BUILDING TECHNOLOGY
A METHODOLOGY OF MEASURING AND IMPROVING THE ECONOMICAL EFFICIENCY OF LOW COST HOUSING CONSTRUCTION IN EGYPT

1- Introduction:
The need to use technology (with its materialistic and spiritual contents) was parallel to the development happening in all scientific fields as a tool to solve its problems especially in the building and construction field in Egypt, as we can benefit these traditional and modern systems using them, the most suitable circumstances of these projects specially in the presence of a group of factors which dedicate the necessity of interference such as:

1- The rapid increase in population all through the past years reached 68.64,47 million. Parallel with the increase of low incomers together with the increase in poverty level reached 30.9% (the U.N. report).

2- Now cities were constructed to help in solving housing problems of low income groups (the occupancy 25.4% of the total built units) due to social reasons like decrease of general services and infra-structure and economical reasons like the unsuitable unit prices compared with the monthly income of users. Nevertheless the need of providing a suitable house to fulfillment the environmental and social and economical needs of the low incomes (who are the main aim of these projects) together with improving the unit efficiency using an evaluating measurement to all constants and the economical efficiency using a methodology to measure the economical efficiency to construct the low income housing projects and to determine the reasons for the increase or decrease also improving the economical efficiency through solving the decrease reasons of economical efficiency.

2- The approach:- 
The building technology concentrates on solving low income housing problems in direct and indirect ways and this is for direct specialists of contracts, Consultants, owners and decision makers of low cost housing sector in Egypt as it helps to form a complete solution for the project. So far, it is clear that using technology is to be as a tool to analyze and study the problem of decrease in economic efficiency of the built units in Egypt. 
The economic efficiency is the dominant element in the research using it as scale to evaluate the problem constants to help in materialistic and spiritual contents of the built units, and this is cured through the (building economics and evaluation researches and analyzing projects) as they are considered the two main contents of building technology, 

a- The building technology. (The general field of the research )
It gathers the production techniques and building, systems it also cover the materialistic and spiritual contents to achieve the highest performance together with the best product¹ (it is a complicated operation and environmental and administrator) which contains a group of common factors that works in a socio-economic system which dedicates a technology frame in application²

(a-1) The building economics (The specialized field):-
A study of all urban contents to reach the aimed economy to choose the suitable design which suits design factors, also the construction system, the technology means through using building materials which fulfillment the aimed needs together with the materialistic and spiritual reward which can be evaluated using an economical efficiency scale.

(a-2) The project evaluation and analytical researches (The specialized field):
An analytical study of projects and evaluating means depending on a group of
analytical process (comparison - improving - repairing - developing -
harmonizing) shorthand it to achieve the suitable solution to manage resources in
a detected time\(^1\) to achieve an economical efficiency scale to increase the (value
and performance) efficiency

b- The housing (The application field):

The housing field is an important and a major field which helps in developing,
also affecting a large sector of population, it gathers a group of different activities
(planning - design - constructing - maintenance - administration) and the (social
- technical - economical - environmental)\(^2\) needs and this aims to reach a group of
life and social needs of families to achieve the most suitable interior and exterior
environment to achieve satisfaction which helps to have a developed civilization
as a nuclear of development process and there are a group of integrated elements
in housing (user - market - cost)\(^3\)

3- The hypothesis:

The housing problem in Egypt is concentrated in low income housing which forms
40% of the housing sector (due to the developing human report 2005)\(^4\), the main
problem here is the decrease of economical efficiency depending on (performance
- cost - time) besides the shortage of a construction system which is effective.
The integrated methodology is to raise the economical efficiency to execute the
low housing program which affects solving the housing problem in Egypt directly.

\(^1\) Smirlune Herbert, Design Cost Analysis for Architects and Engineers, Hill Book Company, 1980, P75,78
\(^2\) Abdel Maksud, Ramsaud, Housing Design Economics, P.H.D, Alex. University, 1987, P57
\(^3\) Elshity – Hisham Galal – Technology of Construction Systems and Management, Alex. University,
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4- The aim:-
The aim of the research focuses on achieving a methodology to measure the economical efficiency to construct the low-cost housing project improving it and to be a helping tool for the decision support systems (for housing administrations and consultants and owners) and this helps to attract the users and reach the balance in housing market (supply and demand).

Means to achieve the aim:-
1- studying the low-cost housing development to achieve a developed study balanced with the real needs in Egypt
2- concluding that the economical efficiency is an evaluating scale suitable for a developed style
3- detecting the main elements of economical efficiency
4- choosing the main limits of the economical efficiency to construct the low cost housing and different examples in Egypt and the world.
5- The study of suggested harmony sequence together with the application field sequence which helps decision makers to use it.
6- Providing a general methodology consisting of a group of sequenced levels to measure and evaluate and improve the efficiency to achieve the best and highest value of construction efficiency of low income housing cost in a regular and clear way.

5- The methodology:-
The general methodology depends on gathering the (extrapolation, reinducing, analytical and differentiate analytical) methodology in a consecutive way all through different research units.

a- The extrapolation, reinducing methodology:
Reviews the historical background of the low-cost housing style in Egypt and the world aiming to achieve a developed style that suits the present circumstances and using the economical efficiency as a measurement scale to construct low cost housing through detecting the most important consistencies of low cost housing.
(design - construct) to achieve the most important bases of the economical efficiency to construct low cost housing, also studying the different effects on constructing low cost housing projects (environmentally - technically - economically - socially)

b.-The analytical and differentiate analytical methodology:
This study is through analytical the project to achieve evaluating factors affecting the initial methodology and eliminating it to suggested factors then achieving the technical economic effects acting on the economical efficiency to measure and evaluate in a digital measurement raising the economical efficiency of low income housing projects.

c.-The extrapolation methodology:
This is through examining the initial suggested methodology on different examples of local projects to show the harmony between the examining project with the methodology of measurement the economical efficiency.

d.-The surving methodology :-
It is an analysis of the concluded study of international and local projects detecting the positive and negative factors to achieve a group of basics affecting the economical efficiency which detects the initial methodology to measure the economical efficiency.

