

Mitigating the Impact of Climate Change on Egyptian Cities: Sustainable Building and Construction as a Strategy

A Policy Paper



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List of Abbreviations

Abbreviations	Definitions
BEEC	Building Energy Efficiency Certificate
CAPMAS	Central Agency for Public Mobilization and Statistics
CBE	Central Bank of Egypt
CPP	City Partnership Program
DFIU	Deutsch-Französisches Institut für Umweltforschung
EEAA	Egyptian Environmental Affairs Agency
EBRD	European Bank for Reconstruction and Development
EDGE-IFC	Excellence in Design for Greater Efficiencies-International Finance Corporation
EGBC	Egypt Green Building Council
EGP	Egyptian Pound
EMA	Egyptian Meteorological Authority
EU	European Union
FDI	Foreign Direct Investment
FEDCOG	Federation of Egyptian Chambers of Commerce
FEI	Federation of Egyptian Industries
GCF	Green Climate Fund
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GPRS	Green Pyramid Rating System
HBRC	Housing and Building Research Center
HCEI	Hawaii's Clean Energy Initiative
IDSC	Information and Decision Support Center
IGBC	Indian Green Building Council
IPPU	Industrial Process and Product Use
LEED	Leadership in Energy and Environmental Design
LEED-ND	Leadership in Energy and Environmental Design - for Neighborhood Development
MCIT	Ministry of Communications and Information Technology
MENA	Middle East and Northern Africa
M&E	Monitoring and Evaluating
MoA	Ministry of Agriculture and Land Reclamation
MoD	Ministry of Defense
MoE	Ministry of Environment
MoEE	Ministry of Electricity and Renewable Energy

List of Abbreviations

MoETE	Ministry of Education and Technical Education
MoF	Ministry of Finance
MoFA	Ministry of Foreign Affairs
MoHP	Ministry of Health and Population
MoHUUC	Ministry of Housing, Utilities, and Urban Communities
MoI	Ministry of Interior
MoIC	Ministry of International Cooperation
MoLD	Ministry of Local Development
MoPMR	Ministry of Petroleum and Mineral Resources
MoPBS	Ministry of Public Business Sector
MPED	Ministry of Planning and Economic Development
MTI	Ministry of Trade and Industry
MWRI	Ministry of Water Resources and Irrigation
NAC	New Administrative Capital
NCCC	National Council for Climate Change
NDC	National Determined Contribution
NDM	New Development Model
NGO	Non-Governmental Organization
NRA	National Research Centre
NSA	National Security Agency
NSDS	National Sustainable Development Strategy
PFI	Partner Financial Institution
PPP	Public-Private Partnerships
ROI	Return on Investment
SDG	Sustainable Development Goal
SMRC	Supreme Media Regulatory Council
TDLC	Tokyo Development Learning Center
UAE	United Arab Emirates
UDF	Urban Development Fund
UK	United Kingdom
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
USA	United States of America
UUU	Urban Upgrading Unit
WB	World Bank
WGBC	World Green Building Council

I. Executive Summary

The construction and building industry is one of the top socio-economic sectors that contributes to 7.5% of Egypt's Gross Domestic Product (GDP) and 13.6% to employment. On the one hand, this sector plays a key role in developing the quality of life as a dynamic sector that affects the foreign direct investments (FDIs) as well as the domestic investments. On the other hand, the construction sector contributes to more than 30% of all carbon-related emissions released from buildings (Ministry of Planning and Economic Development, 2022; Karmany, 2015).

Egypt faces a wide range of challenges including the high increase in population, the Nile water crisis, the desertification and the issue of solid waste and encroachment on agricultural lands, and the current negative impacts of the natural and built environments. The construction sector consumes 28% of the total energy produced in Egypt. The high energy consumption and rise in energy prices along with the aforementioned issues are few of several key factors that urge the need to study how consumed energy could be reduced in the construction sector and consequently limit the sector's impact on the environment (Navigant Energy Germany GmbH, 2022).

The paper calls for establishing sustainable cities through sustainable construction and building approaches and practices given the high significance of the construction sector, the excessive wasted resources, and the increase in construction waste, in addition to the deterioration in people's health and the continued population growth. The

paper sheds light on the need to join forces with experts amongst stakeholders in the construction sector for adopting assessment tools that exist globally on environmental performance within the Egyptian context. This adopted tool should be available for both the private and public sectors to enhance the performance of their construction operations and services and the identification of materials that lead to environmental hazards and affect the population's health, safety, and productivity.

Egyptian policymakers should thus consider sustainable building and construction as an interdisciplinary strategy to establish sustainable cities and hence the mitigation of the impact of climate change. The findings of this paper formulate three proposed policy options in an integrated strategy that are not standalone policy options but simply divided into stages of implementation. Policy option A is a long-term type of 'greening' existing building laws and developing national standards for sustainable construction materials. As for policy option B, it is a kind of short-term implementation and of rapid impact for providing finance and awareness campaigns to promote sustainable construction. The third and final policy option C is a medium-term implementation framework type that proposes establishing a national Sustainable Construction Working Group under the National Council for Climate Change (NCCC) to have representatives of the different stakeholders from the private and public sectors as well as key players from the construction sector and the community.

II. Methodology

This policy paper presents an overview on sustainable construction and building challenges and gaps primarily through reviewing different academic scholarships and official international and national reports. A comparative analytical approach is applied between policies in international and regional experiences to describe the key elements which embrace the legal, social, economic, and political aspects of the sustainable construction and building process and contextualize it to the case study of Egypt.

Based on the questions in Appendix 1, the authors of the policy paper conducted in-depth semi-structured interviews with

11 individuals representing four key policy stakeholder groups: policymakers, academics, non-governmental organizations (NGOs), and the private sector. The qualitative data collected for this policy paper is analyzed using deductive thematic approaches, whereas the in-depth research and policy analysis of the paper is derived through an inductive approach. To enhance the theoretical robustness of the paper, the proposed policy options framework, and the implementation strategy of the selected integrative framework of policies are developed through an analytical research approach across developed and developing countries and accordingly tailored for the Egyptian context.

III. Problem Context and Analysis

Background and Significance of the Problem

Cities across the world expend around two-thirds of the world's energy and contribute to the production of more than 70% of global carbon dioxide emissions (World Bank Group, 2021). Although city growth heavily impacts the environment and existing social fabrics, cities are considered as engines of growth and economic prosperity. Scholars and practitioners argue that cities have major contributions to global sustainable development due to their significance in offering social and economic advancements to societies (Glaeser, 2011; Habitat for Humanity International, 2021).

Globally, the buildings and construction sector has solely contributed to around 40% of energy-related emissions since 2021 (United Nations Environment Program, 2021). In order to achieve the agendas of the Paris Agreement and the United Nations (UN) Sustainable Development Goals (SDGs) to reduce greenhouse gas (GHG) emissions, countries regularly report their revised National Determined Contributions (NDCs) to monitor global progress on the various industries and sectors, including the building and construction sector. However, only in recent issues of NDCs have several developing countries, including Egypt, reported their programs on promoting sustainable approaches in urban developments of existing and new buildings (Egypt, 2022; United Nations Environment Program, 2019, 2021).

Due to this immense global impact, sustainability has been increasingly advocated by the international community for the construction sector to reduce its adverse impacts on the environment. Most

developing countries, such as Egypt and Ghana, rely on traditional construction methods without making use of sustainable and cost-effective approaches in construction (Ayarkwa et al., 2022).

Nowadays, the problem globally and regionally is often observed in the absence of relying on innovative construction methods that balance and address the three pillars of sustainability - the environment, society, and economy - during implementation. Key stakeholders in the building and construction sector, such as owners, national entities, and contractors, often deprioritize utilizing sustainable methods, which is considered a serious impediment to applying sustainable construction. Although scholars have discovered a common desire and interest for sustainable methods by construction companies, there are other issues that hinder the process in developing countries, such as the absence of experience and knowledge in applying sustainable practices (Ayarkwa et al., 2022; Egypt, 2022; Abaza, 2022, Interview; Rostom, 2022, Interview).

Throughout the entire lifecycle of a building, considerable amounts of energy, water, and materials are used, which raises the share of the building in the GHG emissions and amounts of waste disposed to landfills. Such issues necessitated the establishment of sustainable and green building methods, which consequently led to the creation of certifications, standards, and assessment systems that promote sustainable design and the preservation of the natural environment (Karmany, 2015; Ayoub, 2022, Interview).

Delving more into the case study of Egypt, the country's construction sector represents an average of 10% of the overall GDP (Abdelrahman, 2020; Central Bank of Egypt, 2022). It is evident that this sector majorly contributes to the economic prosperity of the country. However, the literature and qualitative data collected also point out that there is a lack of adherence to construction and environmental codes in Egypt that negatively impacts the climate

and social fabric. Another significant issue is the absence of industrial and societal awareness of resource depletion and the drawbacks of using traditional construction methods. Other major challenges and gaps in current standards and codes include the lack of mainstreaming of the three pillars of sustainability in construction methods in Egypt (Rostom, 2022, Interview; Abaza, 2022, Interview; Ayoub, 2022, Interview).

Problem Statement

Based on the presented background and significance of the policy problem, within the construction sector in Egypt, there is a lack of consensus on the approach to sustainable construction in practice. For the scope of this paper, the construction process is tackled from the angle of sustainable construction and green buildings in Egypt. The following

subsections will unveil the historical evolution of the Egyptian construction and building laws and regulations, the outcomes of policymaking efforts in the construction and building sector, current environmental, social, and economic contexts of the problem in Egypt, and the current Egyptian legislative context.

Current Environmental, Social, and Economic Contexts of the Problem in Egypt

The three pillars of sustainable development face numerous challenges in the Egyptian construction and building sector. As for the social aspect, studies proved a significant correlation between the health and well-being of people who work green. According to Egypt's Vision 2030, the Egyptian population is expected to increase to 140 million people by 2050, followed by a significant increase in built-up areas and an increase in the demand for raw materials, energy, and water resources.

Additionally, Egypt suffers from the existence of 273 areas with the following characteristics: unsafe areas, unplanned areas, non-environmental-friendly housing without sanitation services, high volume housing, factories polluting neighboring housing units, and no possession of the building land. These multi-dimensional issues are dealt with through the Urban Development Fund (UDF), which is one of the main actors in the national urban upgrading programs in Egypt (Gohar, 2022, interview).

In the economic dimension, the construction sector is one of the most dynamic sectors in the Egyptian economy and has been growing rapidly during the financial year 2021, contributing to 7.5% of Egypt's GDP and 13.6% to employment. Thus, it is considered one of the biggest productive sectors that depend on local inputs and operate other sectors. In that manner, mega construction projects, such as the New Administrative Capital, the Suez Canal Economic Zone, road expansions, several plants of water and power, and others have significantly increased in Egypt since 2014. The total investments are more than EGP 4 trillion from July 2014 to December 2021 (Ministry of Planning and Economic Development, 2022).

