

STANDARDS FOR THE USE OF SUSTAINABLE GREEN FINISHING MATERIALS AND THEIR IMPACT ON INTERNAL SPACES FROM ECONOMIC, SOCIAL AND ENVIRONMENTAL POINT OF VIEW

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Abstract:

Although Environmentally Sustainable Interior Design (ESID) became the main issue in practicing interior design, there is still a large number of architects and interior design engineers who are still unaware of the importance of sustainable options in the real practice and realistic implementation of existing projects. This is could be observed in many projects. , especially when choosing sustainable building and finishing materials, The present research paper deals with developing a comprehensive understanding of what constitutes as a sustainable option for building materials and finishing and hence carrying a study on some of the current green and sustainable products to practice sustainable interior design. It confirmed how it is difficult to find a source of information on building material and finishing that makes the process of the interior design of integrated elements. The present study also tries to improve access to the basic concept of sustainable residential spaces, as well as updated information on sustainable building and finishing material, this is with the aim that the research can play a critical role in promoting sustainable practice in choosing building material and finishing of internal spaces. The study could also propose methodology that depends on the evaluation of sustainable materials used in building and finishing space in residential buildings and their selection criteria to achieve integration between environmental, economic and social aspects. The “descriptive and comparative analytical approach” was used through analyzing the most important international and Arabic systems in auditing the sustainable buildings, and study of evaluation criteria of every system with digging deeper in studying the points related to standard materials and resources. In addition to analyzing environmental, economic and social aspects related to the choosing of a suitable building and finishing material and then access to the proposed model to measure how sustainable is the building and fishing materials used in projects under study. Then through this model, we can reach an “analytical approach “that is specializes in analytical studies of international and local experiments, and clarify how to use sustainable finishing materials in the different buildings understudy, and measure the extent of achievement of the used material of different sustainability standards in both local and international model buildings., by using proposed model of measurements. In the end, it could benefit from it to lay down strategies and policies for the selection of finishing materials in Egypt

Key Words: Sustainable design – sustainable green material – sustainable interior design

1. Introduction:

Interior design profession is always known with a traditional meaning that means One-dimensional practice only aims to provide aesthetic improvements to interior spaces according to client’s requirements this resulted in narrowing of designer’s job and make it limited only in focusing on the latest findings in the contemporary interior design field, and how to design small luxurious environments. this made it an approach that ignores the importance of saving energy and the reduction of harmful emissions, and lack of full awareness of the harmful effects on the health of users either mentally or physically Most of the pollutants suspended in the air

of the internal spaces are carcinogens, and irritants to the respiratory system and the percentage of these air pollutants found in the internal spaces reaches levels above 2 to 10 times their levels in the outdoor spaces. It can also reach 1000 times higher in the internal closed spaces which are recently built or renovated.

These pollutant levels reach their peak values in the internal spaces at homes, but in the internal spaces of the offices their percentage goes down to a range from 2% -38%, And this according to a report issued by Green guard Environmental Institute, but in recent years interior design practices have undergone a fundamental transformation with the appearance of environmental design strategies that concentrate on providing healthy and sustainable environments to the space users to be suitable for living and work, especially that people spend about 85-90% of their time inside these architecture spaces. And this concern with environmental responsibility has raised the context and need for environmentally sustainable interior design (ESID), and this means that it depends on sustainable concepts and mutual strategies for the built environment as whole, And to provide healthy indoor environments for individuals physiologically and psychologically in the internal spaces. This Research paper will focus on studying the effects of the used finishing material in internal spaces from the point of view above mentioned various aspects to realize sustainability, the effects of these materials on environmental levels and resources are to be studied when evaluating each material at every stage of the manufacturing process, the resources it consumes, the resulting waste and the amount of energy consumed. Also, design building materials that don't need a large quantity of water or power to be manufactured should have priority.

The present study will also focus on the benefiting from renewable energy, the importance of reducing wastes from manufacturing, reduce damaging of current energy resources and to encourage the recycling and reuse of these materials, as for the impact of materials on the social level, the importance of the evaluation of the companies responsible for selling and marketing construction and finishing products, comes first. This will be in addition, taking account of the health of the users of those products and the suitability of the type of used finishing material to activities performed in the internal space, this will lead to the evaluation of the effect of the materials on the economic level as it appears here the importance of studying the evaluation of the life cost (LCC) of finishing material and the possibility of being recycled, the efficiency of using local material and encourage their consumption.