6.- The research consistencies:

Unit one:
The ways of raising the economical efficiency construct low income housing
this unit reviews the research subject defining the economical efficiency which its different ways depending on the user (investors - contractors - engineers - users - the government) to raise the economical efficiency of construction to detect through the running time how to the economy the construction especially after the nineteenth and twentieth century (The Group Housing) together with the building development using the prefabricated units which led to the group housing. Locally after 1952 searching new developing scopes in Egypt and the need of new urban
societies then the economical freedom stage. The low cost housing scales varied together with the construction determinants affecting the economical efficiency regarding the building technology in Egypt. The low cost housing styles were varied and a new construction system came in harmony with the developed measurement scale (The Economical Efficiency) to solve the shortage in market (supply and demand) of the low cost housing locally.

Unit two:-(

Present of the international and local trends to construct low cost housing.

This unit reviews the international trends to low cost housing old studies and new studies (developing - advanced) countries due to circumstances and this is through studying and analyzing the housing studies in the world politically and economically (Capitalism - Socialism) at which construction system some selected projects aiming to get the most important positives and negatives which are common in local and international projects to get the most important base of economical efficiency to construct low cost housing projects.

Unit Three:-

Bases and limits of economical efficiency to construct low cost housing.

This limit reviews the variety of bases and limits of low cost housing projects through a group of constants and compares which form general limits but still they form unlimited measurement limits which are undetectable in a digital measurement as for the cost and time. The general limits vary between three main groups of design and construction and economy and everyone of them is divided to secondary elements forming a group of general limit safe low cost housing costs affecting the economical efficiency. there are a group of general limits with main and secondary limits due to its affect directly or not directly on the economical efficiency We can find that the construction determents and technical determiners, architectural application affect the economical efficiency through affect on performance (mean factor) so we find that the main limits of a low cost housing
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project effecting the economical efficiency in performance, cost and time which form the economical efficiency triangle of a project.

The analytical stages of studies in unit three consists of:

1- A review on the main bases and limits affecting the economical efficiency of the low cost housing projects.

2- emphasis on the main limits and bases effecting the economical efficiency of the low cost housing project.

3- Relating the economical efficiency with the main limits (performance - cost - time) we find that it is necessary to set a methodology to measure low-cost housing projects as a tool for housing users.

4- (environmental - technical - social - economical) studies of affecting the economical efficiency to construct projects of low cost housing.

Unit four:

A methodology to measure and improve the economical efficiency to construct low cost housing.

Unit four reviews (theoretical - analyzable - mathematical) studies through diversion of the measurable and immeasurable of the suggested methodology to a mathematical skeleton. Using the analyzing research trend and evaluating projects as a specialized trend to reach the general methodology to measure and improve the economical efficiency as a main aim of the research.

These initial and analytical and mathematical studies go through a group of steps:

1- Detecting the initial immeasurable skeleton in detail way

2- Exchanging the immeasurable skeleton to a mathematical skeleton

3- Applying some tests to measure (operation - operation quality - formation)

4- Detecting the suggested methodology levels in detail, also means to apply and use then entering inputs to the program and getting outputs then analyzing and reentering it in an improved way and comparing between them. So we can declare from unit four that the general methodology to measure and improve the economical efficiency to construct the low cost housing- projects consists of a
group of steps (inputs - reading - decision making - step making - improving - reentering inputs) which form a multipurpose methodology and levels to help in decision making to construct the future low cost housing in Egypt.

**Unit Five:**

**The conclusions and recommendations:**

Unit five reviews the research summary, detecting the general conclusions of the research through sequenced levels, ensuring the general suggestions of the future studies related to the research field also declaring the harmony of research conclusions with the needed aims.

Also, the research can assure that the economical evaluation is a real scale to evaluate the project construction system, so we can compare different projects in the construction system to reach the best selection to improve the economical efficiency of projects.

Also, the research find that there is a methodology research that helps decision makers to direct the cash flow resources, producing a perfect unit that satisfies human needs which attract users, also balancing the supply and demand market achieving a real plan.

**7- The contribution:**

The research views the building technology as a general scope which integrates with a group of fields like (building economics - evaluating and analyzing project researches) and the housing field as an application trend specially in low cost housing.

Generally, the research can find that developing the housing style to reach a developed style which harmonize with the needs of the real circumstances that aims the methodology to measure and improve the economical efficiency to construct low income housing and this is a contribution to the building technology field to reach the evaluating methodology and measuring.

The research enriched different levels:-
1- Presenting methodology to evaluate and measure the economical efficiency of low cost housing to reach the positives and negatives and curing them to improve the economical efficiency of projects to add to the building technology to construct projects.

2- Presenting a modern value scale technically and economically gathering all effects (environmental - technical - economical - social) so that it makes a contribution to the building technology.

3- Presenting a simple system to evaluate and analyze the projects in a simple way through a computer program using a language which is considered as an addition to the evaluation and analyzing field.

4- Presenting a new tool in housing field (an application trend) which helps to solve housing problems through evaluating constructing low income housing projects in a predictable evaluation to help decision makers to choose suitable projects and construction systems through cash-flow to balance the (supply - demand) market.