Construction companies, government strategies, and policies, available resources, supporting industries, and institutional sponsorships are the five main categories that have an impact on the growth and competitiveness of the Egyptian construction sector in the local and global markets. Modifications and developments within these categories will increase competition and growth in the construction sector (American Chamber of Commerce, 2003). However, contractors continue to face exhaustive costs and legal burdens because of the economic reform program that led to the devaluation of the EGP. Additionally, they have faced rising costs as they are forced to adapt to the COVID-19 pandemic.

As for the high degree of informality in the construction sector, there are regulations that construction enterprises should abide by in terms of employment and the processes of construction. Nevertheless, there are those

who work without the required permits, and they are not closely monitored. This gap creates room for the development of informal buildings that do not fulfill safety or other requirements.

In the environmental dimension, construction materials represent a significant share of the problem when it comes to sustainable construction. Materials used in construction are concrete, cement, steel, glass, red brick, paint, and solvents that produce two kinds of emissions: fuel combustion emissions that fall under energy, and industrial process emissions that fall under industrial process and product use (IPPU), which are measured separately. In 2020, Egypt produced 50 million metric tons of cement, where it was located as one of the top 12 cement producers in the world from 2010 to 2020 (Statista US Geological Survey, 2022).

Regionally, Egypt is the biggest consumer of steel in the MENA region (Organisation for Economic Cooperation and Development, 2020), which produces 10.3 million metric tons of steel in 2021, ranked 20st in a list of the world's 50 top steel-producing countries (World Steel Association, 2022). The construction sector consumes 28% of the total energy produced in Egypt. One of the factors that trigger the need to study how to save the consumed energy in the construction sector and thus limit its impact on the environment is the rise in energy prices (Navigant Energy Germany GmbH, 2022).

Legislative and Regulatory Framework: Policymaking Efforts in the Construction and Building Sector

Throughout history, Egyptian governments have been interested in enforcing laws to control the construction process from the Pharaonic state until the beginning of the Ottoman era, especially from 1517 to 1798 in which these laws were documented, as well as during the period of the modern state from 1805 to 1879. In 1881, the construction work has been regulated under the Higher Order, which was amended in 1889 and continued to be enforced until the issuance of Law No. 52 of 1940 then Law No. 45 of 1962, which was enforced until the issuance of Law No. 106 of 1976 that served as the legal foundation of the Unified Building Law No. 119 of 2008.

The frequent amendments of the building laws were a response to the political and social problems within those laws. These amendments reflected the setting of the ruling regime countries rather than the local Egyptian context. For instance, during the British colony of Egypt, from 1882 to 1936, the building laws were inspired by the Western culture, which negatively affected the Egyptian urban and architectural theme, especially since they neglected the social, cultural, and geographical differences of their countries in comparison to Egypt (Shiba, 2021).

Based on the given history, the actual emergence of laws was from 1881 to 2008 due to the establishment of the implementing regulations for the building laws. The construction laws are important elements for a built environment as they preserve rights and duties, regulating the construction sector, which is regarded as the most environmentally damaging business (Shiba, 2021; Hazem & Fahim, 2021). Thus, Egypt shifted its legislative paradigm toward construction laws that consider the society, environment, and economy through initial interventions such as building standards and interfering with the establishment of laws that govern and stimulate construction in sustainable ways.

The following subsections will shed light on the legislative frameworks covering the construction and building policies, laws, codes, and green rating systems in Egypt. In addition, it will cover the institutional reforming efforts in that regard.

From the times when the executive regulations of building laws first appeared until the enactment of Law No. 52 of 1940, then Law No. 45 of 1962, until the enactment of the current Unified Building Law No. 119 of 2008, successive Egyptian governments have been interested in enacting the necessary legislation to governing the construction process by addressing the gaps of the previous laws (Shiba, 2021), establishing the frameworks governing the process generally to ensure the implementation of specific urban patterns, taking into account the various variables that affect Egypt's construction industry and considering the different levels of urban planning.

Egypt's Unified Building Law No. 119 of 2008 was enacted more than thirty years after its precedent, Law No. 106 of 1976. Although the period is considered long, the legislators and policymakers who developed the new law were unable to precisely indicate the flaws and gaps in the preceding law that led to multiple breaches. They concluded that the main areas of weakness in Law No. 106 of 1976 were the delay from the government side in issuing the building licenses and the individual breaches of some points in the Law besides the government's subsequent reconciliation with them. Thus, the latest Law No. 119 of 2008 tried to focus on the mentioned gaps by limiting the period of issuing building permits by the governmental authorities not to exceed thirty days besides restricting the reconciliation with the individuals who breach the Law (Shiba, 2021).

However, the Unified Building Law No. 119 of 2008 has disregarded the differences between regions in terms of geographical location, weather, type of activities, and people's cultures and backgrounds (Shiba, 2021). To resolve the gaps and weaknesses in the current Egyptian building law, it is vital to examine the international efforts exerted in that regard. The scholarship shows that although some countries' building sectors have enacted and implemented public policies aimed at promoting a sustainable built environment, measures taken have had modest impacts and the least desired change.

In an effort to trace the root causes behind the insignificance of policies' impact, researchers have first developed an evaluating approach to the sustainable development concept in terms of its associated environmental problems caused by planning, building, and construction processes. Secondly, a survey has been used as a tool to examine the resulting changes in public policies for a built environment and to identify some of the reasons that led to policy failure in some cases (Van Bueren & De Jong, 2007).

The barriers to sustainable development are found to be both general and sector specific. The findings were summarized by Van Bueren and De Jong (2007) as follows: policies can be more effective if policymakers focus on solving the fragmented problems associated with the built environment's institutional context. In planning for policymaking, theory and past practices suggest that a variety of actors should be included in the policy process, thus their knowledge can be put together for the best use. All involved parties in the policymaking process must develop a common understanding of what sustainable building entails, and of how it can

be implemented. For example, 'sustainable construction' and 'sustainable buildings' are two interchangeably used terms that need to be stated and defined precisely (Van Bueren & De Jong, 2007).

The term sustainable construction is generally used to describe a process that starts in the planning and design phase and continues after construction ends with a minimum impact on the environment and people (Xia et al., 2015). As for sustainable buildings and infrastructure, they involve considering the whole life-cycle of buildings, taking into account the functional quality, environmental quality, and future values (Xia et al., 2015).

Other core findings behind some policy failures include the monitoring and evaluation (M&E) phase which has to start by closely monitoring and evaluating the use of research results by practitioners on the ground. Besides, it is essential for policy processes to be prioritized, and for the sustainability dimensions of the suggested policy to be presented unambiguously in order to avoid creating policies that are irrelevant to what happens in practice. Appendix 2 shows some key figures in the building and construction sector across its sustainability performance with examples from different countries (Van Bueren & De Jong, 2007).

Since sustainability targets maintaining specific standards of life quality for both the present and future generations, there was a significant need to promote green codes to integrate the sustainability dimension into the construction and building sectors. Thus, Egypt established its own rating systems to accomplish sustainable construction besides green buildings.

Looking at the different national and international rating systems, it is clear that the Leadership in energy and environmental Design rating system (LEED), the Green Pyramid Rating System (GPRS), and the TARSHEED rating system are only a few of the green building rating systems that are now in use.

In 2011, Egypt's Green Building Council (EGBC) introduced the GPRS for new projects to construct green buildings (Abdel Aleem et al., 2015). Although GPRS is based on LEED as they are targeting the same categories, the LEED rating system cannot be implemented on a wide range in Egypt due to the significant cultural and environmental changes between Egypt and the United States. The seven major categories of the GPRS include sustainable sites, energy

efficiency, water efficiency, materials and resources, indoor environmental quality, management protocols, and innovation and value addition. Each category has a set of requirements to meet for the building to receive points (Hazem & Fahim, 2021).

On the other hand, the TARSHEED rating system was created as an upgrade to the GPRS to meet the local needs in the Egyptian context. The TARSHEED assessment system solely considers the performance of sustainable construction in three areas: energy, water, and habitat. For instance, TARSHEED ignores the category of waste management, which is one of Egypt's major concerns (Hazem & Fahim, 2021). Figure 1 below shows the timeline of the different standards and rating systems used in the Egyptian context across history.



Figure 1. Standards and Rating Systems Used in Egypt

Source: The authors.

Institutional Framework: Establishing the Egypt Green Building Council

The Egyptian government has therefore made unprecedented efforts over the past 20 years to increase energy efficiency and reduce GHG emissions. In-depth studies have demonstrated the close connection between population growth and energy, as the population momentum would eventually place enormous demands on all sectors of the Egyptian state and these demands would significantly limit the long-term growth of the Egyptian economy (Eid et al., 2019).

The creation of energy-efficient building codes was a crucial first step in the process of reducing the effects of climate change, and the identification of alternative routes toward energy efficiency was the second step. However, implementation efforts by the Egyptian Government and stakeholders were insufficient in the construction sector. There were suggestions made to enhance performance in this sector, but there was no abundance of enthusiasm or manpower. Thus, the sustainability dimension in the construction field was taken from the researching phase to a practical solution that addresses sustainable construction and green buildings and highlights their significance (Eid et al., 2019).

In January 2009, a further step was taken by the formation of the EGBC that represented a significant advancement in the direction of lowering energy use. The council sought to accomplish several goals to strengthen the provisions of the building codes related to energy efficiency, and environment preservation. In addition, one of the

significant goals of the council is encouraging investors to adopt the Building Energy Efficiency Certificate (BEEC) code. An initial action to activate the role of this council was the creation of a national classification system for the categorization of green buildings, known as the GPRS.

The significance of the EGBC comes from its role in setting policies for green buildings, monitoring their implementation, and demonstrating policies' effects on the citizen and the environment. However, the EGBC lacks the incentive scheme to the acting parties to implement the green building strategy in their pertinent projects (Eid et al., 2019), which is one of the gaps in the usage of sustainable building methods and approaches that this policy paper will try to address.

In line with Egypt's Vision 2030 and the growing interest around the world in addressing the challenges of climate change, including Egypt's hosting of the Conference of Parties COP27, Egypt has restructured the EGBC to establish applicable policies and rules in the field of green construction and sustainable cities on the ground (Eltaameer, 2022). The following subsection on international and regional experiences highlights the main lessons learned and good practices taken into consideration whilst developing the integrative policy options framework of the policy research paper that would follow.

International and Regional Experiences: Sustainable Cities and Buildings

This section aims to present a number of successful case studies in achieving sustainable cities and establishing sustainable buildings via adopting resource efficiency, waste management, and regulations. The section is divided into three main parts: the first shows examples of sustainable cities, the second views examples of sustainable buildings, while the third covers a number

of significant case studies in Egypt. Most of the case studies that achieved successful sustainable cities mainly focused on adopting good practices for resource efficiency and waste management while most of the case studies' examples for sustainable buildings focused more on tailoring policies, laws, and codes. An awareness tool is common for almost all presented case studies.

Moving Towards Sustainable Cities

Kaupuni village in Hawaii, USA turned into a sustainable village through integrating efforts toward energy reduction and providing workshops for residents (Kun, 2014; United States Department of Energy Office of Energy Efficiency and Renewable NREL, 2012).