All of the above mentioned will help to avoid most of the possible effects of finishing material and to reach optimal use within internal spaces and monitor most of the materials available on the market in accordance with the previous requirements, which results achieving the goal of the present study.

2. Research problem :

Despite the continuous efforts of the state and international and local companies in manufacturing sustainable and environmentally friendly building and finishing materials, there are still deficiencies in the selection of these materials and how to use them in architectural spaces in general. This is in addition to not taking into account the consequences of choosing

traditional building and finishing materials, and the extent of their impact on the health of occupants of the architectural space. This because the process of choosing finishing material from the majority point of view is just choosing colours, raw materials, and harmonious materials according to a general sense, This in addition to the unawareness of the importance and how dangerous is these materials that can affect our daily life in a direct way. Not this only but a large number of finishing materials is available at markets in communities of developing and developed countries, but despite these materials are used on the widest range inside or outside Egypt, all of these materials or most of it has negative the environmental, societal and economical negative effects. No attention is paid to these effects despite the severity of these effects particularly on the environment and human health.

3. Research goal:

The research aims to check a set of foundations and requirements for the selection of building materials and sustainable finishing in the interior spaces of the buildings, through which the concept of sustainability of the building can be achieved and its impact on various environmental, economic and social dimensions.

4. Types of interior spaces:

The internal spaces are of great importance, as we spend most of our time in architectural spaces that are designed. Some architectural schools divide architectural spaces into two main sections: residential spaces, non-residential and non-residential spaces or commercial spaces. Despite the multiplicity of architectural spaces that designers deal with, we will find that all of these spaces with their multiplicity and different functions will fall according to the previous classification of spaces (whether residential or non-residential spaces). Residential spaces are all environments intended to live or stay in for periods. But Non-residential spaces are all business-, enterprise or corporate environments, both for public and private purposes, and the figure (1) is shown emphasizes the importance of the importance of internal spaces for the people .

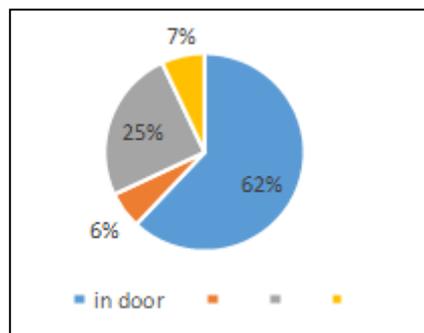


Figure (1) Shows user presence ratios within spaces

Source: Penny Bonda & Katie Sosnowchik, Sustainable Commercial Interiors, Second Edition, John Wiley & Sons, New Jersey, 2014, p 203

5. The most important materials used in different internal spaces and their seriousness :

Interior finishes are the process of removing walls, floors, ceilings, and other surfaces within a space, which is determined by choosing the type of material applied and its treatment. The interior finishes are very important for buildings because they are the visible surface of all parts of the void And the choice of the appropriate finishing materials for the vacuum is determined by several factors, the most important of which is the cost, the influence of architectural coordination, resistance to moisture, fire or sound, the lifetime of the material, and the resistance of the material to abrasion, In addition to that the finishes are highly influenced by personal choice, professional experience and technical taste of the finishing materials and building type, With the multiplicity of those previous determinants in choosing interior finishing materials, the most important factors that affect the vacuum are neglected. Where the interior finishing materials must be chosen based on several additional factors, such as taking into account the health and environmental impact of these materials. All research has confirmed that some of those materials used in finishing the various voids have a great relationship to the pollution of the internal space and the appearance of some health damages to the users of those spaces.

This is in addition to wasting natural resources and a lack of interest in studying the life cycle analysis of each subject. (1).

6. The most important harmful chemical compounds involved in the manufacture of some finishing materials used in internal space as shown in table (1).

