GIZ Employment Promotion Programme: The Egyptian Green Economy

Preliminary Findings for Green Construction Sector

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1. Background

1.1 Conceptual Background

1.1.1 General and Operational Definition

Green Construction refers to the practice of creating structures and using processes that are environmentally friendly and resources-efficient throughout a building life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction (US Environmental Protection Agency EPA, 2 January 2012).

The common objective is that green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by:

- Efficiently using energy, water, and other resources
- Protecting occupant health and improving employee productivity
- Reducing waste, pollution and environmental degradation (ibid.)

There are multiple green construction practices, forms and technologies that differ from region to region and that are constantly evolving. However, Green Construction often emphasizes taking advantage of renewable resources such as using sunlight through solar panels or using trees through green roofs. No matter how technologies and practices are combined, the core essence of Green Construction is an optimization of one or more of the following key principles: Siting and Structure Design Efficiency, Energy Efficiency, Water Efficiency, Materials Efficiency, Indoor Environmental Quality Enhancement, Operations and Maintenance Optimization and Waste and Toxics Reduction. For example, green buildings may incorporate sustainable materials in their construction (e.g. reused, recycled-content, or made from renewable resources); create healthy indoor environments with minimal pollutants (e.g. reduced product emissions); and/or feature landscaping that reduces water usage, e.g. by using native plants that survive without extra watering (ibid.).

Several countries have taken measures to formalize the sector by creating national definitions and codes.For example, in 1990 the Building Research Establishment in the UK introduced the Building Research Establishment Environmental Assessment Method (BREEAM) and several years later, the United States Green Building Council launched its LEED (Leadership in Energy and Environmental Design) system.

1.1.2 Greening Elements in theConstruction Sector

In the design phase:

- Orienting buildings towards the sun and main wind direction
- Constructing wind catchers
- Optimizing the materials consumption (sizes of concrete/metal structure, steel, aluminum, glass, etc) to economize in material

- Consider the use of recyclable materials as much as it is possible.
- Plan for optimum management and maneuverability in the work site.

In the construction phase:

- Using construction equipments in an energy-efficient way
- Minimizing the amount of construction materials used by efficient utilization and consumption.
- Using metal scaffoldings rather than wood scaffoldings when more efficient.
- Organizing work for minimum conflict between different work groups, (plumbers, electricians, brick layers, concrete formers, equipment drivers, etc).
- Watching for the easy and flexible mobility in site.

In the operation phase:

- Domestic re-using of grey water (e.g. for toilet flushing, plants watering, etc)
- Domestic re-using of bio solid waste (e.g. for biogas generation)
- Using double- or triple-glaze for windows to reduce heat radiation (this may result in the use more material but reduces energy consumption on the long-term)
- Utilizing nature day light rather than electricity.
- Minimize the use of electricity in heating (water heating, cooking, clothes ironing),
- Utilizing solar energy (especially in water heating, and producing electricity via photo voltaic techniques), and wind energy if possible to save network electricity consumption.
- Use of efficient lighting bulbs and florescent lamps.
- Grow plants as much as it is possible to reduce CO_2 and help in reducing the green house effect.
- Optimizing the use of energy in heating and air conditioning by implementing optimum energy management plans.

1.2 Background on Green Construction in Egypt

The Green Construction sector in Egypt is a very nascent one, and the concept itself has only been recently introduced in the country, but some efforts have been made to formalize its adaptation into the Egyptian context.

One such step in this direction is the establishment of the Egyptian Green Building Council in 2009. This council is meant to coordinate all activities in the country related to green construction, and is chaired by the Minister of Housing, Utilities and Urban Development. The

vice chairman is the chairman of the Housing and Building Research Centre (HBRC), and its members represent the following entities:

- Ministry of State for Environment
- Ministry of Electricity and Energy
- Ministry of Water Resources and Irrigation
- Ministry of Agricultural and Land Reclamation
- Ministry of Trade and Industry
- Ministry of Petroleum
- Ministry of Health and Population
- Ministry of High Education and Scientific Research
- Relevant civil society organizations (represented by 6 members)

The Council describes the operational goals of greenconstruction as follows:

- Efficient, effective and sustainable site location (including transport needs);
- Efficient, effective and sustainable design of structure, façade and fenestration;
- Efficient, effective and sustainable use of water, energy, and materials;
- Efficient, effective and sustainable operation and maintenance;
- Efficient, effective and sustainable indoor environmental quality;
- Reduction of waste, pollution, embodied energy and carbon emissions.

