' experience .This distribution of sample indicate that significant number of the participants are having relatively high level of expertise in construction field, which is driving to reliable answers of questionnaire, resulting in dependable responses and conclusions.

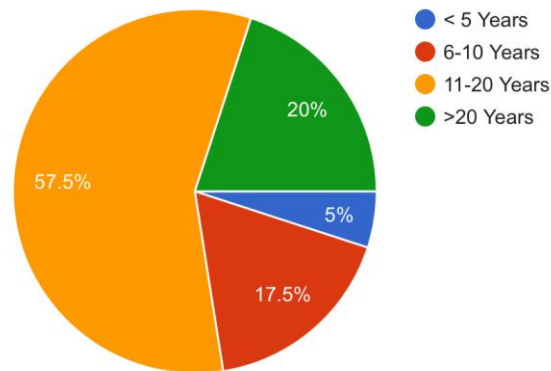


Figure 18: The distribution of sample based on years of experience in construction field.

#### 4.2. Reliability Test

Reliability Test was conducted for the variables extracted from the questionnaire., referring to Table 4 ,items from 1-14 were listed as queries to gather data for descriptive analysis purposes ,helping in exploration level of awareness of sustainability and level of adopting sustainable construction management in Dubai, beside the items from 15 to 25 which were developed to measure the set hypotheses of independent variables(IVs), which are adopting legislation encouraging implementing sustainable practices in construction field, development of knowledge management in term sustainability and sustainable practices among stakeholders, Incorporation at corporate and projects level of organisations and board of directors' adoption, proper management of stakeholders' involvement and interference in construction process ,whereas items from 26-34 in combination were set to represent benefits of adopting sustainable construction management and positive impact, which in combination would result in developing global Dependent Variable (Global DV), demonstrating successful implementation of sustainable construction management style.

Reliability is very important to prove how collected data is consistent, and can be relied on; therefore, higher number closer to value 1 refers to higher dependability of collected data. Reliability test was done for IVs in 2 stages; first one is measurement by Cronbach's Alpha value as illustrated in the Table 5 below.



Table 5: Cronbach's Alpha Reliability

Reliability Statistics	
Cronbach's Alpha	N of Items
.855	11

Cronbach's Alpha value for the measures of the Independent variables is 0.855, which proves significant reliability of the data. Second analysis was conducted is Split Half by dividing the variables into 2 equal groups, for each of them, the Split Half The table 6 below indicates the Guttman Split Half coefficient value of 0.816, which is very close to the overall Cronbach Alpha value of 0.855.

Table 6: split half Reliability

Reliability Statistics				
Cronbach's Alpha	Part 1	Value	.761	
		N of Items	6 <sup>a</sup>	
	Part 2	Value	.766	
		N of Items	5 <sup>b</sup>	
	Total N of Items			11
	Correlation Between Forms			.690
Spearman-Brown Coefficient	Equal Length		.817	
	Unequal Length		.818	
Guttman Split-Half Coefficient			.816	

The second conducted test conducted was correlation test, for the purpose of attesting the relationships between independent variables (IVs) and dependent variables (Global DV). For this research The dependent variable is represented in successful implementation of sustainable construction management in Dubai, which is formed in the combined opportunities and benefits of adopting sustainable construction management, in addition to general positive impact of implementing sustainable construction management as formed in the survey and represented in inquiries from 26 to 34 as illustrated in Table 4, forming combined Global dependent variable (Global DV) which Represented in success of implementation sustainable construction management practices in Dubai.

### 4.3. Correlation Test

Correlation test is conducted for the purpose of measuring the strength of relationship between the four independent variables, which are Legislation supporting implementation of sustainable construction management, develop knowledge management among stakeholders connected to sustainability and sustainable construction management, incorporation of sustainable construction management at corporate and project levels and support of board of directors ,in addition to proper involvement and management of stakeholders, against the dependent global variable which include combination of the criteria of benefits and opportunities of successful implementation of sustainable management in addition to the general positive impact of its adoption.

Table7: Correlation relation and values among DV and IVs

<b>Correlations</b>						
		Legislation	Knowledge Management	Incorporation at Corporate and project level	Involvement Stakeholders	Successful Implementation
Legislation	Pearson Correlation	1	.431**	.140	.238	.536**
	Sig. (2-tailed)		.006	.390	.139	.000
	N	40	40	40	40	40
Knowledge Management	Pearson Correlation	.431**	1	.550**	.541**	.482**
	Sig. (2-tailed)	.006		.000	.000	.002
	N	40	40	40	40	40
Incorporation at Corporate and project level	Pearson Correlation	.140	.550**	1	.555**	.383*
	Sig. (2-tailed)	.390	.000		.000	.015
	N	40	40	40	40	40
Involvement Stakeholders	Pearson Correlation	.238	.541**	.555**	1	.645**

	Sig. (2-tailed)	.139	.000	.000		.000
	N	40	40	40	40	40
Successful Implementation	Pearson Correlation	.536**	.482**	.383*	.645**	1
	Sig. (2-tailed)	.000	.002	.015	.000	
	N	40	40	40	40	40
**. Correlation is significant at the 0.01 level (2-tailed).						
*. Correlation is significant at the 0.05 level (2-tailed).						

As demonstrated in the table 7 above, the parson correlation shows values between .383 to .645, which indicates to moderate correlation between dependent and independent variables, .Referring to above table there is a high significance between global variable of successful implementation, and the four independent variables, which is rounding between 0.0 and 0.015 .which proves that there is a relationship between successful implementation of sustainable management with tested independent variables of adopting supporting legislation ,develop sustainable knowledge management among stakeholders ,incorporation at corporate and project levels, and proper involvement and management of stakeholders. The significance of adoption legislation supporting sustainable management implementation and proper stakeholder involvement and management in term of sustainability have significance equal to 0.0, which proves very high correlation with factor of successful implementation of sustainable construction management in Dubai, However incorporation at corporate and project levels, in addition to development of knowledge management in term of sustainability and sustainable practices have recorded significance of 0.015 and .002 respectively, which shows lesser correlation, but still high and refer to strong relationship with successful implementation of sustainable construction management in Dubai.

In result, the four tested hypotheses (H1, H2, H3, H4) are proved and accepted as there is significant relationship between dependent and independent variables, whereas the null hypotheses are rejected.

#### 4.4. Regression Test

Backward Stepwise Regression:

For the purpose of generating an equation representing the accurate relationship between the Independent variables, which are the tested criteria of supporting Legislation, Incorporation at corporate and project levels, develop knowledge management and proper involvement and management of stakeholders, which are considered as input variables , with dependent variable of successful implementation of sustainable management in Dubai ,which is considered as output variable, a regression test was conducted

As driven in literature review the successful implementation of sustainable construction management depends on incorporation of sustainable principles, and policy at corporate and project levels, in addition requirement of developing knowledge management about sustainability and sustainable management practices among stakeholders, besides the requirement of imposing legislations encouraging adopting sustainable management ,moreover requirement of proper involvement and management to stakeholders in term of sustainable construction management applications. Simply the input variables will be determined based on their respective significance of affecting the output variable. The IVs which are found to have the most impact on the dependent global variable will be the basis of the equation of sustainable construction management in Dubai, in term of likelihood of success, based on the implementation of four independent variables IV.

$$y = f(x_1 + x_2 + \dots)$$

$$\begin{aligned} y & \text{ (Successful Implementation of Sustainable construction management)} \\ & = f(\text{legislation} + \text{Incorporation at corporate and project level} \\ & \quad + \text{Knowledge Managment} \\ & \quad + \text{Involvement and Managment of Stakeholders}) \end{aligned}$$

$$y = \text{Constant Coefficient} + (\text{Coefficient}_1)(x_1) + (\text{Coefficient}_2)(x_2) + \dots$$

*Equation 1 Equation to Model the Relationship between Successful implementation of sustianble management and independent variables subject of this study.*

The proposed equation no. 1 suggests linear relationship between factors x and y. The Test of Stepwise regression is utilized for the testing of the impact of independent

variables separately, which may oversee some of the internal relationships between the independent variables, i.e. sometimes the variables could be subcategories to each other, which together would generate an intensified impact on the dependent variable, when they are presented synchronously. As an alternate method, using the technique of testing overall Independent variables in one group, then imposing exclusion and removal of the IVs with less significance values would lead to highly comprehensive analysis of interdependencies, which can be obtained by utilizing stepwise regression test. For the purpose of getting the most significant input (independent) variables as predictors, regression models are created as in following tables.

Table 8: Regression Modules.