The Sustainable City in Dubai, United Arab Emirates (UAE) is a similar example, where the focus was on energy efficiency (Radwan, 2022). Another similar case occurred in the first eco-village in Jordan, Fefa. Fefa has installed solar

panels and raised awareness (Fefa, 2015). The Moroccan government focused on setting strategies, articulating territorial decision-making bodies, optimizing energy efficiency, and raising awareness (Global Green Growth Institute, 2017). For the case of Kitakyushu in Japan, which is the first leading city to have a successful waste management system for more than 40 years, the system is achieved through awareness, and cooperation among stakeholders (World Bank, 2019, 2020a, 2020b) .

Making Buildings More Sustainable

The United Arab Emirates (UAE) is well-known for its green buildings, such as The Sustainable Building in Al Quoz in Dubai. As for China, the Micro-Emission Sun-Moon Mansion in Dezhou is the world's largest solar-powered building (Feng, 2010). In India, there are over 10 pioneering examples of sustainable green buildings such as Suzlon One Earth, Pune, and CII- Sohrabji Godrej Green Business Centre. Another example in Morocco, King Mohammed VI Green City (VVM6) is the first major African project engaging in the LEED-ND (LEED for Neighborhood Development) certification process (New Cities, 2014).

France and over 50 other countries have developed a number of regulations and codes to transform buildings to be net-zero carbon. Denmark, the Netherlands, and France have

adopted a unified European Union (EU) policy to reduce carbon emissions. Germany and other non-EU members including the United Kingdom (UK) and Switzerland have life-cycle assessment requirements for certain public buildings (United Nations Environment Program, 2021). Chicago set a Sustainable Development Policy making the development teams select the best-fit strategies from a list (Chicago Department of Planning and Development, 2017; Legal Pathways to Deep Decarbonization in the United States, 2015). Another case for India, where the Indian Green Building Council (IGBC) has approved a list of consumed energy by building materials and set a unified Energy Conservation Building Code to reduce energy consumption in buildings (Bureau of Energy Efficiency, 2022; Developer, 2016; El Batran, 2022, interview).

Significant Local Projects and Initiatives Towards Sustainable Cities and Buildings

There are numerous significant local projects and initiatives towards sustainable cities that could be mainstreamed in Egypt. El-Kharga was announced as the first eco-friendly city, as there are many green spaces, no factories, in addition to the existence of the first green school. Haya Karima is a project that applies green building standards, energy reduction techniques, and manages to increase green spaces (Presidency, 2019; State Information Service, 2022) (Moatamed, 2022, interview).

The New Administrative Capital (NAC) is an example of a smart city and was named the

best Arab sustainable development project in 2021 (Official Representatives from the Administrative Capital for Urban Development, 2022, interview).

Due to COP27, Sharm El-Sheikh is on its way to being a sustainable city. Additionally, there are recent global initiatives: the UN-Habitat SDG Cities initiative, COP27 Presidency global sustainable cities initiative, where the latter includes many lead stakeholders, most importantly MoHUUC, MoLD, and the World Bank (WB) (Kamaly, 2022; UN-Habitat, 2022; ICLEI Africa, 2022; Lashin, 2022, Interview).

Stakeholders Mapping

Based on the research and fieldwork interviews findings, Figure 2 below illustrates the power-interest grid analysis of key stakeholders in the field of sustainable construction and buildings. The bottom left corner shows the low power-low interest stakeholders type which is deemed as the category that requires close monitoring and necessitates creating a need for them to reach higher power and interest. On the other hand, the bottom right corner represents the low power-high interest category for stakeholders that should have their power increased, such as the private sector, international organizations, EGBC, etc. As for the top half of the grid in Figure 2, the

top left corner illustrates the high power-low interest stakeholders who need to be kept informed of any progress in the field, such as the MoF and MoLD. The fourth and final zone on the top right corner represents the high power-high interest who are the key players in the stakeholders' ecosystem relevant to the problem of sustainable construction and buildings sector, such as the NCCC, MoE, HBRC, MoHUUC, etc. The in-between stakeholders show that there is no pure designation to a high or low interest or power but rather variations of the scale across a spectrum, such as the individuals and the independent research centers.

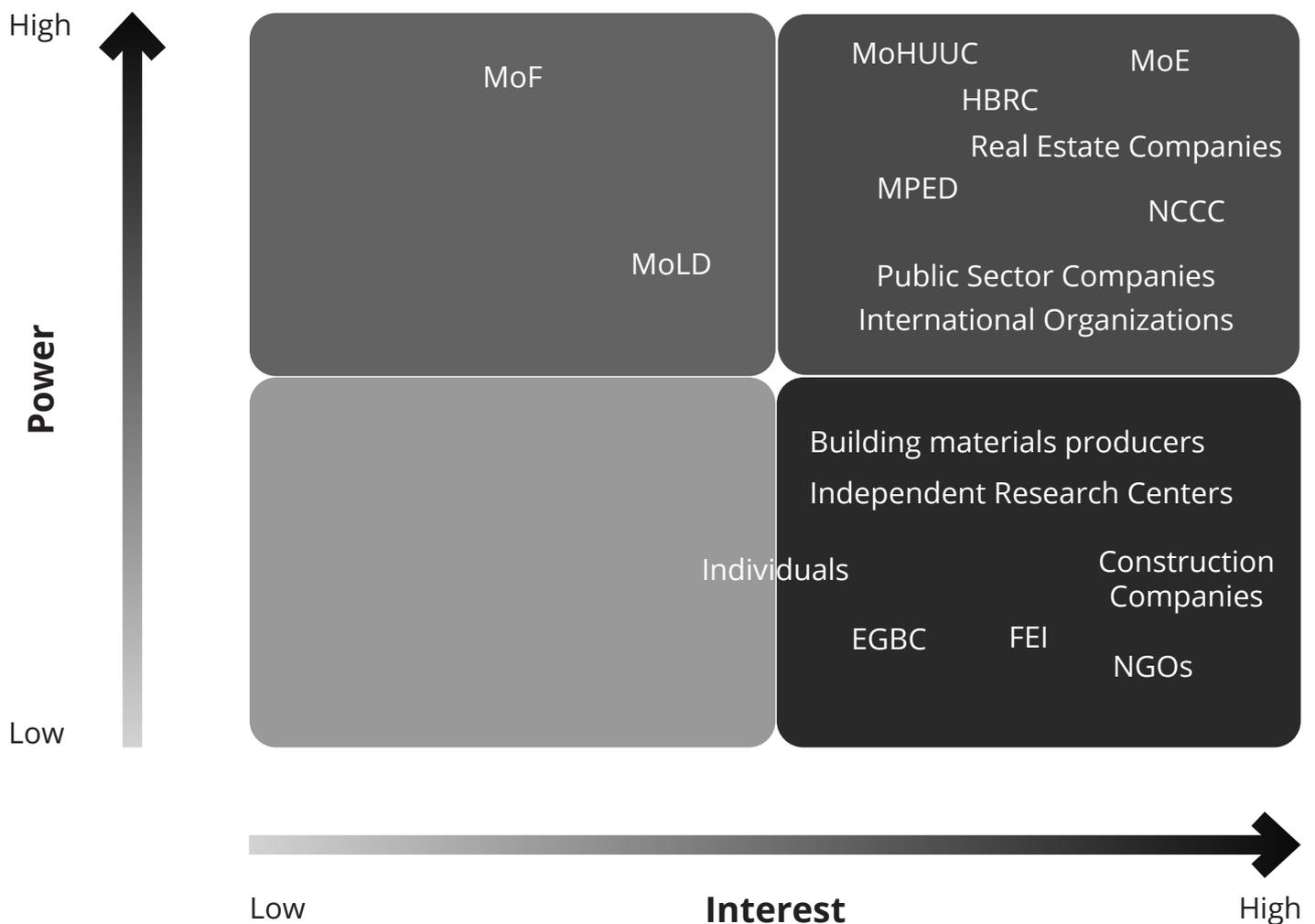


Figure 2. Power-Interest Grid Analysis of Key Stakeholders

Source: The authors.

The Egyptian environment is not immune to global environmental problems but rather exposed to a multitude of issues, including the exacerbated energy crisis and phenomenon of pollution of all kinds, the water crisis after reducing Egypt's share of the Nile water, the desertification and the issue of solid waste and encroachment on agricultural lands, and the current negative impacts of the natural and built environments. Studies have shown that about 30% of all carbon-related emissions

come from buildings, other than the depletion of materials, resources inside the building, and energy consumption. Accordingly, the process of building construction is critical because of its direct and indirect effects on the environment. Thus, this urges the call for providing an integrated strategy for developing the building and construction's sustainability and hence objectively evaluating it (Karmany, 2015).

IV. Integrative Policy Options Framework and Analysis

The complexity of the problem necessitates introducing an interdisciplinary strategy of multiple policy options rather than standalone policy alternatives that would only target a single component of the value chain of the construction sector (Shalaby, 2022, Interview). The Egyptian government should consider sustainable building and construction as an interdisciplinary strategy to establish sustainable cities and hence the mitigation of the impact of climate change.

The three proposed policy options form an interdisciplinary strategy to establish sustainable cities and hence the mitigation of the impact of climate change. The strategy enables a systems thinking approach to solve

the problem, hitting on the entire value chain as a whole. The three proposed policy options are divided into 3 stages and typologies of interventions through Policy option A is a long-term type of 'greening' existing building laws and developing national standards for sustainable construction materials. As for policy option B, it is a kind of short-term implementation and of a rapid impact for providing finance and awareness campaigns to promote sustainable construction. The third and final policy option C, is a medium-term implementation framework type that proposes establishing a national Sustainable Construction Working Group under the NCCC.

Proposed Policy Option A

'Greening' Existing Building Laws and Developing National Standards for Sustainable Construction Materials

To spread sustainable construction techniques in Egypt, it is mandatory to reform the rigid determinants of the current building legislation, the Unified Building Law No.119 released in 2008, and its executive appendix released by the Ministerial Decree No. 144 in 2009, that do not consider the environmental standards and the current global and national growing interest in sustainable construction, which leads to the spread of urban fabrics that do not take into account the surrounding environment, in terms of unsuitable building materials that are used in the multiple construction processes in Egypt and accordingly, its impact on the climate change.

Hence, the first proposed policy option deals with reformulating the current regulatory framework that regulates the construction process in

Egypt, which is represented in the frameworks of building processes and legislation, to include the sustainable construction standards and integrate them into construction legislation and thus the executive requirements regulating the construction process in Egypt. In addition, it is essential to provide packages of financial and in-kind incentives to promote sustainable construction methodologies in Egypt. In parallel, this alternative deals with developing the standards of the building materials in Egypt to achieve the required environmental sustainability standards and ensure the utilization of sustainable and environmentally-friendly building materials, which will reflect on the mitigation of climate change in Egypt, as shown in Figure 3.