Table (1) shows the finishing materials that produce harmful emissions, by the researcher

Finishing material	Harmful compounds found in finishing materials	Pollutants				
		Asbestos	Rn	Pb	Formaldehyde	VOCs
paints	Chemical compounds found in different types of paint			√	√	√
PVC flooring	PVC COMPOSITE				√	√
Floor tiles	Vinyl compounds	√	√			√
Wallpaper,	Harmful additives				√	√
stones	Granite and marble	√	√			
wood	Harmful emissions				√	√
Fire-resistant materials	Harmful flame retardants	√			√	√
Carpet	Dyes and flame retardants					√

7. Sustainable architecture:

Architect William McDonough defined **sustainable architecture** as a set of principles, including respect for the relationship between the building and the surrounding environment, the creation of design solutions based on technology and the environment, as well as the recruitment of sources Natural energy and removal of construction waste.(3) Architect **Charles Kebert** has defined **sustainable architecture** as a set of principles to achieve its goals of establishing and operating healthy building buildings Healthy Built Environment, where sustainable architecture depends on the rationalization of energy, water, construction resources, and other resources(4). Therefore, sustainable interior design is defined as the interior design in which all systems and materials are designed with a focus on integration in its entirety with the aim of minimizing the negative impacts on the environment and occupants and maximizing the positive impacts on environmental, economic and social systems over the course of the life cycle of the building. (Energy, water, construction resources, and other resources)

7.1 Sustainable interior design standards

The trend towards sustainable interior design refers to achieving quality standards, sustainability principles and strategies, high levels of efficiency in the use of energy and water sources, appropriate land use, site coordination and the use of compatible building materials Environmental to achieve the quality of the indoor environment and water efficiency and reduce the impact of the building during its life cycle and solid waste management. Sustainable interior design standards can be stated as shown in figure (2).



Figure (2) Sustainable interior design standards, by the researcher

7.2 Sustainable Building rating Systems:

Is a methodology aimed at achieving a building assessment tool within the framework of the most important determinants affecting the performance of the building: energy, water, carbon emissions, transport and health of individuals? It is a good tool for achieving more comfortable buildings for individuals and more energy efficient by reducing negative environmental impact, relying on sustainable building materials and recycling materials, as well as relying on renewable energy. Different major global systems have been selected and studied in terms of

the method and determinants of evaluation and analysis of the material and resource component in each system, in addition to the study of 3 systems from the Arab world, as shown in figure (3):



Figure (3) international Sustainable Building Rating Systems, by the researcher

7.3 The weight ratio of the material and resource standard in international and Arab rating systems:

When a comparison was made between the different systems, it became clear that THE PRS was the first sustainable building assessment system to have the highest weight ratio of materials and resources by 18%, followed by IGBC by 16%. LEED ranks fifth with a weight ratio of 13% materials and resources. The Egyptian Green Pyramid Assessment System has only 10 % of the material element. Some systems have allocated a separate complete evaluation system to assess sustainable internal spaces where it also includes the internal material component. There is no system in the Arab world yet for assessing sustainable internal spaces, and these systems are: **BREEAM- LEED- Green Star - Green Globes- IGBC**

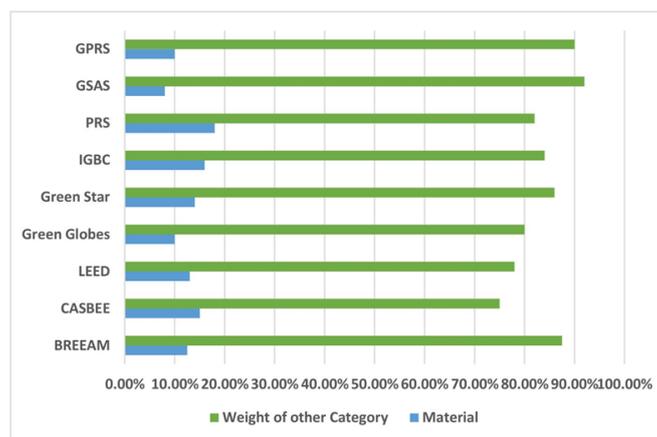


Figure (4) comparison between international rating system in material and resource component

8. Sustainable finishing materials and evaluation criteria:

The concept of sustainable building and finishing materials is those that use natural resources from the earth but in a responsible environmental way while respecting the environment and ecosystems, and away from non-renewable resources such as coal and minerals. These are recycled materials, energy and water efficient, environmentally friendly and respectful of the resource life cycle. (5)