Model Summary <sup>c</sup>					
Model	R	R Square	Adjusted Square	R Std. Error of the Estimate	Durbin-Watson
1	.645 <sup>a</sup>	.416	.400	.51677	
2	.756 <sup>b</sup>	.571	.548	.44888	2.549
a. Predictors: (Constant), Involvement Stakeholders					
b. Predictors: (Constant), Involvement Stakeholders, Legislation					
c. Dependent Variable: Successful Implementation					

As shown in the model summary as in Table 8, the most significant predictors(IVs) contributing in successful implantation of sustainable construction management in Dubai is Model 2, which shows combination of proper management and involvement of stakeholders in stainable construction management practice in Dubai. In addition to Requirement of adopting legislations, encouraging implementing sustainable practices in construction field, which account 57.1% of the variance in dependent variable, which is relatively high percentage and prove the fairly high contribution in achieving dependent variable.

Table 9: Regression Model Significance Analysis

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.223	1	7.223	27.046	.000 <sup>b</sup>
	Residual	10.148	38	.267		
	Total	17.370	39			
2	Regression	9.915	2	4.958	24.603	.000 <sup>c</sup>
	Residual	7.455	37	.201		
	Total	17.370	39			
a. Dependent Variable: Successful Implementation						
b. Predictors: (Constant), Involvement Stakeholders						
c. Predictors: (Constant), Involvement Stakeholders, Legislation						

As demonstrated from table 9, Model 2 predictors have very high significance value equal to 0.000 (at  $p \leq 0.05$ ) in relation of their impact on successful implementation of sustainable management as in Equation. The two predictors which are Proper involvement and management of stakeholders in stainable construction management practice in Dubai, in addition to Requirement of adopting legislations encouraging implementing sustainable construction management practices in Dubai, explain 57.1% of the variance with a p-value equal to 0.000, which is considered satisfactorily very significant to confirm this established relationship. Thus, those aforesaid independent variables can accurately predict 57.1% of the factors, which contribute and lead in successful implementation of sustainable construction management in Dubai

Table10: Residual Statistics.

<b>Residuals Statistics<sup>a</sup></b>					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.1415	4.8322	4.1032	.50421	40
Residual	-1.23099	1.18043	.00000	.43722	40
Std. Predicted Value	-1.908	1.446	.000	1.000	40
Std. Residual	-2.742	2.630	.000	.974	40

a. Dependent Variable: Successful Implementation

For the purpose of assessing the accurateness of the resulted model, the dispersion of the dependent variable results around its mean is examined. Table 10 illustrates that the dependent variable mean is 4.103 and the standard deviation is 0.667. Also, the standard error of this estimate is 0.449 as shown in Model 2 in Table 8. By dividing the value of standard error of model on the Mean of Dependent Variable, which is successful implementation of Sustainable, then the value would be 10.9%, which is slightly exceeding 10% of the value of the mean of the dependent variable, which is 4.103. Thus, in order to demonstrate the suitability of the predictors as the basis of a regression model, additional analysis has been undertaken.

Table 11: Coefficient values of Regression Model

Coefficients <sup>a</sup>											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
		2	(Constant)	-.231			.628		-.368	.715	
	Involvement Stakeholders	.678	.137	.548	4.945	.000	.645	.631	.533	.943	1.060
	Legislation	.335	.092	.405	3.655	.001	.536	.515	.394	.943	1.060

a. Dependent Variable: Successful Implementation

Table 11 above shows the extracted coefficient factors, which specify the ‘weightage’ or value of change that each IV predictor is relative to the dependent variable when all other factors remain constant. Involvement of stakeholders and Proper legislations are very significant with value of .00 and .001 consecutively. The constant coefficient of the equation is insignificant. Whereas The Obtained Beta values for variables are all positive, which demonstrates that the predictors are positive contributors to the dependent variable. The variance inflation factor (VIF) is very important in the extent of correlation between one predictor and other value range, which is fairly low as it equal to 1.06, hence as the value is very close to one, then collinearity isn’t a problem, which shows that the values are not inflated, therefore there is no significant collinearity between the IVs, which could impact the validity of the data. VIF value of 1 indicates no multi-collinearity, and a range between 1 and 5 is moderate collinearity, thus as VIF is very close to 1, then the regression results are highly reliable.

Table 12: Correlations between Independent Variables

Correlations						
		Successful Implementation	Legislation	Knowledge Management	Incorporation at Corporate and project level	Involvement Stakeholders
Sig. (1-tailed)	Successful Implementation	.	.000	.001	.007	.000
	Legislation	.000	.	.003	.019	.070
	Knowledge Management	.001	.003	.	.000	.000
	Incorporation at Corporate and project level	.007	.019	.000	.	.000
	Involvement Stakeholders	.000	.070	.000	.000	.

Table 12, proves in obvious illustrations that the significance values of the correlations between all of the independent variables are highly significant, and with dependent variable as well, which are equal to 0.00 for Both factors of legislation and involvement of stakeholders and .001 for knowledge management and .007 for incorporation at corporate and project levels.

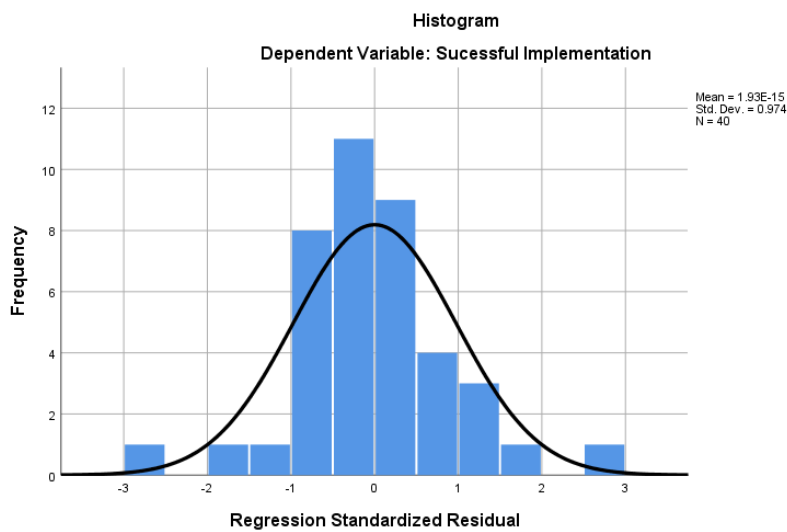


Figure 19: Histogram and normal curve of the regression residuals

Referring to the residual statistics, Table 10 demonstrates that the residual mean value is equal to 0. The Histogram above, as in figure 19, illustrates that the residuals are satisfactorily adhere to the normal curve distribution on the graph.

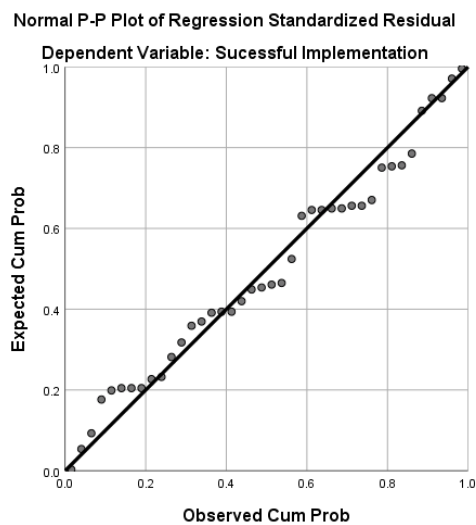


Figure 20: Regression PP plot



The figure 20 above, explains the PP regression plot, in which the Participants' given information is adherent to the straight line of the graph. The values between 0.75 and 0.9 and 0.1-2 show a minor deviation from normality, nevertheless the remaining data are almost following the regression line.

In conclusion, an equation based on coefficient values of regression model can be extracted and used to measure the influence of independent Variables (IVs), in relation to dependent variable for Success of implementation sustainable construction Management in Dubai. The equation of the regression model, basing on the preceding analysis and table 11 is determined as follows:

$$Y=0.678(\text{Involvement Stakeholders}) +0.335(\text{Legislations})-0.231$$

### Simple Regression Test

For further analysis and investigation of the relationship between Set Global Dependent Variable (DV) of successful implementation of sustainable construction management and Global Independent Variables (IVs) of studied four criteria contributing in dependent variables, a simple regression test was conducted. The four IVs were grouped together into Global IV to facilitate the needed analysis of confirming amount and direction of relationship.

Table 13: Regression Analysis between Global IV and Global DV

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.496	1	8.496	36.382	.000 <sup>b</sup>
	Residual	8.874	38	.234		
	Total	17.370	39			
a. Dependent Variable: Successful Implementation						
b. Predictors: (Constant), Global Independent Variable-Global IV						

Table 13, shows that the obtained F value is 36.383, and has high significance with 0.0 value, which proves that the regression line model, that will be utilized predicts the dependent value satisfactorily.