Integrating Green Building Codes with Laws for Existing and New Buildings

By comparing the Unified Building Law No. 119 of 2008 with the Green Building Codes in Egypt, a great discrepancy was observed between the requirements of sustainable construction in the green codes and the Egyptian building law. Therefore, spreading the concept of sustainable construction requires working to reformulate the current building law to integrate the standards and techniques for implementing sustainable construction by taking into account the conditions and impact of

climatic change in the different regions of Egypt, as well as considering the different building materials and integrating what is environmentally appropriate and achieves the desired environmental standards. These amendments should also be done by setting a specific timetable for implementation on the ground, providing methodologies and comprehensive frameworks for the transition to sustainable construction in Egypt.

Incentive Schemes in Laws and Regulations

The private sector's contribution to the construction sector in the fiscal year 2021 in Egypt is about 450 Billion EGP (Abo El Magd, 2021). Despite this, the current building law is devoid of any incentives offered to encourage the relevant stakeholders concerned with construction operations in Egypt to follow sustainable construction techniques in Egypt.

This reinforces the reluctance of the private sector to include these techniques in their constructions. Therefore, this alternative proposes providing packages of incentives, whether financial or in-kind, whose role will promote the use of sustainable construction methodologies in Egypt, which in turn will enhance the state's current orientations in integrating the private sector more efficiently and effectively.

Financial Incentives

The Unified Building Law is amended, by adding new texts that incentivize projects that adopt sustainable construction standards with a package of financial incentives that encourage various parties to integrate sustainable building techniques into their projects (Scholar.Cu.Edu.Eg.Pdf, n.d.). These incentives may include:

Licenses Issuing

- Reducing licensing fees.
- Speeding up the process of issuing licenses.

Land Ownership

- Reducing the prices of lands whose owners provide evidence of the use of sustainable construction techniques in building.
- Increasing the periods of paying back the payments of the land.
- Allocating several distinctive lands for construction using sustainable construction techniques.

Tax Facilitation

- Exemptions from real estate taxes.
- A reduction in contracting fees for facilities for buildings that follow sustainable construction methods.

In-Kind Incentives

- **A reduction in the initial and recurring utilities cost:** This type of incentive includes water, electricity, and road infrastructure for the public and private sector working in construction which will provide the required drawings and construction specifications that prove the consideration of the sustainable construction techniques. The suggested incentives aim to promote the opportunity for a better integration between the different related actors in the construction and building sector in Egypt.
- **Selection criteria:** An extra assessment score should be considered in this type of incentive to the bids that integrate the sustainable construction techniques in their technical offers. Thus, the selection criteria shall prioritize the bids with the most sustainable construction specifications and those that promote the eco-friendly techniques.

National Standards for Sustainable Construction Materials' Production

- Proceeding from the fact that the application of sustainable construction techniques requires a comprehensive realization of the production cycle in general, including the determinations and standards for the production of building materials to be environmentally appropriate to achieve the environmental sustainability of construction, this solution provides a recommendation to develop standards for the production of the different materials that are being used in construction in Egypt. These standards can be derived from the green building codes in Egypt so that they become mandatory as environmentally appropriate standards. In that sense, this solution aims to contribute directly to the dissemination of sustainable construction techniques and requirements on the national level. The lead stakeholders for the proposed option are the MoHUUC, the parliament, and the MoF.

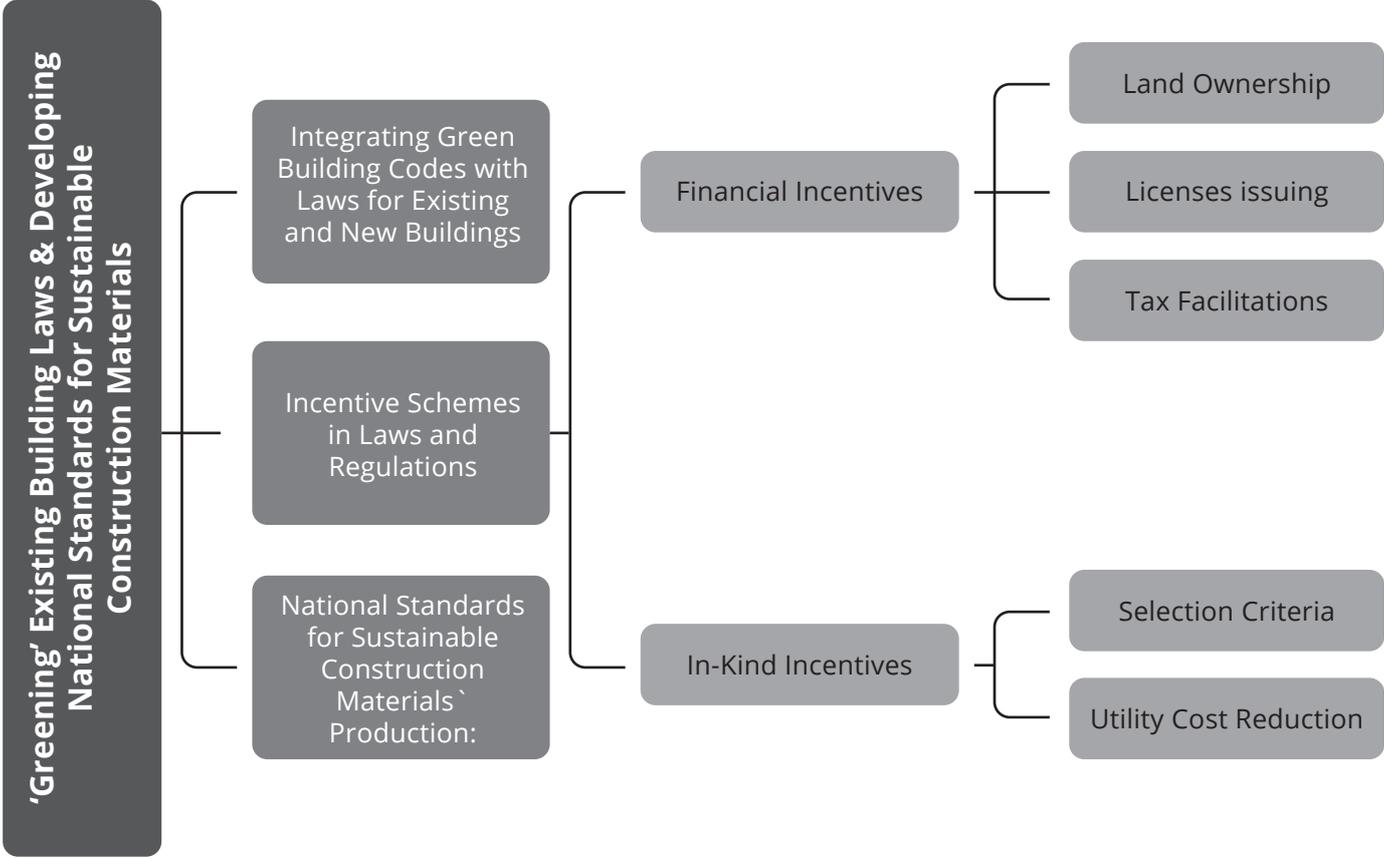


Figure 3. Proposed Policy Option A: Breakdown of Regulatory Framework Reform

Source: The authors.

Proposed Policy Option B

Providing Finance and Awareness Campaigns to Promote Sustainable Construction

The second proposed policy option is a straightforward short-term implementation of incentives and awareness interventions. Despite the overall prevalence of sustainability related terms, few of the stakeholders truly comprehend the concept of sustainable construction in specific. Therefore, awareness coupled with incentive schemes, such as direct financing, green bonds, intermediated finance through local financial institutions, public-private partnerships (PPP) framework programs,

and motivation to influence change are all vital building blocks. This type of proposed policy option is considered as an executional type. As a result, achieving sustainable construction means improved health for the people who use the buildings, and improved workers' productivity during construction thanks to better surroundings, work environments, and noise protection. This will lead to an integrated society directed towards one goal, which is a more sustainable construction industry.

Program-Based and Programmatic Incentive Schemes

Green Financing

Green buildings represent a major global investment opportunity; thus, facilitating investments in green construction, both directly and indirectly, through a variety of innovative channels and financial tools, could effectively lead to an increase in the number of green buildings rather than the ordinary ones (EBRD, 2020).

- **Direct Financing** is a tool that entails green investments and the use of advanced resource-efficiency measures, including debt, equity, or quasi-equity financing. One international example is Colombia's largest commercial bank, which provides over 40 % of the construction finance in the country to grow its green building portfolio. The bank provided a developer with a conventional, non-discounted loan in 2016 (World Bank, 2018).
- **Green Bonds and Securitizations** aim to boost liquidity (commercial/public buildings). The Barclays Green Bond launched in 2017 in the UK is an international model to finance and refinance low-carbon buildings (World Bank, 2018).
- Provision of **Incentives by Insurance Companies**, this tool depends largely on green building certifications and enabling developers to identify and minimize risks, which make them better candidates for insurance more accurately.

Facilitative Schemes and Tools

The suggested tools for facilitative schemes are: installments for land prices, land price reductions provided for green projects only, technical support and assistance, reputational internationally-credible green labeling for buildings, and non-financial intermediators, such as utilities and energy service companies/ infrastructure.

- **Installments for Land Prices** to be facilitated for longer term and smaller payments for installments of land prices offered by the government. The European Bank for Reconstruction and Development (EBRD) offers credit lines to local partner financial institutions (PFIs) for on-lending to small and mid-sized green projects with loans or leasing
- **Technical Support and Assistance** to be offered by governmental specialists in implementing national entities to overcome market barriers by providing the needed know-how and ensuring the successful planning and implementation of the green-building projects.
- **Reputational Green Labeling** to be provided for green buildings that could be created through a new labeling system created by an affiliation to the international community through the national EGBC, which will be credible and reputational especially for the private sector thus motivating them towards further investments in green buildings.

Awareness Plan and Advocacy Strategies

Awareness targets reach multiple levels of stakeholders, despite their level of influence, whether they are reachable, change in time, how they will be affected, and their contribution in awareness. Sustainable construction awareness could be achieved through decentralizing and localizing the awareness level through having implementation units in each governorate and enhancing the role of Urban Upgrading Unit (UUU) in each governorate. All suggested awareness tools are intertwined and complementary to each other. Table 1 illustrates the effects of these tools on different stakeholders through a set of criteria. The criteria are determined to consider all aspects of these tools. The public sector, the private sector, and the

NGOs have the highest overall scores. The awareness tools could be easily applied on those aforementioned stakeholders rather than others, while changing the behavior of developers and contractors are the most difficult. For example, training can reach the private sector more conveniently than in the case of the public sector. It is crucial to note that awareness tools must be tailored for each stakeholder. Table 1 measures the reachability, the impact and influence (power to make the stakeholders choose a certain behavior), implementation time, the quality of change, and the change of the tailored awareness tools on each stakeholder. The weights reflect the overall level of convenience for applying the tailored awareness tools on the stakeholders.