One of the activities of the council has been to establish a unified system for the assessment and rating of buildings in Egypt entitled the“Green Pyramid Rating System” (GPRS). The GPRS aims to:

- Provide a benchmark for good practice that enables buildings in Egypt to be assessed for their green credentials through a credible, challenging and transparent environmental rating system;
- Enable building designers, constructors and developers to make reasoned choices based upon the environmental impact of their decisions;
- Stimulate awareness of, and demand for sustainable construction;
- Allow informed dialogue with interested parties and contribute to wider debate on green construction in Egypt during the coming years;
- Encourage the design and construction of sustainable buildings, and contribute significantly to a better, more sustainable building stock for the Nation.

The system attempts to achieve the above aims through producing a set of rating criteriathat enforces standard regulations at the national level, raising national awareness about the issue of environmental-friendliness and the need for green construction, and promoting innovative solutions that minimize the environmental impact of the construction sector.Through providing this system and set of criteria, the GPRS assists designers and constructors in minimizing their environmental footprint.

The GPRS is designed to be used for new buildings at both the design and post-construction stages. The system consists of several categories/criteria, each of which is given a specific weight. The combined weight of these criteria enables the system to rate the building being assessed in terms of its complicity with the green construction mode. The criteria and their weights are as follows:

Green Pyramid Category	Weighting
Sustainable Site, Accessibility, Ecology	15%
Energy Efficiency	25%
Water Efficiency	30%
Materials and Resources	10%
Indoor Environmental Quality	10%
Management	10%
Innovation and Added Value	Bonus

Each category plays a particular role within the system through specific objectives, outlined below.

The *Sustainable Site, Accessibility, Ecology* category has the following objectives:

- Site Selection: Encourage development in desert areas, redevelopment in informal areas and avoid projects which negatively affect archaeological, historical and protected areas.
- Accessibility: Minimize pollution and traffic congestion from car use and to conserve non-renewable energy by encouraging public and alternative transport.
- Ecological balance: Minimize the environmental impact of the project on the site and its surroundings, to protect existing natural systems, such as fauna and flora (including wildlife corridors and seasonal uses), soil, hydrology and groundwater from damage and to promote biodiversity.

The *Energy Efficiency* category has the following objectives:

- Reduce energy consumption and carbon emissions by incorporating passive design strategies;
- Optimize the choice of electrical and mechanical equipment, to evaluate the inventory of energy and carbon for each developed MEP system, and to minimize their impact on the environment;
- Reduce energy demand to cater for loads at peak use times through efficient building and services design and site based, where possible, on renewable energy generation;
- Encourage the provision of metering facilities that allow the energy performance of the building to be recorded and monitored to allow future improvement and prove validity;
- Minimize the energy consumed by the commonly used building appliances.

The *Water Efficiency* categoryhas the following objectives:

- Help professionals across the country to improve the quality of buildings and their impact on the environment;

- Develop and implement a comprehensive water strategy
- Minimize indoor and outdoor water demands
- Reduce potable water use.
- Reduce potable water use by promoting the use of reused grey water or avoiding the use of potable clean water, where possible;
- Ensure water-efficient landscaping
- Minimize potable use for irrigation
- Reduce generation of wastewater

The *Materials and Resources* category has the following objectives:

Encourage selection of materials with a low environmental impact and cost over the full life cycle of the building, particularly:

- Regional and local materials (to reduce the environmental impacts resulting from transportation);
- Renewable materials;
- Recycled materials;
- Highly efficient materials (to reduce the need for maintenance, construction energy or skill or can be easily dismantled for reuse).
- Re-use of previously used materials and avoidance of wastage.