Table 14: Regression Analysis-Model Regression Summary

Model Summary <sup>b</sup>										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.699 <sup>a</sup>	.489	.476	.48325	.489	36.382	1	38	.000	2.592
a. Predictors: (Constant), Global Independent Variable-Global IV										
b. Dependent Variable: Successful Implementation										

For the purpose of examining the value of contribution in percentage of which the global IV causes the variance in the global dependent variable (DV), the values of, R Square and Adjusted R Square should be analysed. Table 14, indicates the R Value is equal to 0.699, R square value equal to 0.489 and the Adjusted R square value equal to 0.476. Noting that R square and adjusted R square are very close, which proves that the variance in the Global DV is an allegation of the Global IV. Accordingly, the Global IV causes around 48% of the variance that are found in the Global DV outcomes.

Table 15: Regression Analysis: Beta Factor

Coefficients <sup>a</sup>											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-.485	.765		-.634	.530					
	Global Independent Variable-Global IV	1.056	.175	.699	6.032	.000	.699	.699	.699	1.000	1.000
a. Dependent Variable: Successful Implementation											

The following systematic procedure is to test the path and tendency of the relationship between the Global IV and the Global DV factors. Accordingly, the Beta factor is acquired as per table 15. The resulted value based on simple linear regression analysis is 0.699. We can read from this value that Beta value is positive, which simply indicates to a positive relationship, in which the Global DV is intensified via the application of the Global IV. This result reinforces the Global Hypotheses, which ascertains that that

the Global IV is increasingly contributing positively in the Global DV, which is the successful implementation of sustainable construction management in Dubai.

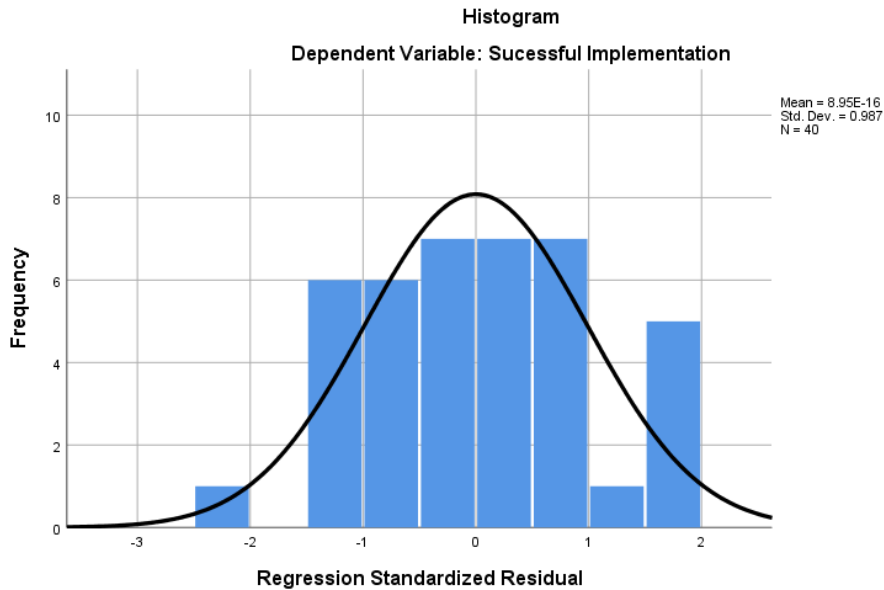


Figure 21: Normal distribution of Variables.

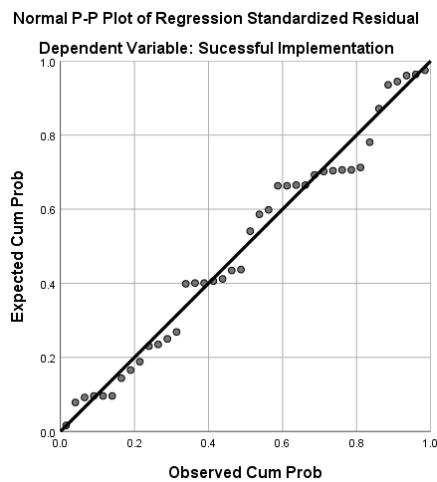


Figure 22: Normal Regression PP plot

The histogram as in figure 21, and curve as in figure 22 are showing the normal distribution behaviour, and charts the regression line found by the slope of the Beta value, which proved the positive trend and relationship between DV and IV.

The following procedures are conducted for further confirming of the validity of the set global hypotheses, through doing single simple linear regression test for each independent variable with global dependent variable, then compare the resulted

adjusted R square value, F value and significance with the opponent values resulted from performing simple regression analysis with global independent variables. If the value of the tests of each single IV is less than the value resulted of global IV, then this would simply prove that the total impact of combined independent variables has greater contribution and enhancement to the global variables.

As resulted in below tables from 16 to 23 a test was conducted for the 4 independent variables which are: adopting legislation encouraging implementing sustainable practices in construction field, development of knowledge management in term sustainability and sustainable practices among stakeholders, Incorporation at project and corporate levels of organisations and board of directors' adoption, and Proper management of stakeholders' involvement and interference in construction process, against global dependent variable which is successful implementation of sustainable construction management in Dubai.

Table 16: Simple Regression Analysis-Model Regression Summary for Legislation IV

<b>Model Summary</b>										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. Change	
1	.536 <sup>a</sup>	.287	.268	.57085	.287	15.305	1	38	.000	2.605
a. Predictors: (Constant), Legislation										
b. Dependent Variable: Successful Implementation										

Table 17: ANOVA Regression Analysis between legislation IV and Global DV

<b>ANOVA <sup>a</sup></b>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.988	1	4.988	15.305	.000 <sup>b</sup>
	Residual	12.383	38	.326		
	Total	17.370	39			
a. Dependent Variable: Successful Implementation						
b. Predictors: (Constant), Legislation						

Table 18: Simple Regression Analysis-Model Regression Summary for Knowledge Management IV.

<b>Model Summary <sup>b</sup></b>										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. Change	
1	.482 <sup>a</sup>	.232	.212	.59234	.232	11.507	1	38	.002	2.575
a. Predictors: (Constant), Knowledge Management										
b. Dependent Variable: Successful Implementation										

Table 19: ANOVA regression Analysis between Knowledge Management IV and Global DV

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.037	1	4.037	11.507	.002 <sup>b</sup>
	Residual	13.333	38	.351		
	Total	17.370	39			
a. Dependent Variable: Successful Implementation						
b. Predictors: (Constant), Knowledge Management						

Table 20: Simple Regression Analysis-Model Regression Summary for Incorporation at Corporate and project level IV.

Model Summary <sup>b</sup>										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.383 <sup>a</sup>	.147	.125	.62442	.147	6.551	1	38	.015	2.129
a. Predictors: (Constant), Incorporation at Corporate and project level										
b. Dependent Variable: Successful Implementation										

Table 21: ANOVA Regression Analysis between Incorporation at Corporate and project level IV and Global DV.

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.554	1	2.554	6.551	.015 <sup>b</sup>
	Residual	14.816	38	.390		
	Total	17.370	39			
a. Dependent Variable: Successful Implementation						
b. Predictors: (Constant), Incorporation at Corporate and project level						

Table 22: Simple Regression Analysis-Model Regression Summary for management and involvement of stakeholder IV

Model Summary <sup>b</sup>										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.645 <sup>a</sup>	.416	.400	.51677	.416	27.046	1	38	.000	2.450
a. Predictors: (Constant), Involvement Stakeholders										
b. Dependent Variable: Successful Implementation										

Table 23: ANOVA Regression Analysis between Involvement Stakeholders IV and Global DV

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.223	1	7.223	27.046	.000 <sup>b</sup>
	Residual	10.148	38	.267		
	Total	17.370	39			
a. Dependent Variable: Successful Implementation						
b. Predictors: (Constant), Involvement Stakeholders						

Table 24: Shows comparison of Single IVs with Global IV in term of F-Factor, R square and significance.

Independent Variables	F Factor	Adjusted R square	Significance
Global Independent Variable(Success of sustainable Construction Management in Dubai)	36.382	0.476	0
Legislation Adoption	15.305	0.287	0
Development of Knowledge Management	11.507	0.212	0.002
Incorporation at corporate and Project Level	6.551	0.125	0.015
Involvement and management of Stakeholders	27.046	0.416	0

Table 24 illustrates that each single Independent variable have less F-Factor, adjusted R square, comparing with Global independent variable and shows the significance values are either equal or less comparing to Global Independent variable analysis against Global Dependent variable, which support the set hypothesis that combined Independent variables are contributing positively higher than each independent single variable, As it contributing collectively in 48% in the variance of independent variables.