Criteria /Stakeholders	Public & Private Developers & Contractors (Tools: Media-Based Campaigns & Trainings)	Individuals & Communities (Tools: Media-Based Campaigns, Education Development & Trainings)	Public Sector (Tools: Media-Based Campaigns & Trainings)	Private Sector & NGOs (Tools: Media-Based Campaigns & Trainings)
Reachability	2	3	3	3
Influence	2	2	3	3
Time-Efficiency	1	2	2	2
Effectiveness & Awareness Quality (in Outcomes) /Response to Awareness	2	3	3	3
Contribution & Role	3	3	3	3
Total	8/15 (53.3%)	13/15 (86.7%)	14/15 (93.3%)	14/15 (93.3%)
*Criteria: Weak (1), Moderate (2), Strong (3)				

Table 1: Viewing Criteria When Applying Tailored Awareness Plans for Each Stakeholder

Source: The authors.

Media-based campaigns can be a very strong tool for empowering stakeholders due to the ease of accessibility to these frequently used platforms in the Egyptian scene, and the ease of reaching categories which cannot be reached on ground. It is worth noting that there were more than 69 million mobile internet users in Egypt in July 2022 (Ministry of Communications and Information Technology, 2022).

The impacts of developing curricula, courses and education appear in the longer term in comparison to other sub-options. It is extremely essential to also

provide training sessions for developers, contractors, and household owners. NGOs could spread awareness through training to the developers, contractors, and household owners. Thus, training will assist contractors and developers to shift easily towards sustainable construction. Moreover, training for individuals, could be helpful to educate people to save energy by using solar panels built on their building roofs, plant more trees in their surrounding areas, find sustainable substitutes and green areas, learn more to satisfy their needs via hydroponics, aquaponics, and farming, etc.

Proposed Policy Option B

The lead stakeholders for green financing and facilitative schemes are the Central Bank of Egypt (CBE), MPED, Insurance

Companies, while the lead stakeholders for the awareness plan and advocacy strategy are MoHUUC, MoE, MoETE, and NGOs.

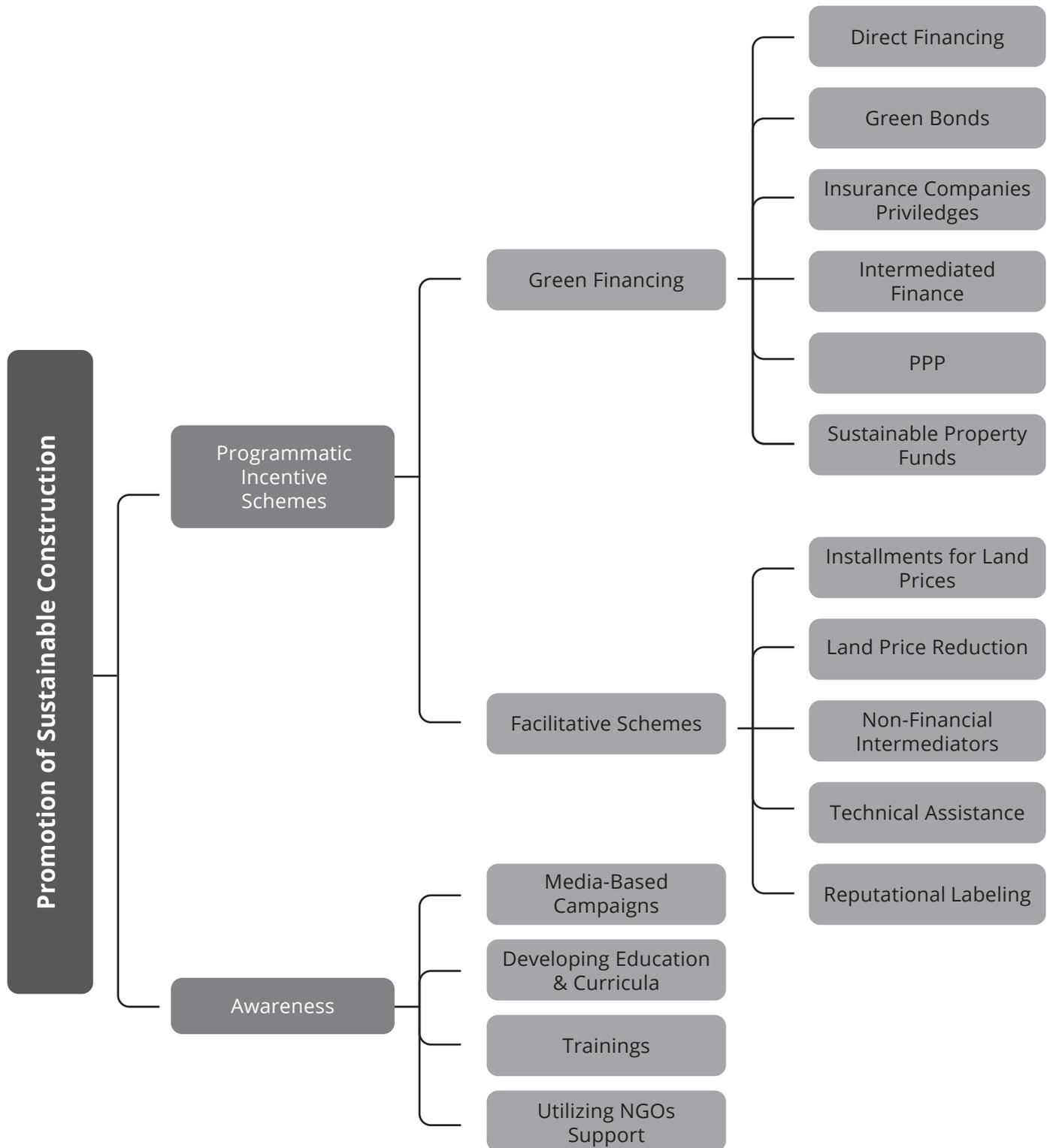


Figure 4. Proposed Policy Option B: Promotion of Sustainable Construction
Source: The authors.

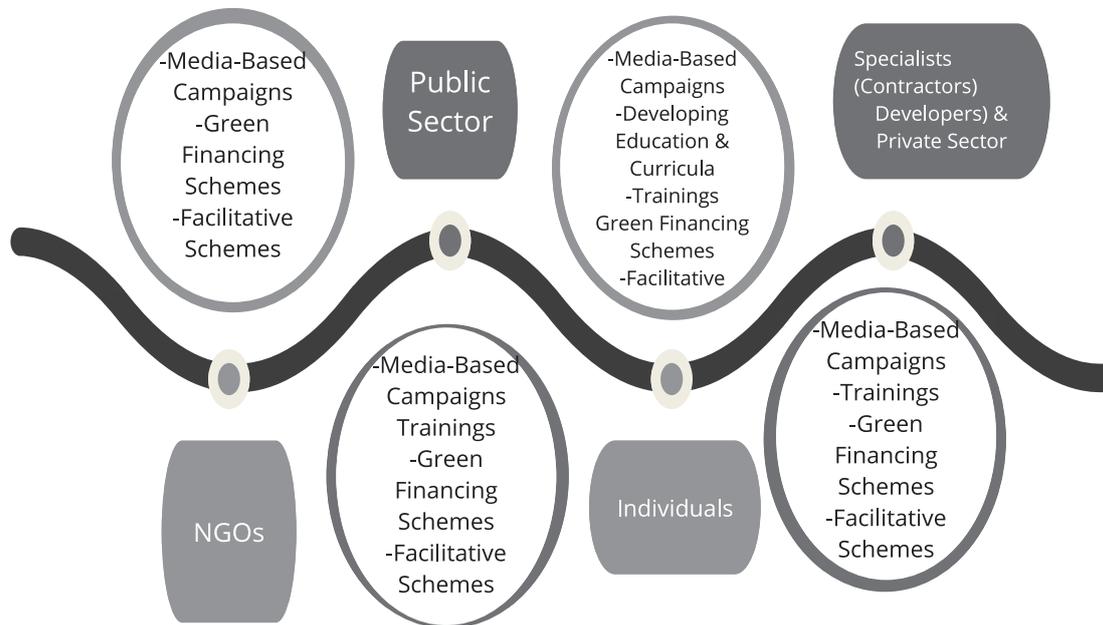


Figure 5. Promotion Tools Classified by Targeted Stakeholders

Source: The authors.

Proposed Policy Option C

Establishing a National Sustainable Construction Working Group

The final proposed policy option C covers an integrated stakeholder framework of cooperation in the form of a branching technical working group under the NCCC.

Given the multiplicity of stakeholders involved in the entire cycle of the construction process and sustainable construction practices, an integration and full inclusion of this wide range of stakeholders must take place. This type of proposed policy option is considered as an institutional type of restructuring to current cooperation frameworks and partnership

groups on climate change impact and sustainable construction practices (Shalaby, 2022, Interview).

The lead stakeholders and implementing agencies to this policy option are the MoHUUC and the Prime Minister in coordination with MoE, the Egyptian Environmental Affairs Agency (EEAA), and the United Nations Framework Convention on Climate Change (UNFCCC) Focal Point as steering entities in the structure of the NCCC.

National Sustainable Construction Working Group under the National Council for Climate Change

Drawing from the good practices of Nordic countries' cooperation framework in sustainable construction, Denmark as one example has recently issued a National Strategy for Sustainable Construction in 2021, where multi-level cooperation frameworks are introduced as developments under current mechanisms and entities, such as the Danish Agency for Housing and Planning and the Nordic Ministers for Construction and Housing (Ministry of the Interior and Housing, 2021).

