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(Innovation – Design – Production – Competiveness)

### Innovation in The Design of Lightweight Units as a Way to Solve Interior Design Problems

**Paper's Theme : Design Innovation “ Application of Creative Techniques in Design and Production “**

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#### **Abstract**

*Through the life cycle of any building many developments and changes take place for example economical, social, technological, psychological changes. in addition to the building's needs and the expectations of its users leading us to an advanced distinguished architectural solutions .*

*Most of these solutions are carried out by extending and adding spaces in different ways. so that the original space fulfills the requirements and needs of its users . These added extensions can be as simple as a light structural as forming a “tent” or it can be as sort of adding block equivalent to the original building or maybe exceeding it in size.*

*In this paper the lightweight units , types and standards has been studied as a sort of permanent or temporary extension .*

*Moreover a set of design problems has been monitored which can be solved by using lightweight units. Through studying different types of extensions as adding extensions to historical building and the impact of the addition on its architectural style.*

*The idea of the integration between the original building and the added units is a must to make sure that the building will be able to fulfill the user's needs, moreover the link between lightweight unit's interior design and exterior is extremely necessary, as we can't solve the interior design problems without taking into consideration the architectural envelope. Flexibility in design was discussed as one of the most important lightweight unit's design standard.*

*Also Digital design and fabrication is a main aspect of the study as forms are influenced by digital technologies through the design , fabrication process and material studies , where the Digital methodology helps to enhance generative and per*



*formative processes. It creates forms, that were impossible to be generated or fabricated before.*

**Keywords :** Lightweight units , Extensions , Digital fabrication , Innovation , CAD, CAM ,CNC , historical building .

## **1. Introduction**

Interior architecture has been always aiming to find the best solutions for the social and environmental problems whether it was physical problems or psychological ones.

Moreover, it tries to introduce interior spaces appropriate with the functional needs, and corresponding to the contemporary technical development

As a result, many attempts have emerged since ancient times to overcome a number of problems such as limited interior spaces.

Where the architectural spaces suffer from fixed dimensions and lack of flexibility in addition to facing the increase in the functional and physical requirements of spaces' occupants (users). Therefore , lightweight structures have appeared , either in a horizontal, vertical or both extensions or independently whether that was permanently or temporarily .

Throughout the study, the most important design problems concerning the interior spaces have been addressed, for instance, limited interior spaces, in addition to increasing the number of space users as in the residential spaces. Moreover the need for increasing the activities pursued inside the space.

Many historical places have lost their identity because of unstudied random extensions with regard to its matching with the surrounding style. Also the omission of the lightweight structures' role in solving the particular design problems

Consequently the research has discussed a number of addition methods for an extension through lightweight structures, in addition to studying sorts and forms of extensions and flexibility principles, as one of its main features represents its capacity for movement, mobility, jaw and installation

## **2. Research's problem :-**

The research addresses some design problems facing a set of interior spaces

1. Tight interior spaces as a result of several factors comprising the increase for the number of space's occupants as in residential and educational spaces. In addition to the excess need for adding new activities in these tight spaces.

2. Some institutions resort to exploit a group of historical buildings and convert them into services ones (such as real estate offices, banks, schools, .etc)



As a result, a set of random changes arise such as adding extensions with total ignorance for the historical value of the building, which causes a conversion for these buildings from being a source of national income into neglected ones as a result of adding random extensions which use to create additional spaces without taking in consideration the historical and cultural building's value.

3. Omission for principles and standards of inflicting lightweight structures as an extension or addition to a building.

#### **4. Research's Objectives**

The research aims to find a set of design's principles concerning the addition of a lightweight structure for a building with a view to have an extension in order to overcome a set of design problems that is previously mentioned within the research problem.

The research also seeks to highlight the importance of preserving historical buildings, in addition to studying the standards for adding lightweight structures that preserves the building's identity and adding new functions for its interior space.

#### **5. Research's axis**

**This paper include four main points :-**

1. Studying and classifying the lightweight structures with regard to its historical background, its standards and design principles
2. Defining the diverse types of extensions attached to any architectural space, whether inside or outside the building. Also studying the effect of these extensions on historical buildings even in a positive or a negative manner. In addition to mentioning the different addition strategies for historical buildings
3. Studying the innovation in the design and constructional phases for lightweight structures through using digital fabrication techniques
4. An applied study for an extension added to the Faculty of Fine Arts, Alexandria University ( Tosson basha palace) in addition to designing a new proposal instead of the current one.

#### **5. Methodology**

The research's methodology is based on an analytical approach investigating diverse design problems which can be solved through using light weight structures

This paper will discuss the different types of architecture extensions and their physical and psychological influence on the building and its occupants.





The researchers worked on a case study( Faculty of Fine Arts – Alexandria University- Tossou Basha Palace) to design a lightweight structure proposal as an extension unit instead of the current chaotic extension the already exists .

## 6. Conclusion

1. Through the life time of most building changes occur due to variant occupational circumstances which will eventually lead to the need of additional spaces (extensions).
2. When adding an extension to an existing building we should take into consideration the function, form and design of both structures.
3. The classification of lightweight structures depends on several criteria depending on the type of structure and the way of connection.
4. In case of adding extensions to historic or listed buildings we should put into consideration the value of the building and the surrounded environment.
5. Diverse strategies are used when making lightweight extensions to historical building, either same style or total contrast.
6. Digitally fabricated architecture can be created using variety of computer programs.
7. Digital fabrication technology provides realistic opportunities to build creative and complex designs .

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