In conclusion the statistical analysis conducted by SPSS Software proved and established the positive relationships between factors extracted from literature review and assumed in 4 hypotheses, which are strongly demonstrated, consequently the ensued effect would be as following:

### Hypothesis 1

There is proved and established relationship between Successful implementation of Sustainable construction management in Dubai, and requirement of adopting legislations encouraging implementing sustainable practices in construction field, with individual contribution of 29% in variance of dependent variables.

### Hypothesis 2

The is proved and established relationship between Successful implementation of Sustainable construction management in Dubai, with development of knowledge management in term sustainability and sustainable practices among stakeholders, with individual contribution of 21% in variance of dependent variables.

### Hypothesis 3

The is proved and established relationship between Successful implementation of Sustainable construction management in Dubai, and Incorporation at project and corporate level of organisations and board of directors' adoption, with individual contribution of 12.5% in variance of dependent variables.

### Hypothesis 4

The is proved and established relationship between Successful implementation of Sustainable construction management in Dubai, and requirement of proper management of stakeholders' involvement and interference in construction process, with individual contribution of 42% in variance of dependent variables.

## 5. Discussion

This research was conducted to put focus on the concept of sustainability and sustainable construction management, and their importance in construction filed in Dubai, and highlight the conceptions and methodologies to achieve sustainable end product, and establish a framework of sustainable management style associated with implementing assumed crucial factors leading to practical and successful sustainable construction management practice fitting construction sector in Dubai.

The research aim, as explored previously, is achieved though the fulfilment of the four research objectives, answering the set research questions, which are listed as follows:

*First objective was set proper definition and KPIs of Sustainable Construction project and sustainability concept in construction filed.*

The researcher has explored thoroughly the articles and books related to definition of sustainability and sustainable construction management, and their KPIs in construction field ,then fixed clear definitions, which are all about reinforcing development fulfilling current generation needs without compromising future ones to meet their own demands ,and highlighted the dimensions of sustainability ,including environmental social and economic with their practical applications in construction market, then distinguished between the concept of sustainability and sustainable construction in term of definition and applications, and between concept of construction practice and sustainable practice ,then between green building and sustainable construction ,and highlighted the KPIs for measurement of incorporation level of sustainability in construction field, through discussing the most popular global and local rating systems to measure sustainability in construction field, such as Leed and Dubai green building Code. Moreover, to bring practical meaning to the soft data, the researcher explored the level of awareness of sustainability in the conducted survey as established in Section 1 of table 4 including items from 1 to 3, to verify level of awareness among professional of construction field in Dubai, which is resulted in descriptive conclusion as follows.

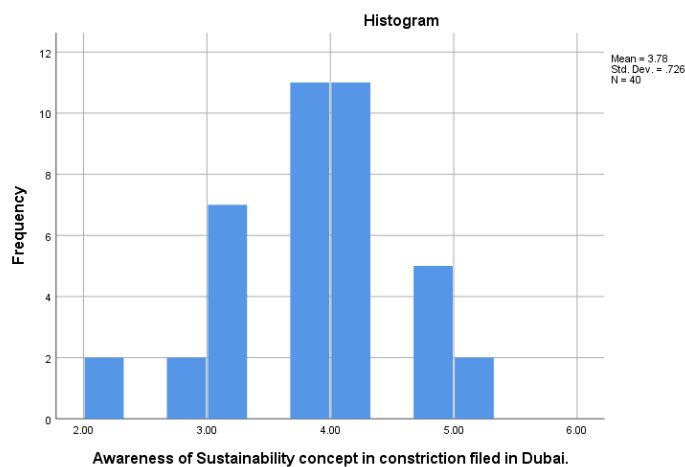


Figure 23: Mean and Sd. of Awareness about sustainability in Dubai.



Table 25: Mean, median and Mode of Awareness about sustainability in Dubai.

<b>Statistics</b>		
Awareness of Sustainability concept in construction filed in Dubai.		
N	Valid	40
	Missing	0
Mean		3.7840
Median		3.6700
Mode		4

Histogram in Figure 23, shows that the participants has recorded answers with mean value of 3.78 out of 5 in level of awareness about sustainability in construction market in Dubai, and by reading it with median value of 3.67 and mode value of 4 as in table 25 ,then this would certainly indicate to moderate confirmation that level of awareness of sustainability in Dubai Market is acceptable ,which can be explained that the market of Dubai is widely opened to multinational companies, and to the current level of application for Green building code in Dubai ,However if this read with level of sonority and years of experience of participants, then it would be explained by relatively high experience of participated sample.

*Second objective was to highlight the factors, and methodologies leading to sustainable construction project management practice, which are utilised for constructing sustainable buildings in Dubai.*

The researcher has searched for relevant data explaining the factors and methods that would be utilised to achieve sustainable construction management practices, then reflect and project them into Dubai construction market. The researcher studied sustainable construction management theories ,conceptual frameworks , process approach ,area of knowledge and model approaches for implementing sustainable construction management, such as STURE ,then highlighted and detected four main factors, that are important to achieve sustainable construction Management, including incorporating of sustainable management practice at corporate and project levels of organization ,and the importance of issuing policy supporting adopting sustainable management, then utilise it for business units and projects levels ,moreover the importance of development knowledge management among stakeholders to develop their awareness and skills in term of sustainable practices in construction sector, then highlighted the important of supporting legislations by relevant Authorities to encourage implementation of sustainable practices in construction field ,then through piloting the instruments of the research and as embedded in the literature review ,It was decided to consider the fourth factor needed to be studied in the effort of exploring variable necessitated for successful implementation of sustainable construction management, which was defined to be exploration involvement ,skills and management Stakeholders involved in construction field in term of sustainability and sustainable

construction field, which was reflected as part of the research. Those aforesaid major assumed factors were reproduced in the set of four hypotheses to measure the contribution of them in establishing successful sustainable construction management practice in Dubai, which were proven, individually and in combination, in causing positive and significant contribution for successful implementation of sustainable construction management in Dubai, as demonstrated, in details, in the section of analysis of this research, by using quantitative analysis, reaching to set the outlines for well-defined framework of implementing sustainable construction management in Dubai.

- *Third objective: Highlight the challenges and opportunities facing implementation of sustainable construction project management in construction filed in Dubai.*

The researcher derived from relevant literature reviews the threats and opportunities could be resulted from implementing sustainable construction management practices on the levels of environment, economy, society and even legal, and found that the benefits and opportunities are greater than risks, and would result in great positive impact on construction field in term of enhancing, environmental, HSE, economic and social benefits that would be accomplished for the sectors, societies and even individuals. This objective would be soundly fulfilled by reading the data from literature review with practical relevant survey, so as in Table 4, section 5 of the survey, the participants were asked about the specific benefits of utilizing successful implementation of sustainable management on construction sector in Dubai. The relevant descriptive conclusion is summarized as follows.

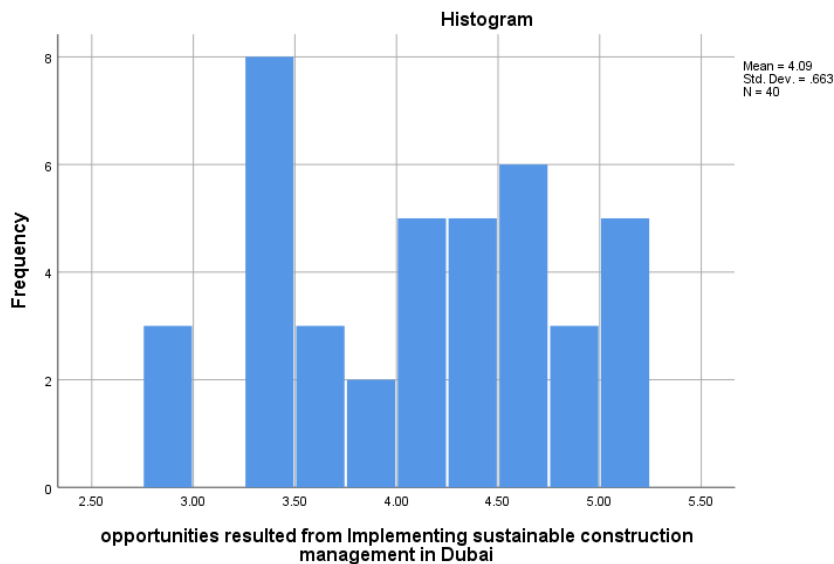


Figure 24: Mean and Sd. Of opportunities resulted from Implementing sustainable construction management in Dubai.