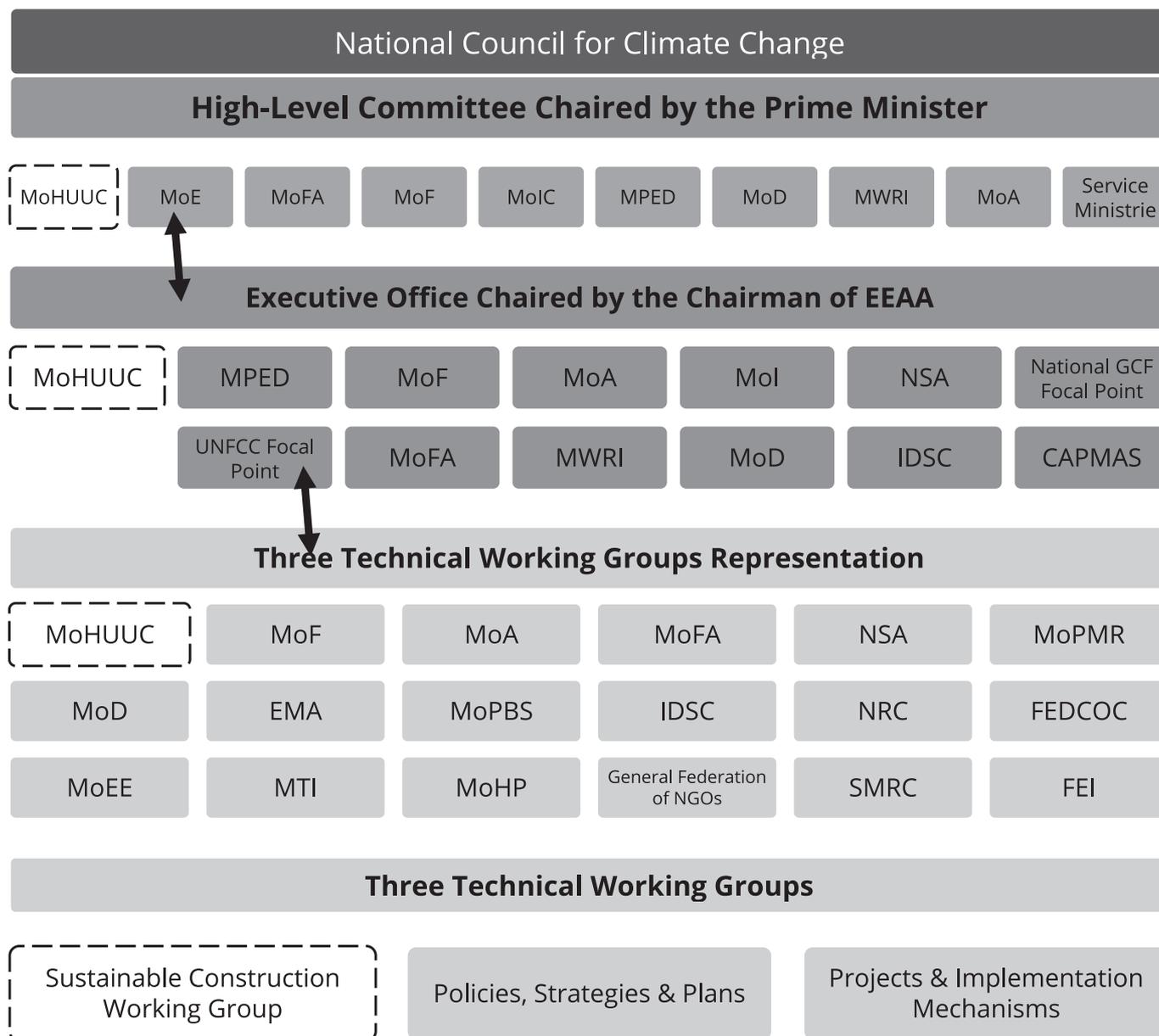
In that spirit of building on current mechanisms, and given its high-level, inter-ministerial role in overseeing all climate policies and strategy development across Egypt, the NCCC can serve as the umbrella for a branching working group that can operate under it (Climate Action Tracker, 2022). This working group can bring together key stakeholders from the field of the construction sector. The NCCC in this proposal should initially be re-mandated to include a representative from the MoHUUC as the Prime Ministerial Decree No. 1129 of 2019 for the organizational structure of the NCCC stipulates the membership of other ministries such as MoIC, MPED, MoF, etc. with no reference to MoHUUC representation (PM Decree No. 1129 of 2019 National Council for Climate Change, 2019).

Accordingly, the Prime Minister and the Cabinet of Ministers should thus issue a follow-up amendment to the Prime Ministerial Decree No. 1129 of 2019 to include MoHUUC representation across all three levels of office in the NCCC: the high-level committee chaired by the Prime Minister, the executive office chaired by the chairman of the EEAA, and the two existing

technical working groups in addition to the third and newly proposed Sustainable Construction Working Group in this policy option - to be chaired by the MoHUUC, as shown below in Figure 6.

This newly proposed national Sustainable Construction Working Group under the NCCC can operate as the entity that brings insights from the field to the NCCC given the different levels of representation from technical to managerial positions in the construction industry that would thus enable an environment conducive to sustainable practice in the construction sector. Potentially, this working group can develop an action plan and a national strategy for sustainable construction in Egypt to operationalize the structure of sustainable construction in Egypt (Ministry of the Interior and Housing, 2021).

The newly introduced representative member from MoHUUC across the three different levels of office under the NCCC is illustrated below in Figure 6 as a restructured framework proposal to the current NCCC organizational structure. In addition to the two current technical working groups on "Policies, Strategies, and Plans" and "Projects and Implementation Mechanisms" shown in Figure 6 below, a newly proposed third working group called the Sustainable Construction Working Group should operate under the NCCC umbrella with the MoHUUC representation as the lead implementing entity that holds members accountable through its representation in the high-level committee of the NCCC and the executive office as well as in the technical groups (Ministry of Environment, 2019).



*Dotted lines indicate new representations and newly proposed technical working group.

Figure 6. Proposed Policy Option C: Organizational Restructuring for the National Council for Climate Change

Source: The authors.

Stakeholder Division and Representation

The type of cooperation between stakeholders under the umbrella of the NCCC should be categorized into general, financial, technical, and knowledge exchange subcategories, discussing the gaps and challenges in the field as well as propose contextualized solutions in the form of policy recommendations to advocate and operationalize sustainable construction practices in Egypt. This new organizational structure should consist of mid-management-level representation of the different stakeholders that will be introduced in the following section in order

to allow for technical as well as institutional levels of analysis to problems and solutions from the different entities and affiliations of the members of the Sustainable Construction Working Group.

This envisioned framework of stakeholder engagement includes representatives from members of the two existing technical groups under the NCCC as well as additional representations from the public sector, the private sector, NGOs, industrial associations, and independent individuals and entities as illustrated below in Figure 7.

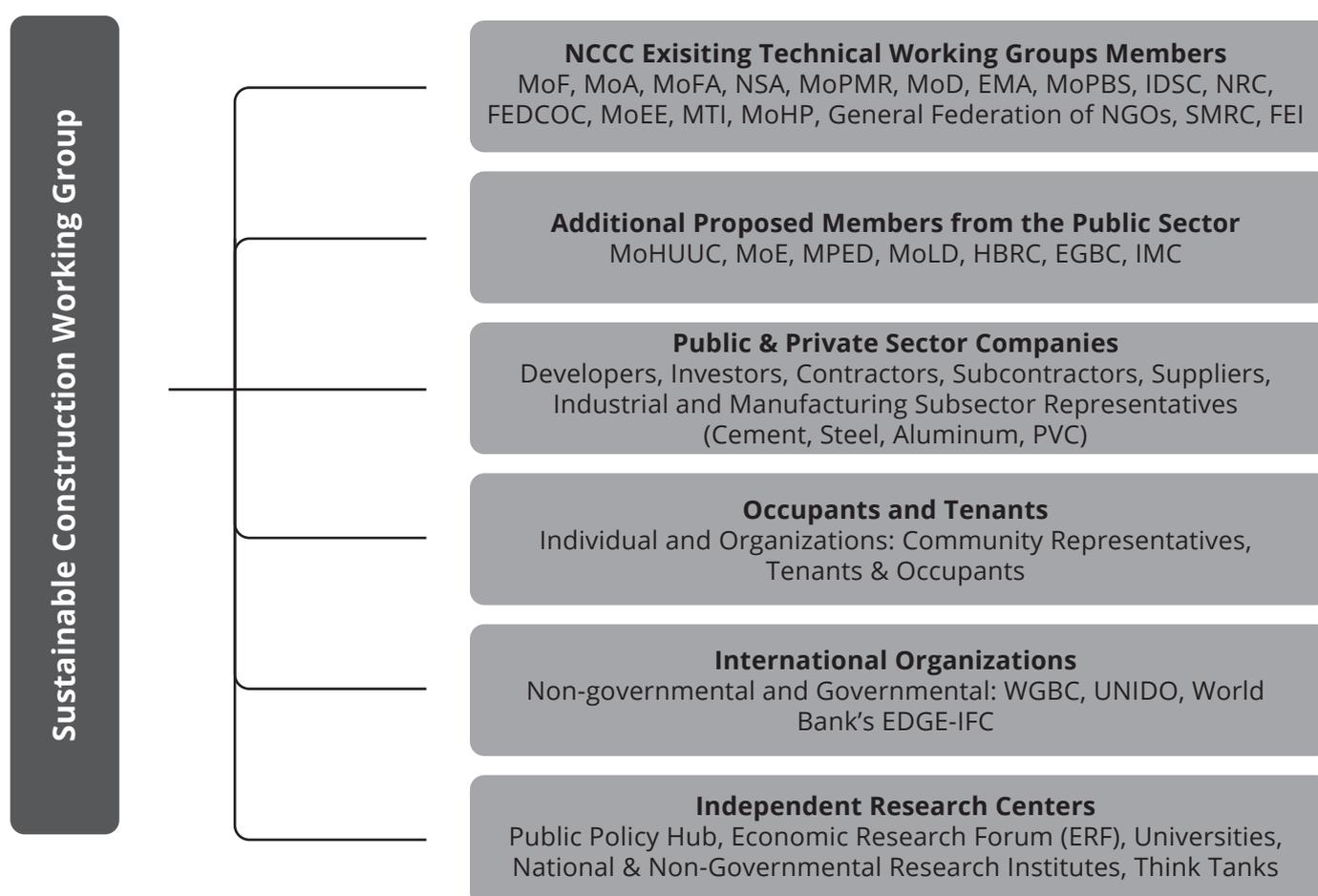


Figure 7. National Sustainable Construction Working Group New Members and Stakeholders

Source: The authors.

Policies Assessment Methodology

The three main selected criteria are effectiveness and efficiency, level of collaboration across implementation phases, and long-term benefits, gains, value, and return on investment (ROI). The main criteria are selected on the basis of analyzing the process, the outcomes, and longevity for each proposed policy option. The methodology in Table 2 is based on setting a scale from one to three points for each criterion, reaching 27 as a total score (weight) for each policy option. Table 2 reflects that the proposed option B acquires the highest weight, while the proposed policy option A acquires the least weight. The weights do not signify that policy option A is not as significant as policy option B. However, the weight reflects the overall level of convenience for implementing the policy option in the field.

The first criteria on effectiveness and efficiency reflects the productivity and the quality metric, assuring the consumption of the least amount of inputs - time, resources, and cost - and receiving the desired outputs. The first criterion is divided into seven sub-criteria. The second main criterion measures the level of integration between stakeholders during the implementation phase. As for the third main criteria, it

represents the expected long-term benefits achieved by each policy option.

Achieving 17 points in policy option A indicates that the selected regulatory framework reaches its targeted stakeholders, with minimum costs and resources, and an extremely influential change. However, applying policy option A is more time-consuming for official issuance and approvals and cannot be localized or created by individuals. Recording 22 points for the second policy option, for ease of application, policy option B takes a relatively short time in implementation compared to other policy options and could be localized. However, policy option B needs financial and resource support.

As for the third policy option, it scored 21 points, where it moderately needs finance and resource support but is relatively inconvenient in reaching out to the stakeholders. The proposed policy option C receives a moderate weight, where it is relatively easy to reach out to the stakeholders for maximum impact. However, cooperation among stakeholders requires a lengthy timeline.