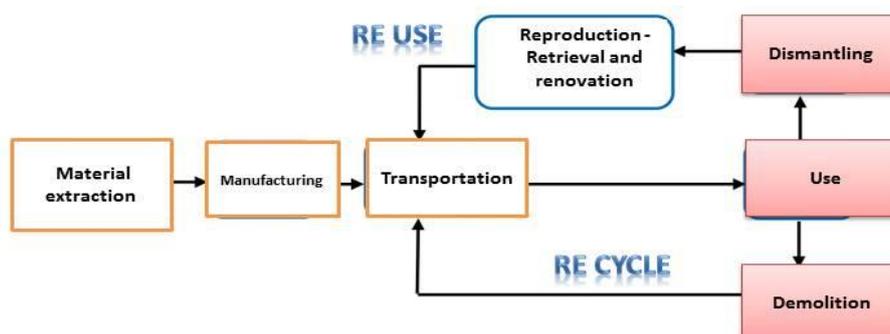


Figure (5) sustainable finishing material life cycle

Source: Bill Addis, Building with Reclaimed Components and Material, Earths can, UK, 2006, p13

8.1 Criteria for the selection of sustainable finishing materials figure (6):

Efficiency standards	Quality of the interior environment	Resource efficiency
<ul style="list-style-type: none"> • Materials vortex • Energy efficiency • Water efficiency • Recyclability • Recyclability • Biodegradability 	<ul style="list-style-type: none"> • Reducing construction residues • Use of local materials • Toxicity • renewable energy sources 	<ul style="list-style-type: none"> • Waste Reduction • Pollution Prevention • Integrated Energy • Ingredient Recycling • Natural Material

Figure (6) Criteria for the selection of sustainable finishing

Source: Ross Spiegel & Dru Meadows, Green Building Materials: a guide to product selection and specifications, New Jersey, JOHN WILEY & SONS, 2012, p27

8.2 Analysis of the economic, environmental and social aspects of finishing material:

Sustainable green materials are those that are employed in projects to achieve three main advantages, environmental, social and economic. As local and natural as possible, their use does not adversely affect health, is not toxic, renewable, durable, and recyclable and used, low-energy, low-cost, and cost-effective. The sustainability of materials is assessed in three key

areas that must be adhered to achieve sustainability: the environmental dimension, the social dimension, and the economic dimension

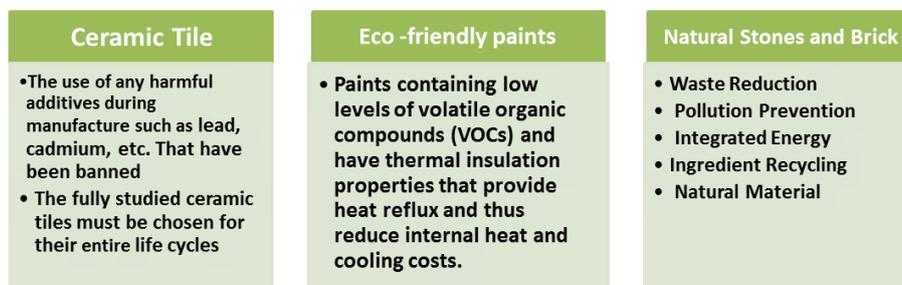


Figure (7) sustainable finishing treatments

Source: Annette K. Stelmack, sustainable residential interiors, SECOND EDITION, John Wiley & Sons, Hoboken, New Jersey. 2014. P327

9. Applied Studies Methodology:

This section reviews the components of the methodology used in the analytical study, and begins by identifying the objectives of the study by analyzing models of global and local projects that adopt a sustainable environmental trend and through these objectives the descriptive methodology proposed in the analytical study is formulated, By identifying the tools used in collecting information, determining the scope of the study by setting a set of criteria to be met when selecting residential projects in place of the head, and identifying the samples of the head, followed by the analysis of the sample of the study and measuring the sustainability of the materials used in the sample of the course using the table Proposal for measurement to reach the results of the analytical study figure (8).