Table 26: Mean, median and Mode opportunities resulted from Implementing sustainable construction management in Dubai.

Statistics		
opportunities resulted from Implementing sustainable construction management in Dubai		
N	Valid	40
	Missing	0
Mean		4.0935
Median		4.1400
Mode		4

Histogram in Figure 24 shows that the answers of participants has recorded mean value of 4 out of 5 in level of trustiness and confidence of opportunities and benefits could be attained for construction market in Dubai, if sustainable management is implemented successfully, and by reading this value in conjunction with median of 4.14 and Mode of 4 as in table 26 ,then this would certainly indicates to relatively high confidence for level of opportunities would be attained ,which can be explained that there is good awareness by participated sample of the expected benefits; either from its knowledge or experience ,additionally since the sample seniority level and years of experience are relatively high, then this would give reliable feedback accredited from solid realization of such benefits.

- *Fourth Objective: Determine the influence of utilising sustainable project management practice on construction filed in Dubai.*

From literature reviews and accompanied survey, the research proved high positive impact of implementing sustainable construction management in construction field of Dubai, in current time and future, conditional to the undertaken enhancement measures, which also set as criteria to generate global dependent variable of successful implementation of sustainable construction practices in Dubai. The descriptive analysis as obtained in the questionnaire is summarized as follows:

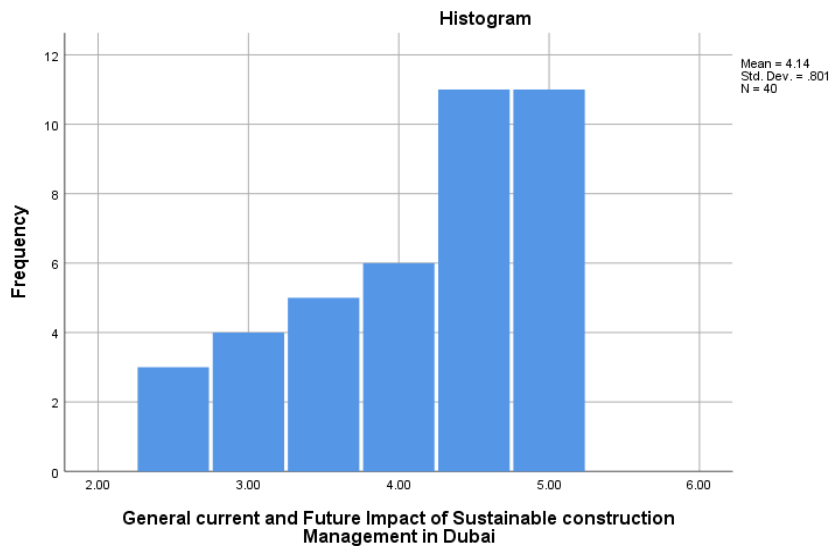


Figure 25: Mean and Sd. Of general current and Future Impact of Sustainable Construction Management in Dubai

Table 27: Mean, Median and Mode of ggeneral current and future Impact of Sustainable Construction Management in Dubai

Statistics		
General current and Future Impact of Sustainable construction Management in Dubai		
N	Valid	40
	Missing	0
Mean		4.1375
Median		4.5000
Mode		4.50 <sup>a</sup>
a. Multiple modes exist. The smallest value is shown		

Histogram in Figure 25 shows that the answer of participants has recorded mean value of 4.13 out of 5 in level of trustiness and confidence of Positive current and future impact could be attained for the construction market in Dubai, if sustainable management is implemented successfully, and by reading this value in conjunction with median of 4.5, and Mode of 4.5 as in table 27 ,then this would certainly indicates to relatively high confidence that level of positive current Impact and what would be attained in future are dignified to be greatly positive .This can be explained by realization of participants of the value and worthiness of implementing sustainable construction Management ,counting that those professionals have good background of knowledge and experience in the construction market of Dubai, as the measured level of seniority and years of experience for them are relatively high, then this would give concrete feedback accredited from solid realization of such positive influence.

In brief, and for explore the gap in the market, between current applications and desired ideal practice as in section 3 of Table 4, the researcher decided to explore the level of current implementation of sustainable construction management practice in Dubai, in order to gauge the present gap, utilizing the result for future possible improvement and the outcomes are summarized as follows:

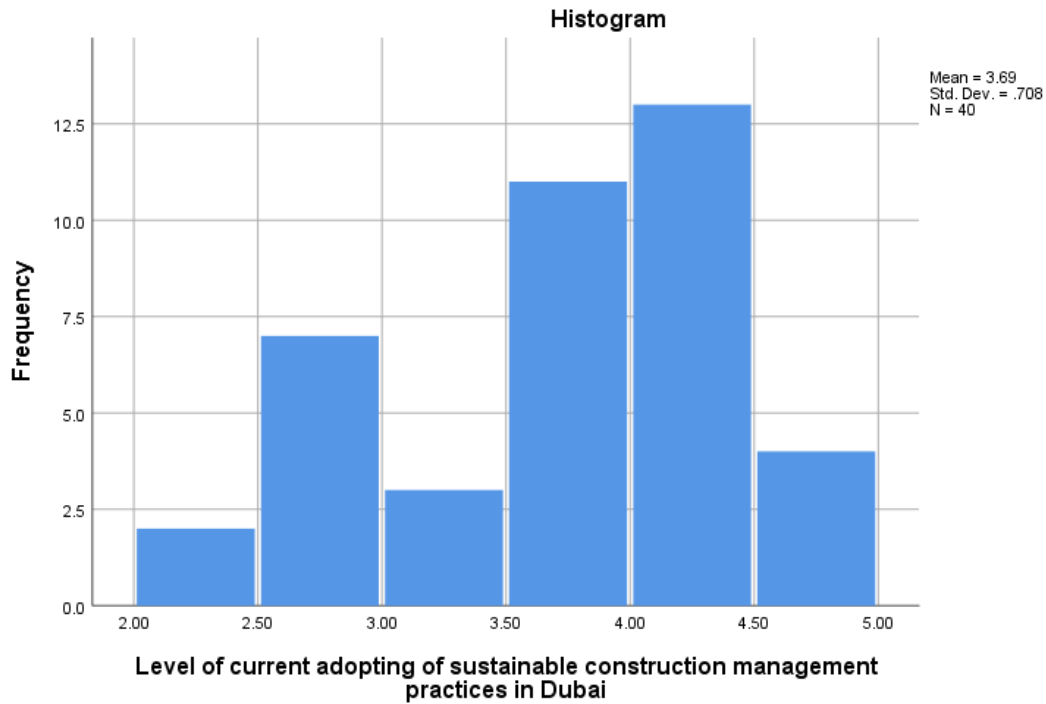


Figure 26: Mean and Standard deviation of Level of current adopting of sustainable construction management practices in Dubai

Table 28: Mean, Median and Mode of Level of current adopting of sustainable construction management practices in Dubai

Statistics		
Level of current adopting of sustainable construction management practices in Dubai		
N	Valid	40
	Missing	0
Mean		3.6868
Median		3.8900
Mode		3.89 <sup>a</sup>
a. Multiple modes exist. The smallest value is shown		

Histogram in Figure 26 shows that the participants recorded mean value of 3.69 out of 5 for their opinion about current level of implementing sustainable management in construction market in Dubai. By reading this value in conjunction with median and mode with values equal to 3.89, as in table 28, then this would indicate that level of implementation, as explored is relatively medium as all values are less than 4, which can be explicated by emphasizing the fact that Dubai is leading construction market in GCC and Middle east regions, which is established in mega development of infrastructure and building projects, that is steered by pioneer construction organizations from various parts of globe, allowing for transferring relative expertise, including sustainable management, however this exploration gives indication of the existent gap with targeted level of excellence, due to moderate satisfaction among the sample, that need to be bridged by taking many relevant measures, including employing and undertaking the factors and independent variables suggested in this research, in order to reach to the sophisticated level, which is anticipated to be revealed in construction market of Dubai, setting ideal example in this domain.

Fulfilment aforesaid research objectives, drive to validate the ultimate established aim of setting well-defined Framework for implementation sustainable construction management practices successfully in Dubai, as summarised in following section of research recommendations.