Priority Criteria in Implementation/ Policy Option	Policy Option A: 'Greening' Existing Building Laws	Policy Option B: Providing Finance and Awareness Campaigns	Policy Option C: Establishing a National Sustainable Construction Working Group
Effectiveness & Efficiency:	Subtotal: 13	Subtotal: 17	Subtotal: 16
Feasibility (Socio-economic, Political, Technical, Executive, & Legislative)	1	3	2
Sustainability Balance between Social, Economic, & Environmental Factors	1	2	2
Cost & Resources	3	1	2
Time	1	3	2
Reachability	3	2	3
Decentralization in Decision-making & Localization in Implementation	1	3	2
Impact	3	3	3
Level of Collaboration Across Implementation Phases	Subtotal: 1	Subtotal: 2	Subtotal: 2
Long-Term Benefits, Gains, Value, & ROI	Subtotal: 3	Subtotal: 3	Subtotal: 3
Total	17	22	21
*Weight/ Score: Low (1), Medium (2), High (3)			

Table 2. Priority Criteria Assessment for Proposed Policy Options

Source: The authors.

The following section on conclusions and recommendations covers the policy assessment analysis and scoring results. Conclusions and recommendations discuss the integrative frameworks of the three chosen policies in order of priority and

explain the different justifications of each set criterion and score for the different policy options, followed by the implementation and monitoring and evaluation strategies of the policies.

V. Conclusions and Recommendations

The paper includes responses from around 11 interviews with different representatives for the key stakeholders, which gives insights from a select number of international and national case studies and effective projects through analyzing the construction and building market with its laws and final products. As a result, the paper creates a plan for achieving sustainable construction through the concluded, integrated framework of three policy options.

The three presented policy options are complementary, as the construction sector elements are interlinked and intertwined in a manner that necessitates an intricate plan and intervention scheme to solve the problem with sustainable construction. Accordingly, the paper recommends that decision-makers must apply the three policy options in line to each other, starting with the policy option that has the highest weight until reaching to apply the policy option of the least weight.

Decision-makers should thus commence implementation with policy option B, followed by policy option C and then applying policy option A. In that regard, promotion for the concept of sustainable construction must take place to inform and motivate all stakeholders on the way forward to mainstreaming sustainable construction in Egypt. Moreover, stakeholders should find common interest and benefits from achieving sustainable construction through cooperation and integration frameworks under current mechanisms. Finally, one of the most important steps is to formalize all actions under a determined and approved framework to add credibility to the process of achieving sustainable construction and in sequence towards establishing sustainable cities and communities.

Implementation Strategy of the Policies

The implementation strategy includes applying the three proposed policy options in an integrated framework divided into stages of implementation in line to each other starting with policy option B that scored the highest weight in priority followed by policy option C and moving forward with policy option A. Due to the intricate nature of the problem, they are not policy options in silos. The proposed policy option A is a long-term type of implementation framework that introduces amendments to laws and

regulations and developing decrees or decisions on financial and in-kind incentives. As for the proposed policy option B, it is a type of short-term implementation and of rapid impact for adopting both program-based incentive schemes as well as utilizing advocacy strategies in raising awareness. The third proposed policy option C is a medium-term implementation framework type for introducing institutional changes of a new sustainable construction working group under the NCCC.

Monitoring and Evaluation Strategy

The monitoring and evaluation (M&E) strategy for the integrative framework of the three policy options includes mandating an M&E unit that runs simultaneously with the structure of the Sustainable Construction Working Group under the NCCC. It should have representatives from the private and public sector as well as key players from the construction sector and the community.

This parallel independent M&E unit should closely monitor and evaluate the progress and implementation framework of the integrative policy options and formulate

this into deliverables and reports that should inform the development of the Sustainable Construction Working Group and its action plan and potential strategy development on sustainable construction in Egypt. Table 3 below illustrates the different M&E mechanisms across the unit under the Sustainable Construction Working Group that should gather and collect data as well as analyze and report regularly on the progress of the options and their influence and development in practice, ultimately to inform a national strategy and/or action plan on sustainable construction in Egypt.

Integrative Policy Options Framework Components/ M&E Plan	Tool	Key Performance Indicator (KPI)	Stakeholders
Coordination of National Bodies	Formation of an independent unit/ committee from multiple national bodies	Legislative, executive, judicial validation/ verification/ harmonization	Suggested unit under the newly proposed Sustainable Construction Working Group under the NCCC
Phases of Implementation	Database collection, technical data analysis	Regular reports (annual, biannual, monthly, bimonthly as necessary)	Suggested unit under the newly proposed Sustainable Construction Working Group under the NCCC
National Profile	Political will, expertise and technical support, resources	A national interactive map of the progress with multiple layers of details (proposed pilot level of details: status of projects phase, whether planned, in-progress, or implemented projects)	Suggested unit under the newly proposed Sustainable Construction Working Group under the NCCC

Table 3. Tools and Mechanisms under the M&E Unit of the Sustainable Construction Working Group

Source: The authors.

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VII. Appendices

Appendix 1: Comprehensive Guide for Interview Questions

General Interview Questions on Sustainable Cities

- **Where does Egypt stand in its goal towards sustainable cities? How far has Egypt achieved from SDG 11 Sustainable Cities & Communities for making cities safer, resilient, and more inclusive? How to achieve the following targeted goals as per the UN SDGs by 2030?**
 - Increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, and resilience to disasters.
 - Enhance inclusive and sustainable urbanization and capacity for participatory, integrated, and sustainable human settlement planning and management.
 - Safe and affordable housing and basic services and upgrading slums.
 - Energy efficiency in existing and new buildings and infrastructure.
 - Provide universal access to safe, inclusive and accessible, green and public spaces.
 - Reduce the adverse per capita environmental impact of cities, including special attention to air quality and municipal and other waste management.
 - Financial and technical assistance, in building sustainable and resilient buildings utilizing local materials.
 - Safe, affordable, accessible, and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.
- **Out of the above targeted goals by the UN SDGs by 2030, which sectors/ or sub-sectors do you think is a priority when adopting the idea of sustainable cities in Egypt? And in accordance with the construction sector, how does the ministry of environment engage/coordinate/overview the sustainable construction and/or green buildings in Egypt in terms of policies, initiatives, laws, etc.? (MOE)**
- **What are examples/ models of sustainable and/or green cities in Egypt, and their SWOT analysis?**

Interview Questions for Sustainable Construction

- **As sustainability's triple bottom line is concerned with the common ground among environment, economy, and society, what are the main gaps/ challenges in the construction sector in Egypt including sustainable construction and green buildings in specific? What are the suggested solutions for the mentioned challenges? (MOE)**
- **Are there governmental bodies responsible for checking/reviewing the construction sector status regarding its practices in Egypt? Are the materials used safe for the environment and occupants? Does the construction process conserve natural resources?**
- **Are there standards for sustainable construction in Egypt? If yes, what are they?**
 - a) Environmental assessment impact, complementary policies/ standards (research this more)
 - b) Effectiveness of non-binding environmental standards and codes (research)
- **What are the penalties and incentive schemes regarding sustainable construction in Egypt? Are there any penalties enforced by Egyptian Law if breaches occur? (Search for the Egyptian construction law) Are there incentives or assistance from the state towards the sustainability of construction?**
 - a) Environmental assessment impact, complementary policies/ standards (research this more)
 - b) Effectiveness of non-binding environmental standards and codes (research)
- **What are the best practices to achieve sustainable construction (triple bottom line of sustainability - economy, society, and environment) in Egypt?**
- **What are examples/ models of sustainable construction projects in Egypt, and their strengths, weaknesses, opportunities, and threats analysis?**
- **How to make the recycling of construction & demolition waste handled in a costless or less expensive, and safe way to both the environment and people?**
- **Is establishing an ultimate mixed-use project similar to that Copenhagen's case applicable or can it be applied in Egypt's case especially construction & demolition waste?**
 - (A power plant that burns waste to generate electricity, and operates a sports facility. Where 440,000 tons of waste are yearly converted by furnaces, steam and turbines into clean electricity and heating for 150,000 nearby homes)

Interview Questions for Green Buildings

- **What is the importance (should it be obligatory in the Egyptian law for example) of the green buildings rating systems used in Egypt such as LEED, GPRS, Tarsheed (Egypt's GBC) in our way to sustainable construction? Will there be modifications on the Unified Building Law No. 119/2008 to include the enforcement of a specific rating system per green buildings?**
- **What are the challenges for constructing green buildings in Egypt? How can they get solved?**
- **Sustainable buildings can be in both cases: new buildings and retrofitting of existing buildings. What is more suitable in Egypt? Why?¹**
 - Is reconstruction or remodeling of old buildings and transforming them to green sustainable ones affordable to an average standard of living citizen? To be applied in many areas in Egypt?
 - What are the best ways to reduce operation, & design costs? In old buildings & new green buildings?
 - What is the best solution for building demolitions? How to efficiently make use of construction, and demolition (C&D) waste? (Technically, financially, & environmentally) How to make the recycling of construction & demolition waste from old buildings costless or less expensive?
 - Which type of buildings are the most expensive to be green? (Schools, homes, commercial & public buildings, healthcare facilities?)
 - Is it applicable to add solar panels on the buildings' roofs? (We have Benban the world's biggest solar power stations)
 - Can green buildings depend only on renewable energy sources in Egypt? Is it risky? Not stable in Egypt? Expensive? Can it be a "net zero energy building"?
 - (Similar to a green building in Pune, India, the Suzlon One Earth campus has a platinum LEED certification, generating some of its electrical needs on site - 80% of this power comes from wind and 20% from solar. The rest of its electricity comes from its off-site windmill farms, making it a net zero energy building.)
 - Do you think it should be a pilot project, focusing on a certain area/ region at the beginning?
 - What building types could be green easily? Example: schools, homes, commercial & public buildings, healthcare facilities?
 - How to make existing buildings green? Through remodeling, retrofitting and improved operations for example? Or to totally remove the building?
 - How to have an effective waste management process in buildings?

¹New buildings & existing buildings can be used in the policy paper as one category. Construction materials and construction methods can be used in the policy paper as another type of categories

Are there any penalties enforced by Egyptian Law if breaches occur? (Search for the Egyptian construction law- Green building code in Egypt implementation (research + Unified Building Code/ Law)

- a) Environmental assessment impact, complementary policies/ standards (research this more)
- b) Effectiveness of non-binding environmental standards and codes (research)

- If yes? Are such laws really effective?

- Do you think that the government should impose taxes on non-environment friendly acts in buildings? Do you think imposing taxes on green buildings is a good idea as a source of funds? Or should they give incentives instead?

- Are there bodies responsible for checking, reviewing green/sustainable buildings status in Egypt? What is the main institution/ person concerned by drafting laws, policies, incentives for green buildings?

- Are there incentives or assistance from the state towards encouraging green buildings?