The *Indoor Environmental Quality* category has the following objectives:

- Provide a building and its systems that support the wellbeing and comfort of occupants by providing sufficient outside air ventilation and indoor air quality;
- Eliminate exposure of building occupants to the harmful effects of tobacco smoke, the risk of Legionella and other pathogens;
- Encourage use of low-emission adhesives, sealants, paints, coatings, flooring and ceiling systems and to mitigate the health risks associated with formaldehyde in building products;
- Promote thermal, visual and acoustic comfort of occupants (including provision of individual comfort controls, where appropriate) to optimize occupant wellbeing, productivity, energy efficiency and future flexibility;

The *Management* categoryhas the following objectives:

- Site Provision: Encourage development in desert areas, redevelopment in informal areas and avoid projects which negatively affect archaeological, historical and protected areas.
- Site Environmental: Minimize the environmental impacts associated with construction operations.
- Building User Guide: Ensure that the building will be operated responsibly and maintained properly by providing a Building User Guide and Periodic Maintenance schedule.

The *Innovation and Added Value* categoryhas the following objectives:

- Cultural heritage: Create designs which excel in reflecting national and regional cultural heritage while contributing to the environmental performance of the building.

- Exceeding Benchmarks: Promote initiatives which demonstrate additional environmental benefit by exceeding the current benchmarks of GPRS.
- Innovation: Encourage initiatives and construction practice which have a significant measurable environmental benefit and which are not otherwise awarded points by GPRS.

Buildings that would like to be certified according to the GPRS can achieve a rating of "Green Pyramid", "Golden Pyramid", or "Silver Pyramid" according to the number of criteria they fulfill, with Green being the highest score.

Another step towards increased formalization of the sector is a MoU that was signed between the Egyptian Ministry of Housing Utilities and Urban Communities and the American International Code Council to develop a national training program for licensed technical inspectors.

2. Preliminary Field Work Findings

2.1 Sector Size and Growth Trends

When addressing the activities of the Green Constructionsector in Egypt we have to distinguish between two levels:

A- Constructing a *green building* in accordance with the GPRS.

B- Using *green components*, i.e. environmentally-friendly materials in one or more of the construction stages.

2.1.1 Green Buildings

The study reflects almost a complete absence regarding the construction of green buildings at the commercial level. Green construction is currently restricted to experimental level and is very limited in scope. The most important examples of such initiatives are:

- HSBC Bank Egypt Global Service Center:The building is located inGiza's Smart Village and is one of the first buildings in Africa to be LEED certified.
- Egyptian Museum Store:The 5000 square foot building is located in the area of New Cairo and incorporates several green-building components such as shaded windows and stone surfaces.
- The Eco-Villages National Project: Currently still in proposal form, the recently approved project will be designed and planned by the HBRC, andconstructed in an area in southern Cairo.
- PLEV: Egypt's first Productive, Low-Cost, Environmentally-Friendly Village (PLEV) is a pilot project currently being implemented by the HBRC in Fayoum.

2.1.2 Utilizing Green Components

This pattern is more widespread and is witnessing the more growth – albeit at a limited rate. Despite of the different sub-types that can be classified under this pattern (i.e. different construction components that can be classified as green), there is a lack of quantitative data

about the size of each sub-sector. Based on the estimations of key persons interviewed, the most important green components – whether in terms of materials used or the building process itself – are:

- Implementing environmental management systems(particularly ISO 14001:2004)by some construction companies to reduce environmentally-harmful emissions.
- Raising the energy consumption efficiency during the construction process and the transportation process (for example, some companies are beginning to hire or train Energy Managers).
- Using eco-friendly paints.
- Using reflective glass in building interfaces. This sector that has witnessed significant growth which can be inferred from the growth in employment, size, and scope of companies that produce reflective glass.
- Using sound-insulating glass.
- Isolating walls and ceilings.
- Constructing the building so that residents can maximize their dependence on natural lighting.
- Using building materials which can be recycled.
- Applying air-conditions systems which rely on pumping cold air.

2.2 Key Sector Obstacles

The most important obstacles facing the growth of the sectorcan be summarized as follows:

- The low level of the environmental awareness in general and the low priority of decision making in the environmental issues
- Low awareness and knowledge about the green architecture in particular and consider talking about it well-being even from most of the professionals.
- The state don't provide any incentives to promote the dissemination of the green building
- Lack of sufficient scientific studies about the green building in the Egyptian context
- High investment cost of the green facilities
- Lack of the companies specialized in the green building
- Lack of engineering cadres in the field of green architecture although some of them have capabilities in the field of green facilities design
- Lack of the legislations related to the green building components
- Lack of the trained labors in the green building field.