## 6. Recommendations and Conclusion

### 6.1. Recommendations

The researcher, as implicit from literature review and conducted survey result, would suggest tailoring a framework, aiming to set systematic procedures for successful implementing of sustainable construction management practice in Emirate of Dubai, which is outlined in seven Pillars, as follows:

Pillar 1. Optimises the sustainability goals and priorities in construction market of Dubai, which can be attained for construction corporations, through developing special policies of sustainability, and for projects via imposing sustainable rules, in attempt to organise different aspects of sustainable construction management in unified model, to develop an ego-centred Trend of marketplace dominance, so the target of achieving highest economic benefits would be aligned with more sustainability goals.

Pillar 2. Adopting relevant legislations, which impose incorporating sustainability and sustainable practices into construction process and products, through enhancing Dubai municipality code for green buildings, to contain a record of clear credit of points' register to classify level of sustainability incorporation in construction projects, as exemplified in pearls rating of Estidama code in Abu Dhabi, then create disciplinary and incentive mechanism for better accountability, in term of applying sustainable specifications and schedule of projects requirements

Pillar 3. Merging sustainability tools and practices, with construction projects management, through projecting them into corporate level of organization, and the lifecycle of project management process, including project initiation, planning, execution, controlling and project closure, which can be attained through creating binder and schedule of sustainable practices, and map them to the phases of projects, by considering environmental and sustainable aspects in any count and course of project actions and decisions.

Pillar 4. Develop proper knowledge management among stakeholders in Dubai, and introduce them to sustainability and sustainable construction management practices, enhancing level of awareness and adoption by the clients and employers, then lift up the skills of engaged professionals including project managers and projects employees, leading to broader "Familiarity "of sustainability and sustainable construction management in construction market of Dubai.

Pillar 5. Stakeholders is the human factor, who are driving the process of construction including sustainability , thus their involvement would lead to direct impact on the process of sustainable management and end product, which could be positive or negative depending on scenarios of engagement and communication level, thus managing their needs and control their impact, in addition to revitalizing skills of internal stakeholders would strongly result in successful sustainable management practices in construction field of Dubai.

Pillar 6. Establish Internal control mechanism to ensure proper implementation of sustainable management practice is recommended, driving to assert implementing processes, and result in adopting early corrective measures for any deviation, which could be implied by conducting quarter reviews for sustainable tools and results at corporate and board of director level, and monthly reporting and reviewing of sustainable management procedures and output at project level, to guarantee proper incorporation and evaluation for the ensued revenues and benefits to the company, project, and personnel.

Pillar 7. Continues learning, obtaining feedback from employees and stakeholders in order to improve the employed processes, initiate course of corrective measures and pilot the sustainable tools, leading to better implementation and conclusions.

Nevertheless, always each corporate and project have their own unique criteria and circumstances, therefore the researcher recommend to use above recommendations and framework as principles and outlines, which need to be tailored and aligned to the size of each organization and project, in light of their internal and external influences and circumstances.

## 6.2. Conclusion

The general conclusion of this research outline the fact, that The real progress of organizations toward sustainable management system depends on the internal ability and expertise to make required changes, as well as the outside forces such as societies and market. An integrated management system with focusing on sustainability gives the companies an opportunity to develop their operations and the potential for more effective cooperation with stakeholders, reaching to noticeable enhancements in process and products. Moving towards more sustainable management systems often requires improvement in social and lifestyle needs. The intersection of enterprise management systems, and sustainability form sustainable management approach as defined practice of managing the effect of three bottom lines (Planet-People-Profit), that support the long term capability of business, because it is simply forming a protective rather than reactive approach.

Sustainability and sustainable management practices are increasingly being implemented for various global sectors and markets, as the realization of benefits is sharply tend among stakeholders, thus a requirement for solid sustainable framework becomes essential necessity to amplify the gains on economic, social and economic



levels. The researcher indeed found Specific benefits and general positive impact thumb for implementing sustainable construction management on the sector of construction in Dubai, that is realised and endorsed by surveyed sample of construction management professionals in Dubai.

The researcher has confidence that considering recommended aforesaid pillars for successful implementation of sustainable construction management in Dubai, would result in dynamic sustainable management framework, which is accredited by solid studied concepts ,proper management tools, and examined contributing factors, along with systematic integration into construction field, which would ultimately lead to successful implementation of sustainable practices, that would Intensify the Ecological, social and financial gains for the organizations ,projects and societies.

The researcher found from tested hypotheses, that the factors of requirement for adopting legislations encouraging implementing sustainable practices in construction field, and requirement of proper management of stakeholders' involvement and interference in construction process in term of sustainability and practicing sustainable management, are in combination causing major positive impact toward successful implementation of sustainable construction management, however another two studied factors, which are incorporating sustainable construction management practices at corporate and project levels, and spread knowledge management of sustainable practices and sustainability among stakeholders still backing positively in successful implementation of sustainable construction management in Dubai.

For future researches ,the researcher recommend to consider and investigate the applicability of the proved theories and hypotheses of adopting sustainable construction management in international context, as the nature of construction market community in Dubai, is formed from diverse , multi-ranged, global and multinational corporations and professionals, who are coming from almost all corners of the world ,which by necessity increase the chance of finding reliable connections with other populations, and would result in customizing the outcomes of this academic research to different communities and countries, which could be in high needs of considering sustainable management practices to enhance the process of construction, in order to gain the

anticipated benefits. Also the researcher would recommend investigating the impact of adopting newly introduced and invented technologies, in term of integrating them into sustainable principles, processes and practices in construction field, such as utilizing Internet of things(IOT) for Purpose of reducing environmental impacts and improving used sustainable construction automated tools for decreasing wastages, using clean energy and causing faster processing and progressing of construction operations.

Finally, the researcher would quote, in his own words, that *“The viable prosperity we look for is laying in the embedded veins of our deeds, and driven by our moral cautiousness, which impose on humanity to act sustainably in all terms and at all scales, to maintain the earth living as it’s right now”*

## 7. References

1. Abdulrahman Ismail, Hameed Aftab. (2013). The way forward sustainable construction. Univirsiti Tun Hussein Onn Malaysia.
2. Aghmohammadi Mahdi and Yakhchali Siamak. (2017). Sustainable Model for Project management Processes. International Conference on Literature, History, Humanities and Social Sciences (LHHSS-17). UAE-Dubai.
3. Ali Hikmat H, and Nsairat Saba F. (2009). Developing a green building assessment tool for developing countries-Sase of Jordan. *Building and environment* 44 (5), 1053-1064, 2009.
4. Apuke Oberiri Destiny. (2017). Quantitative Research methods: A Synopsis Approach. Department of Mass Communicationm Taraba State University, P.M.B 1167, Jalingo, Nigeria.
5. Araujo Catarina, Braganca Luis, Almeida Manuela. (2013). Sustainable construction key indicators. [Repositorium.sdum.uminho.pt](http://Repositorium.sdum.uminho.pt).
6. Asif Mohammad, Searcy Cory, Zutshi Ambika, Ahmad Naiz. (2010). An integrated management system approach to corporate sustainability. *Europen Business Review*. Vol 23 no 4.2011. pp 353-367. Emerrald Group Publishing Limited.
7. Awadh Omair. (2017). Sustainability and green building rating systems: LEED, BREEAM, GSAS, and Estidama critical analysis. *Journal of building engineering* 11, 25-29, 2017.
8. Azapagic A. (2003). *System Approach to Corporate Sustainability: A General Management Framework*. Chemical and Process Engineering. University of Surrey, Guildford. UK.
9. Azapagic Adisa and Perdan Slobodan. (2003). *Managing Corporate Social Responsibility: Translating Theory into Business Practice*. Chemical and Process Engineering. University of Surrey, Guildford. UK.
10. Gilbert Silvius A.J. and Schipper Ron P.J., (2014), Sustainability in project management: A literature review and impact analysis, *Social Business*, Vol 4, No 1, pp 63-96.
11. Bal Monika, Bryde David, and Ochieng Edward. (2014). A Critical Review of Integrated Project Management for Construction Sustainability. International Conference Economics, Management and Development.
12. Baloi Daniel. (2003). Sustainable construction: challenges and opportunities. 19<sup>th</sup> Annual ARCOM Conference, University arcom.ac.United Kingdom, 289-297,2003.