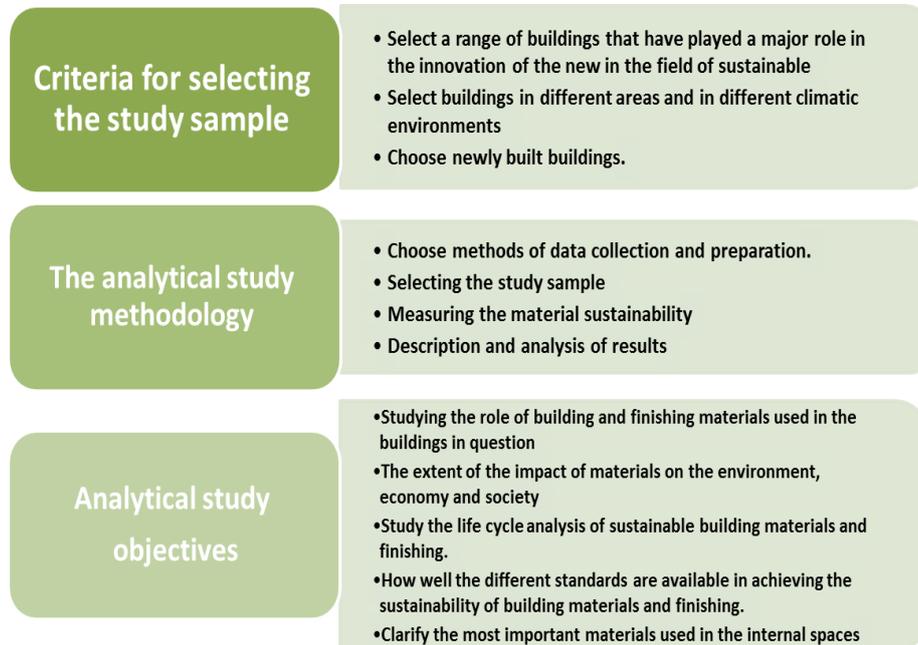


Figure (8) Studies Methodology by researcher

9.1 Case study:

The case study (4 building) were chosen by the previous criteria and what achieves the objectives of the study, and they are as shown per the table (2)

Table (2) case study introduction & analysis by researcher

Project Name	EcoVilla الفيلا المستدامة	Neil Road Home منزل	Citriodora House منزل	Hover House منزل
Introduction	It is a pilot project equipped with energy and water-saving technologies, and an Emirati family will move to test the experience of living in this typical sustainable housing	This home emphasizes preserving the heritage and identity of the ancestral homes while adding some modern changes to suit the current living requirements. It was revitalized by ONG * ONG Pte Limited in 2013	This house Designed for vacation, this home is set amidst trees that smell lovely lemon and near the famous Great Ocean Road.	It is the third home in the Glen Irani Architects 'Hoover House' series. This series focuses on maximizing outdoor living, making the most of daylight and building connectivity with nature and exterior location
A picture of the project				

Sustainability Standards	Furniture	Architectural vacuum determinants		
		Ceiling	Flooring	Walls
Aspects of sustainability The environmental aspect	Hover House	Environment	good	
		Social	Very good	
		Economic	good	
	Citriodora House	Environment	very good	
		Social	very good	
		Economic	very good	
	Nile House	Environment	good	
		Social	very good	
		Economic	very good	
Eco villa	Environment	good		
	Social	very good		
	Economic	good		

9.2 Analysis of the study sample

The buildings under study are analyzed by studying a set of elements that achieve the objectives of the research, which include architectural design, energy, and environment, interior design, materials used in construction, finishing and furniture, an end by measuring the sustainability of the materials used in finishing the internal spaces.

The result of the research study:

From the result of the previous analytical study, both the Neil Roadhouse and the Citriodura house obtained the highest evaluation rate in measuring the sustainability of building and finishing materials used in terms of the economic dimension, as all of these projects took into account the use of locally sourced materials whenever possible.

10. Conclusion

- -The field of sustainable architecture is one of the vital areas that concern everyone and in all environments. It is necessary to increase social awareness of the concept of sustainability and education with the advantages of using building materials and sustainable finishing in internal spaces
- -increasing interest in the interior spaces of different buildings, and focusing on the use of sustainable and suitable building and finishing materials suitable for the local environment in Egypt
- -Working to increase information and depth in analyzing the social and economic dimension of building and finishing materials used in any project
- -including the idea of sustainable spaces in the curricula of architecture education, to create a new generation of designers fully aware of the importance of designing internal spaces that are not harmful to humans or the environment.
- -Encouraging the architects of all their customers to use and purchase sustainable building and finishing materials, changing the idea of the high economic cost of these materials, and raising awareness of the extent of the benefits of using those materials, whether in the short or long term.
- -Lack of awareness among users of the importance of choosing sustainable building and finishing materials, and the spread of the idea of the high economic cost of sustainable materials, in addition to the lack of availability and spread in the local market.

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