- **How is green building related to smart growth, sustainable development, and sustainable resilient cities?**
- **In Egypt's case, where can I find more information, data, and advice about the components of green building, like energy efficiency or reduced waste?**
- **Are there any existing sustainability programs or initiatives through the ministry of environment that can support (whether financially or technically or any other support) green building projects in Egypt? (MOE)**
- **Are there any examples/ models of green buildings in Egypt? If yes, what is their SWOT analysis?**

Additional Questions for Green Buildings

Many individuals assume that a green building is going to cost more money, have you found this to be the case in Egypt, or would you say that this is a false statement?

- If the previous statement is false, why do you consider it inexpensive or a money saver?
- If the previous statement is correct, & the green building project is expensive, what are the factors that make it financially expensive? (Design, renewable energy consumption, waste management, operations, or others)
- If the first statement is correct, and upon the answer of above, are there substitutes for expensive factors? What are they?

- **Do you think that Egypt is financially ready to incorporate green building strategy? Are there enough donors for this project? Who are they?**
- **One of the main elements of green buildings is to be a money saver & its design enables adaptation to a changing environment. How to make this element available in buildings?**
- **Do you think the government should apply green buildings projects in certain areas or on a certain standard of living? Or to be applied to all Egyptian cities regardless of their economic status? What are the potential opportunities in PPP among stakeholders (government, citizens, private sector developers, contractors, NGOs) in adopting green buildings projects? Is it a luxury for Egyptians' lives right now to focus on sustainability and green buildings, if it is not a priority? When can the Egyptian government consider it as a priority? (This question is targeting the social and economic aspects of the green buildings)**
- **What are the economic & social benefits of green or sustainable building and development?**
 - How do you think the green buildings will help/ affect the Egyptian economy? Budget? Resources allocation?
 - Do green buildings really matter for people's health, productivity, &... etc? What are the direct & indirect impacts on people?
 - When are the results expected to be tangible and on ground?
 - What will be the direct & indirect costs on all stakeholders? (Real estate companies, governmental institutions, citizens/residents)
 - Will any stakeholders be harmed?

Interview Questions for Initiatives/ Projects in Egypt

- **What was your role in the initiative/project?**
- **What are the results/ expected results achieved by the initiative/project?**
- **What is the goal & vision of the initiative/project?**
- **In which phase is the project/ initiative?**
- **What is the success rate for the project?**
- **What were the challenges in the initiative/project? How to avoid, solve or find a substitute for the challenge?**

For Research Examples of Green Certified Buildings

- **Credit Agricole in Fifth Settlement**
- **Galleria 40 as an example for a building project in Egypt complying with international green building standards and received the LEED Gold certificate in 2016 from the United States Green Building Council (Raya, 2020).**

Appendix 2: Key Figures for Building and Construction Sector Sustainability Performance

Economic Impacts	On average, in the US, Japan and the European Union, the sector accounts for (OECD, 2003, p. 20):
	<ul style="list-style-type: none"> • 5–15% of gross domestic product
	<ul style="list-style-type: none"> • 45–55% of gross fixed capital formation
	<ul style="list-style-type: none"> • 5–10% of total employment.
Environmental Impacts	In the US, 40% of all extracted materials are used for building and construction (Kibert et al., 2002, p. 7).
	In OECD countries, the built environment accounts for 25–40% of final energy use (OECD, 2003, p. 20).
	Construction and demolition waste makes up 30–50% of total waste generation in higher income countries (UNEP, 2003, pp. 6–7) and is the largest waste stream (in quantitative terms) in the European Union (European Commission, 2000, p. 2).
	The built environment accounts for some 40% of the world's greenhouse gas emissions (UNEP, 2003, p. 6).
Improved Sustainability Performance of the Built Environment	Some examples: <ul style="list-style-type: none"> • In the UK, from 1970 to 2001, insulation and heating energy efficiency in the housing stock led to a saving of 46% (Shorrocks and Utley, 2003, p. 13).
	<ul style="list-style-type: none"> • In the European Union, 25% of construction and demolition waste is reused and recycled, with countries such as Denmark, Belgium and the Netherlands leading the way with recycling rates of 80–90% (Symonds Group Ltd, 1999, p. 7; European Commission, 2000, p. 27).
	<ul style="list-style-type: none"> • In the interests of saving land and resources, urban areas are being developed at higher densities and renovation is increasingly being preferred to building on greenfield sites; renovation and maintenance currently account for 33–50% of construction activity in European countries (UNEP, 2003, p. 6).
Deterioration of the Sustainability Performance of the Built Environment	Some examples: <ul style="list-style-type: none"> • In the UK, from 1970 to 2001, domestic energy use rose more rapidly than overall energy use (Shorrocks and Utley, 2003, p. 14).
	<ul style="list-style-type: none"> • Between 1995 and 2010 the waste stream in the European Union is expected to more than double, while in Japan it is set to more than triple (OECD, 2003, p. 27).
	<ul style="list-style-type: none"> • CO₂ emissions by the world's cement industry are expected to quadruple by 2050 (UNEP, 2003, p. 6).
	<ul style="list-style-type: none"> • If left unchecked, current trends of urbanization will result in the destruction or disturbance of natural habitats and wildlife on over 70% of the Earth's land surface by 2032 (UNEP, 2003, p. 5).

Appendix 3: International and Regional Experiences: Sustainable Cities and Buildings

Country	City/ Case Study	Tools
USA	Kaupuni Village, in Hawaii	<ul style="list-style-type: none"> • Integrated Efforts • Energy Efficiency, & Reduction, Net Zero Energy Home Design • Providing Workshops for Residents
UAE	The Sustainable City, Dubai	<ul style="list-style-type: none"> • Energy Efficiency
Jordan	Fefa	<ul style="list-style-type: none"> • Resource Efficiency (Water, & Renewable Energy) • Raising Awareness with Local Communities
Morocco	General	<ul style="list-style-type: none"> • Setting Strategies • Articulating Territorial Decision-Making Bodies in New Development Model release (NDM) • Energy Efficiency • Raising Awareness
Japan	Kitakyushu	<ul style="list-style-type: none"> • Cooperation of Citizens (in recycling and separation systems) • Establishment of Recycling Centers by Public Companies • Integration among Stakeholders, & Information Sharing

Table A: Moving Towards Sustainable Cities Through Resource Efficiency, Waste Management & Regulations

Country	Building/ Case Study	Tools/ Building Criteria
UAE	The Sustainable Building in Al Quoz in Dubai	<ul style="list-style-type: none"> • Resource Efficiency • Waste Management
China	The Micro-Emission Sun-Moon Mansion in Dezhou	<ul style="list-style-type: none"> • Energy Efficiency (Solar-Powered Building) • Resource Efficiency
India	Over 10 Pioneering Examples of Sustainable Green Buildings (such as Suzlon One Earth in Pune, & CII- Sohrabji Godrej Green Business Centre in Hyderabad)	<ul style="list-style-type: none"> • Energy Efficiency • Unified Energy Conservation Building Code • An Approved List for Consumed Energy by Building Materials
Morocco	King Mohammed VI Green City (VVM6)	<ul style="list-style-type: none"> • First major African project engaging in the LEED-ND Certification Process
France	General	<ul style="list-style-type: none"> • Unified EU Policy • Developed a number of regulations, & codes for buildings (France & other 50 countries)
Denmark & Netherlands	General	<ul style="list-style-type: none"> • Unified EU Policy
Germany, UK & Switzerland	General	<ul style="list-style-type: none"> • Having a Life Cycle Assessment Requirements for Certain Public Buildings
Chicago	General	<ul style="list-style-type: none"> • Setting a Sustainable Development Policy • Giving Space for Developers in Choosing the Best-Fit Strategies

Table B: Making Buildings Sustainable Via Resource Efficiency, Waste Management, Codes & Regulations

Case Study	Tools	Extra Notes
El-Kharga	<ul style="list-style-type: none"> • No Factories • Has Large Green Spaces • Eliminates the Use of Plastics • Has the First Green School 	First Eco-Friendly City in Egypt
Haya Karima	<ul style="list-style-type: none"> • Develops Rural Areas, Including Environmental Aspect • Applies Green Building Standards • Has Solar Lighting for Governmental Buildings, Biogas Units, Energy-Saving Lamps • Plans to Increase Green Spaces • Renovates Tourist Attraction Spots 	An Initiative in the Second Phase of Implementation
NAC	<ul style="list-style-type: none"> • Expands Dependence on Renewable Energy (Energy & Resource Efficiency) • Waste Management • Has Large Green Spaces • Provides Ecosystems Services 	<ul style="list-style-type: none"> • Best Arab Sustainable Development Project • Smart City
Sharm El-Sheikh	<ul style="list-style-type: none"> • Plans to Develop Solid Waste Management System • Expands Dependence on Renewable Energy (Energy Efficiency), Starting by the City's Airport & the International Convention Center • Convert Transportation Means to Run on Natural Gas or Electricity 	Sustainable City

UN-Habitat SDG Cities Initiative	<ul style="list-style-type: none"> ● Has an inclusive strategic planning process: <ul style="list-style-type: none"> - Regulations - Revenue Collection - Public Infrastructure 	Global Initiative
	<ul style="list-style-type: none"> - Economic Initiatives ● Provides an SDG Cities Certification process ● Provides a Platform for Sharing Knowledge on a Global Scale 	
COP27 Presidency Global Sustainable Cities Initiative	<ul style="list-style-type: none"> ● Creates a Partnership for a Sustainable Cities Initiative to be Launched During COP27 ● Sets Guidelines for Stakeholders ● Identifies Workstreams for the Initiative 	Global Initiative

Table C: Significant Local Projects & Initiatives Towards Sustainable Cities & Buildings

THE PUBLIC POLICY HUB

Where Rigour Meets Creativity

The Public Policy HUB is an initiative that was developed at the School of Global Affairs and Public Policy (GAPP) in October 2017. It was designed to fill in the policy research gap in Egypt. It provides the mechanism by which the good ideas, plausible answers, and meaningful solutions to Egypt's chronic and acute policy dilemmas that are proposed by the country's best minds, the experienced and the creative from different age brackets, can be nurtured, discussed, debated, refined, tested and presented to policymakers in a format that is systematic, highly-visible and most likely to have a lasting impact.

It is designed to develop a cadre of well-informed and seasoned policy developers and advocates, while simultaneously fostering and promoting creative solutions to the challenges facing Egypt today. The project provides a processing unit or hub where policy teams are formed on a regular basis, combining experienced policy scholars/mentors with young creative policy analysts, provide them with the needed resources, training, exposure, space, tools, networks, knowledge and contacts to enable them to come up with sound, rigorous and yet creative policy solutions that have a greater potential to be effectively advocated and communicated to the relevant policymakers and to the general public.

Since its establishment, the Public Policy HUB has been supported by Carnegie Corporation of New York, UNICEF Egypt, and Oxfam. The Hub had partnerships with different ministries and governmental institutions like the Ministry of Social Solidarity, Ministry of Planning, Ministry of Health, Ministry of Trade and Industry, Ministry of Local Development, Ministry of Education, Ministry of Environment, National Council for Childhood and Motherhood, National Population Council, and General Authority For Transportation Projects Planning.

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