13. Bartelmus Peter. (1994). Environment, Growth and Development: The concepts and strategies of Sustainability. 2<sup>nd</sup> edition. Taylor & Francis e-Library, 2003. 29 west 35<sup>th</sup> Street, New York, NY 10001.
14. Baumgartner R. (2003). Tools for sustainable business management. University of Leoben. Austria.
15. Bon Ranko, and Hutchinson Keith. (2000). Sustainable construction: some economic challenges. Building Research & Information 28 (5-6), 310-314, 2000.
16. Brayman Alan, and Bell Emma. (2011). Business Research methods. 3<sup>rd</sup> edition. OXFORD university press Inc., New York.
17. Centre for Environment and Sustainability (GMV). (2016). Action Plan for the Environment and Sustainable Development 2017-2019. [Medarbetarportalen.gu.se/styrdokument](http://Medarbetarportalen.gu.se/styrdokument) and [www.gu.se/miljo](http://www.gu.se/miljo)
18. Charles J. Kibret, 2012, Sustainable Construction: Green Building Design and Delivery, 3<sup>rd</sup> edn, WILEY & Sons Inc.
19. CIB and UNIB, 2002, Agenda 21 for sustainable Construction in Developing Countries, CSIR.
20. Cole R.J. (2000). Building environmental assessment methods: assessing construction practices. Construction Management and Economics, Vol 18, pp 949-957.
21. Cole R.J and Lorch R, 2003, building Culture and Environment: Informing local and global practice, Blackwell Publishing Ltd, Oxford, UK.
22. Creswell J. W. (2014). Research Design: Qualitative, Quantitative and Mixed Methods Approaches, 4<sup>th</sup> edition. Thousand Oaks, Canada: Sage.
23. DANCIU Victor. (2013). The sustainable company: new challenges and strategies for more sustainability. The Bucharest University of Economic Studies. Romania.
24. Darius Zuhairuse Md, Hashim nor Atikah, Salleh Elias, Haw Lim Chin, Abdul Rashid Abdul khalim, Abdul Manan Siti Nurhidayah. (2009). Development of Rating System for sustainable Building in Malaysia. WSEAS Transactions on Environment and Development 5 (3), 260-72, 2009.
25. Doppelt Bob. Leading change toward sustainability: A Change- Management Guide for Business, Government and Civil Society. (2017). 2<sup>nd</sup> edition. Routledge. 2 Park Square, Milton Park, Abingdon, New York, NY 10017, USA.
26. Dubai Municipality. (2011). Green Building Guide Regulation and Specifications. Dubai Municipality, Dubai, UAE.

27. Dyson Robert G. (2002). Strategic development and SWOT analysis at the University of Warwick. *European Journal of Operational Research*. UK.
28. Eid Mohamed and Roger Talbot. (2001). Rethinking Project Management; The business Case for Sustainable Construction. PMI Europe 2001 Conference. London.
29. Engeret Sabrina, Rauter Romana, Baumgartner Rupert J. (2015). Exploring the integration of corporate sustainability into strategic management: a literature review. University of Graz, Graz. Austria.
30. Epstien Marc J, Buhovac Adriana Rejc. (2014). making sustainability work: Best practices in managing and measuring corporate social, environmental, and economic impacts. 2<sup>nd</sup> edition. Berrett-koebler publishers. 1333 Broadway, Oakland.
31. Fiksel Joseph. (2006). A framework for sustainable materials management. *JOM* 58(8), 15-22, August 2006.
32. Furneaux, Craig w. and Hampson, Keith D. and Scuderi, Peter and Kajewski, Stephen L. (2010). Australian construction industry KPIs. In: CIB World Congress Proceedings- Building a Better World, 10-13 May 2010, The Lowry, Salford Quays, United Kingdom.
33. Harmesen Jan, and Powell Joseph B. (2010). Sustainable Development in the Process Industries: Cases and Impact. John Wiley&Sons. Canada.
34. Hellweg s, Rebitzer G. (2007). 3<sup>rd</sup> International Conference on life cycle management from analysis to implementation. ETH Zurich, August 27-29,2007.
35. Hill R.C and Bowen P.A. (1997). Sustainable construction: principles and framework for attainment. *Construction Management and Economics*,15 (3), 223-39, 1997.
36. Holland Karin, Lewis Raymond E, Tipton Karina, Karnis Stella, Dona Carol, Petrovskis Erik, Bull Louis P, Taege Deborah, Hook Christopher. Framework for integrating sustainability into remediation projects. (2011). Wiley Online Library (wileyonlinelibrary.com). DoI:10.1002/rem.20288.
37. Ismam Jannatun Naemah, and Ismail Zulhabri. (2014). Sustainable construction waste management strategic implementation model. Faculty of Architecture, Planning and Surveying, University Technology of MARA. Shah Alam, Malaysia.
38. Jabbour Charbel Jose Chiappetta, and Santos Fernando Almmada. (2008). The Central Role of Human Resource

- Management in the search for Sustainable Organizations. The International Journal of Human Resource Management. UK.
39. Kim Jong-Jim, Brenda, Rigdon, Graves Jonthan, 1998, Sustainable Architecture Module: Introduction to Sustainable Design, National Pollution Prevention Center.
  40. Kuhlman Tom and Farrington John, 2010, What is sustainability? Sustainability, vol.2, no.11, pp.3436-3448. <https://doi.org/10.3390/su2113436>.
  41. Lancaster Jim. (2017). The work of management: A Daily Path to Sustainable Improvement. Lean Enterprise Institute. USA.
  42. Leon-Soriano Raul, Munoz-Torres Maria Jesus and Chalmeta-Rosalen Ricardo. (2010). Methodology for sustainability strategic planning and management Industrial Management & Data Systems, Vol. 110 No. 2, 2010. pp249-268. Emerald.
  43. Marcelino-Sadaba Sara, Gonzales-Jaen Luis Felipe, Perez-Ezcurdia Amaya. (2015). Using project management as a way to sustainability. From a Comprehensive review to a framework definition. Department of Project and Rural Engineering, Public University of Navarre. EINA. Spin.
  44. Matar Mohamad M, Georgy Maged E, Ibrahim Moheeb Elsaid. (2008). Sustainable construction management: introduction of the operational context space (OCS). Structural Engineering Department, Cairo University. Cairo, Egypt.
  45. Mathur, V.N., Price A.D.F. and Austin, S. (2008). Conceptualizing stakeholder engagement in the context of sustainability and its assessment. Construction Management and Economics. 26:6, 601-609. UK.
  46. Mavi Reza Kiani, Standing Craig. (2018). Critical success factors of sustainable project management in construction: A fuzzy DEMATEI-ANP approach. Journal of cleaner production 194,751-765,2018.
  47. Michaud William. (2009). Sustainable materials management: The road ahead; Appendix: Relative Ranking Technical Support Document. EPA United States Environmental Protection Agency. USA.
  48. Moldan Bedrich, Janouskova Svatava, Hak Tomas. (2011). How to understand and measure environmental sustainability: Indicators and targets. Charles University Environment Center, J. Martiho. Elsevier Ltd.
  49. Morrow David, and Rondinelli. (2002). Adopting corporate environmental management system: Motivations and results of ISO 14001and EMAS certification. European management Journal 20 (2), 159-171, 2002.

50. Morse Janice M., Mayan Maria, Olson Kari, Spiers jude. (2016). *Verification Strategies for Establishing Reliability and Validity in Qualitative Research*. University of Alberta Edmonton, Alberta, Canada.
51. Mosher Margo and Smith Lorraine. (2015). *Sustainability Incorporated: Integrating Sustainability into business, A Guide for Sustainability Practitioners*. Sustainability Ltd. London.
52. Nagapan Sasitharan, Abdul Rahman Ismail, Asim Ade, Memon Aftab Hameed, Latif Imran. (2012). *Issues on construction waste: The need for sustainable waste management*. 2012 IEEE colloquium on Humanities, Science and Engineering (CHUSER), 325-330, 2012.
53. Ogunde Ayodeji, Olaolo O. Afolabi AO, Owolabi J, Ojelabi Rapheal A. (2017). *Challenges Confronting Construction Project Management System for Sustainable Construction in Developing Countries: Professionals perspectives (a case study of Nigeria)*. *Journal of building Performance* 8(1), 1-11,2017.
54. Omran Abdelnaser, and Hussin Abdul AZIz. (2009). *Roles of professionals in construction Industry*. The International Conference on Administration and Business. 14-15 November 2009. The Faculty of business and Administration. University of Bucharest.
55. Persson Urban, Olander Stefan, Landin Anne, Persson Mats H. (2008). *Sustainable construction management at project level: Modified Environmental management system structure*. Lund University. Sweden.
56. Persson Urban. (2009). *Management of sustainability in construction works*. Lund University. Sweden.
57. Petkar Sanket. (2014). *Environmental Impact of Construction Materials and Practices* article. National institute of Construction Management and Research.
58. Project Management Institute (PMI). (2019). *A Guide to the Project Management Body of Knowledge (PMBOK Guide)*. 6<sup>th</sup> edition. Newtown Square, PA: Project Management Institute.
59. Pope Jenny, Annandale David, Morrison-Saunders Angus. (2004). *Conceptualising sustainability assessment*. *Environmental impact assessment review* 24 (6), 595-616, 2004.
60. Robinson H.S, Anumba Chimay, Carrillo Patricia, Al-Ghassani Ahmad. (2006). *STEPS: a knowledge management*

maturity roadmap for corporate Sustainability, Loughborough University's Institutional Repository. UK.