2.3 Technical Labor

2.3.1 Skilled Labor Availability

According to the interviewed key persons, in general the need of the technical staff in the green construction sector is restricted primarily to the engineers and consultants both in the planning

and implementation stages.There are not really special skills required for the green construction technical labor that differs from regular non-green construction, as the steps performed are more or less equal in both cases.

However, this does not mean that the labor does not represent a problem for the sector (whether in terms of constructing a green building or utilizing green components). Rather, the sector faces many difficulties in finding skilled labor that have the necessary basics, especially in terms of consistency and quality control. Companies that "produce" green construction – whether buildings or components – often have to train their own labor on such basics, and the labor they train often don't last for a long and soon leaves the company in search for other work. This represents a persistent burden for such companies,and impedes their production and raises their costs. Technical labor also represents an obstacle in the sector of production and installation of reflective glass, both in terms of finding workers able to work with such materials, and thelevel of skills that such workers have.

The officials believe that the green building sector labor needs three types of qualifications to fill the abovementioned gaps:

*Rehabilitation of personal skills (Soft Skills)*as the technical labor don't have the basic soft skillsnecessary to perform the work, regardless of the sub-sector or material being used.

*Rehabilitation of occupation-based technical skills*such as plumbing, carpentry, and building and utilizing glass.These occupations in general are not necessarily "green", but they are no less important to the green construction sector. Producing and installing glass interfaces and walls has a special importance as it can be considered the most common and widespread green component in Egypt. In this field, there is a lack in the necessary skills, as well as a difficulty in finding the required labor, since there is no specialization within technical education curricula geared towards producing "glass-operating technicians" for example. Overall, this field depends to a large degree on a number of occupations that have no specializations within the technical education curricula, and thus companies are forced to depend on any technical school graduate. Such occupations are include:

- Glass cutting technician
- Punching and dismantling glass windows
- Washing technician
- Polishing technician
- Oven-operating technician
- Installations technician
- Double glass technician
- Triplex technician (double glass with an extra layer)

*Rehabilitation of environmental awareness*as the labor don't have enough environmental awareness whether in general or specifically regarding green building and architecture. There are some limited efforts to help workers learn more about the environmental dimensions of the production process, or to train them to conduct eco-friendly performance although this is usually done in the frame of the rationalization of the consumption of the building cost without understanding the environmental dimensions (such as energy saving behaviors).

2.3.2 Importance of Technical Education

Regarding technical education, companies that work in the manufacturing and installation of glass interfaces and walls expressed the strongest need for specialized training related to their sector. In the current curricula, there are no specializations that directly serve this sector, and so most of the technical workers are graduates of technical school, technical secondary school, or the Institute of Technology (there is a preference for the German school Galal Fahmy, Abassaya Technical secondary school, and Zin Al Abdeen Mechanical Secondary School).

The interviewed companiesbelieve that a worker that has graduated from a technical school is always better than one from a regular school or non-technical school,especially in the following:

- Quality control in general
- Understanding the technical terms
- Accepting the new technologies
- Easy learning and absorbing of the technical information
- Level of precision especially in the measurements
- Sensitivity in dealing with machines
- Distinguishing between materials
- Sensitivity to the final product and its quality
- Knowledge of the English words used in the sector
- Ensuring the occupational safety
- Understanding engineering drawings

2.3.3 Preliminary Recommendations

Establishing new technical education specializations:The proposed specialization in the Green Construction sector is **"Glass Operation Technician"** as the sector is growing increasingly and there aren't technicians able to perform the required tasks without an efficient training,andlabor represents a significant obstacle to the growth of this sub-sector.

Adding new courseswithin the current specializations: It is proposed to add the following courses:

Personal skills development and this includes:

- Systematic thinking and planning skills
- Adaptation of innovative working systems and new technologies
- Work ethics, commitments to the instructions, times and attention to precision and proficiency
- Problem-solving skills
- Communication and team work skills

Environmental awareness and this includes:

- Basic information about the environment and its related problems
- The concept of green production and its importance to save the environment
- The concept of the green building and its importance to save the environment
- Rationalization of energy consumption
- Practical training of the eco-friendly production behavior