61. SA of Regional Spatial Strategies and local Development Documents' (OPDM). (2008). 6 key Sustainability Issues and Problems (Task A3). London. Available on [https://www2.merton.gov.uk/chapter\\_6\\_sustainability\\_issues\\_and\\_problems.pdf](https://www2.merton.gov.uk/chapter_6_sustainability_issues_and_problems.pdf)
62. Salvioni Daniela M., Bosetti Luisa. (2014). Sustainable Development and Corporate Communication in Global Markets. *Symphonya Emerging Issues in Management* (Symphonya.unimib.it). n.1, pp. 1-19.
63. Schuitmann Frank, Sunke Nicole. (2007). Sustainable Management of Construction Projects. Construction Management and Economics University of Siegen. Germany.
64. Seow Christopher, Hillary Ruth, Robinson HS, Anumba CJ, carrillo PM, Al-Ghassani AM. (2006). STEPS: a knowledge management maturity roadmap for corporate Sustainability. *Business Process Management Journal*/Volume 12 Issue 6.
65. Shareef Sundus L. and Altan Hasim. (2016). Building sustainability rating systems in the Middle East. *Engineering Sustainability*. Ice publishing.
66. Stuart L. Hart. (1997). Beyond Greening: Strategies for a sustainable world. *Harvard Business Review*. USA.
67. Seliger Herbert W., and Shohamy Elana. (1989). *Second Language Research methods*. OXFORD university press Inc., New York.
68. Stubbs Ben. (2008) *Plain English Guide to Sustainable Construction Constructing Excellence*. Construction Excellence.UK. Available at: [www.constructingexcellence.org.uk](http://www.constructingexcellence.org.uk)
69. Svensson Goran, Wagner Beverley, Asif Muhammad, Searcy Cory, Zutshi Ambika, Ahmad Niaz. (2010). An integrated management systems approach to corporate sustainability. *European Business Review*, Vol.23 No. 4, 2011, pp. 353-367.
70. Taylor P., Bain, P.M., & Gall, G. (2003). Call Centre organising in adversity: from Excel to Vertex. In *Union Organizing: Campaigning for Trade Union Recognition* (Routledge Studies in Employment Relations). Ac. UK.
71. Tharp, J. (2012). Project management and global sustainability. Paper presented at PMI® Global Congress 2012—EMEA, Marsailles, France. Newtown Square, PA: Project Management Institute.
72. Too Eric G. Weaver Patrick. (2014). The management of project management: A conceptual framework for project



- governance. *International Journal of Project Management* 32 (8), 1382-1394,2014.
73. Walker Helen, Seuring Stefan, Sarkis Joseph, Klassen Robert, Huq Fahian Anisul, Stevenson Mark, Zorzini Marta. (2014). Social sustainability in developing country suppliers. *International Journal of Operations & Production Management*, 2014.
74. Yates J.K. Lacouture Castreo. (2015). *Sustainability in engineering design and construction*, CRC press, Taylor & Francis Group. Celeveland, Ohaio.
75. Yilmaz Ayse and Flouris Traint. (2010). Managing Corporate Sustainability: Risk Management process based perspective. *African Journal of Business Management*. Vol.4 (2), pp. 162-171.
76. Yin Rumin, Cheng Vincent. (2005). Policy option for sustainable construction. *The 2005 World Sustainable Building Conference*. Tokyo. Japan.

# **APPENDIX I**

## **Sustainable Construction Management practice in Dubai**

### **Sustainable Construction Management**

#### **\* Required**

The purpose of this questionnaire is to collect relevant feedback about Sustainable Construction Management practices in Dubai, in order to explore the practicality, applicability, challenges, opportunity, and impacts of adopting Sustainable Construction Management approach in Dubai. Please take a few minutes to read the survey carefully, and complete it by ticking relevant box:

#### **Section I: Background & general information**

1. Specify your Gender: \*

- Male
- Female

2. Type of your company: \*

- Contractor
- Consultant
- PMC
- Client
- Other:

4. How many years of Experience do you have in Construction Project Management? \*

- < 5 Years
- 6-10 Years
- 11-20 Years
- >20 Years

3. Specify your level of Management in Company/ Project: \*

- Senior Management
- Medium Management
- Junior Management

5. What is the size of your Organization you work in? \*

- < 100 staff
- 101-250 staff
- 251-500 staff
- 500 staff

**Section II: Please select your opinion  
replaying to following questions about  
Sustainable Construction Management.**

6. Sustainability has clear definition and applications in construction sector. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

7. You are sufficiently aware of rating systems, such as LLEED; for evaluating incorporating sustainability in construction sector. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

8. You are working in projects adhering with Dubai green building guidelines. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

9. Sustainability implementation in construction sector has lack of clear applying and management framework. \*

- Strongly Agree
- Agree
- Neutral
- Disagree

- Strongly Disagree

**If Sustainable Construction Management Means Incorporating Sustainable practices and construction applies, in order to reduce the Environmental, Social, and Economic impacts of construction activities during its lifecycle. Then please answer following questions:**

10. Your organization is applying sustainable management approach at corporate level. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

11. You are working in construction projects are applying sustainable management approach. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- 

12. Integrating sustainability into construction management has become essential to manage construction projects. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

13. There are Clear guideline and strategy for implementation of sustainable construction management in your company. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

14. There are Clear guideline and strategy for implementation of sustainable construction management in your Projects. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

15. Authority relevant legislation in Dubai support implementation of sustainable construction management. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

16. Communities and pressure group support implementation sustainable management practice during construction operations. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

17. Stakeholders detection, analysis and engagement is very important to imply sustainable management practices. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

18. The project team you are working with has sufficient knowledge of sustainable management practices. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

19. Senior management/board of directors play key role in adopting sustainable construction management policy into organization. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

20. Successful implementation of project management requires development of Knowledge management associated with sustainability and ecological concerns in order to raise awareness and develop project team skills. \*

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

21. Successful implementation of sustainable construction management requires adopting legislation encouraging adopting sustainability and sustainable practices in construction sector. \*

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

22. Successful implementation of sustainable construction management requires adopting sustainable management principles and policy at corporate level of construction companies. \*

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

23. Successful implementation of sustainable construction management requires adopting sustainable management principles at construction project level. \*

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

24. Successful implementation of sustainable construction management at project levels require combining sustainability tools and practices with Construction project management, through the lifecycle of project management process, including project start up, planning, execution, controlling and project closure. \*

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

25. Successful implementation of sustainable construction management depends on successful management of projects stakeholders. \*

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

26. Successful implementation of sustainable construction management depends on competency of Project managers. \*

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

27. Successful implementation of sustainable construction management depends on skills and sustainable knowledge of construction Project team. \*

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

28. Successful implementation of sustainable construction management depends on positive involvement of clients /employers in term of

adopting applications of sustainability in projects specifications. \*

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

29. Successful implementation of sustainable construction management depends on positive involvement of Consultants and PMCs in term of ensuring applications of sustainable management in construction field. \*

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

30. Adopting Sustainable construction project management would result in good Economic opportunity through improving efficiency in production, and lifting up product quality by using clean technologies, which enhance production rates and reduce costs. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

31. Adopting Sustainable construction project management would result in reducing environmental risks, mainly in pollution of environment. \*

- Strongly Agree
- Agree
- Neutral
- Disagree

- Strongly Disagree

32. Adopting Sustainable construction project management would result in improving Health and Safety measures taken in construction projects. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

33. Adopting corporate sustainable construction management Would be encouraging improved partnerships with investors and clients, through strong economic, social, environmental and ethical records. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

34. Adopting Sustainable construction project management would result in positive social impact via attracting high qualified employees Who are seeking for innovative, continuous development and moral management approach. \*

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

35. Adopting Sustainable construction project management would result in

improving/reducing the time of d projects development. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

36. Adopting Sustainable construction project management would result in improving quality of construction end products. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

37. Each project is unique in nature and Require specific sustainable management framework that is tailed from general principles and strategy applied at corporate levels. \*

- Strongly Agree

- Agree
- Neutral
- Disagree
- Strongly Disagree

38. Sustainable Construction project management 'in general' has positive impact on construction project operations and end product. \*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

39. Applying Sustainable construction management practices in Dubai has promising future for successful applications. \*

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

**Thank you for your valuable contribution.**

-