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The art of making decision to choose the appropriate shading devices for the double skin- glasses facades

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ملخص البحث:

إنتشر في الوطن العربي منذ ستينات القرن الماضي إنشاء الواجهات الزجاجية تقليداً لدول أوربا التي تتناسب مثل هذه الأنواع من الواجهات لطبيعة المناخ البارد لديهم، إلا أن تلك الواجهات لا تتناسب مع طبيعة المناخ الحار، لأنها تساعد على زيادة إرتفاع درجات حرارة الفراغات الداخلية، وسوء الراحة الحرارية للمستخدمين، بالإضافة إلى زيادة الإكتساب الحراري للمبنى، وإستهلاك كم هائل من الطاقة اللازمة لتبريد وتكييف الفراغات الداخلية.

وتعتبر وسائل الإظلال من المعالجات المعمارية الهامة لخفض درجات الحرارة الفعلية للواجهات المعرضة لأشعة الشمس، مما يساهم في تحقيق الراحة الحرارية للمستخدمين، وتمكين الفراغات المعمارية من القيام بوظائفها.

والإدارة هي فن إتخاذ القرار، وبإتخاذ القرارات التصميمية المناسبة من خلال الدراسة نصل للأهداف بما يحقق (الجودة والتكلفة والزمن) وتوافق القرار مع كافة عناصر المشروع، وفن إتخاذ القرار هو لب العمليات الإدارية في جميع مراحلها المختلفة، المتمثلة في أربعة مراحل هي (التخطيط، التنفيذ، الرقابة والتشغيل).

يهتم البحث بوضع منظومة تساعد القائمين على إنتاج المباني من إختيار وسائل الإظلال المناسبة بنظام الواجهات مزدوجة الغلاف، وذلك بإستخدام المنهج الوصفي التحليلي لمقارنة ودراسة كيفية إتخاذ القرار التصميمي المناسب، ولتحقيق الهدف المطلوب يهتم البحث بالتعرف على مفهوم الإدارة، ودراسة وسائل الإظلال بنظام الواجهات مزدوجة الغلاف، ومدى توافقها مع طبيعة مناخ القاهرة الكبرى، وصولاً لوضع قائمة مقارنة لإختيار وسائل الإظلال المناسبة.

ABSTRACT:

The construction of glass facades has been spread in the Arab countries since the sixties of the last century. It had been imported as a new type of buildings from European countries which have a cold climate. These buildings proved to be unsuitable for warmer countries because it helps to increase the internal spaces temperature, poor thermal comfort of users, in addition to increasing the thermal acquisition of the building, and the consumption of a large amount of energy needed to cool and adapt the interior spaces.

Shading devices are an important architectural solution for reducing the actual temperatures of sun-exposed facades, contributing to the thermal comfort of users and enabling architectural spaces to function. The management is the art of decision-making of an appropriate design decisions through the study to achieve the objectives with (quality, cost and time), and the compatibility of the decisions with all project elements, the decision is the core of the administrative process at all stages (planning, implementation, control and operation).

This paper is concerned with the development of a system that helps the building producers to choose the appropriate double skin facades shading devices, using the analytical descriptive approach to compare and study how to make the appropriate design decisions. To achieve the desired goal, the research aims to identify the management concept, and study of the double skin-faceted shading devices system, and its compatibility with the nature of the Climate in Greater Cairo., Down to a comparative list to choose the appropriate shading devices.

KEY WORDS:

Shading devices, environmental treatments, double skin-facades, make decision.

1. Introduction:

Relying on the correct administrative principles and planning methods ensures proper use of the possibilities and avoid deviating from the achievement of the project objectives. [1] Therefore, some important administrative definitions should be noted so that we can understand the steps of the proper management process to develop the strategies of the double skin-facades system**.**

2. Definition of projects:

Projects was defined by The French Association for Measurement (established in 1969, member of the International Organization for Standardization (ISO)) to identify the project as: "The project is a specific step to achieve a future goal, to meet the needs of the user by respecting the objectives, activities and resources." [2]

While it was defined by the Organization of the American Enterprise Management Institute (established in 1969 in Valdivia, aimed at issuing methods and methods of project management) as: "A temporary effort directed at generating a single product or a single service." [3]

3. Define the concept and functions of projects management:

Management is the art of decision making; it is a comprehensive system of systems, procedures and interrelated means to reconcile the resources and the objectives of the establishment.**[4]**

Also management in general has three basic functions (planning, implementation, oversight or follow-up). **[1]**

4. System for the designation of shading devices in the system of double skin-facades in hot climate:

The economic system can be set to choose suitable shading devices in hot climatic zones, applying on the double skin-facades system through project management stages as follows:

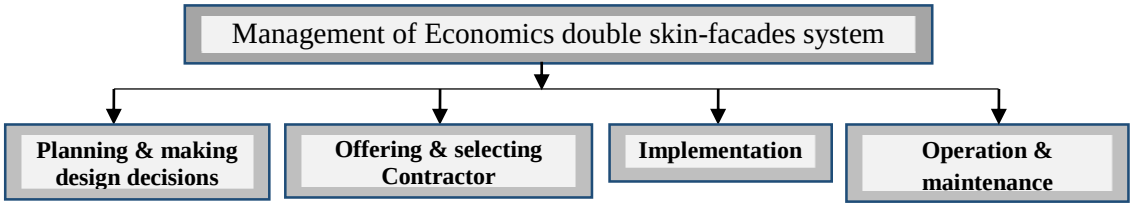


Figure (1) shows the stages of managing the work strategies of the double skin-facades system.
Source: Author

The design decisions are at the planning stage, where planning steps can be simplified through Figure 2, it begins by collecting information, then analyzing it, then setting the goals, and finally the final stage of the planning, that is the stage of decision making.

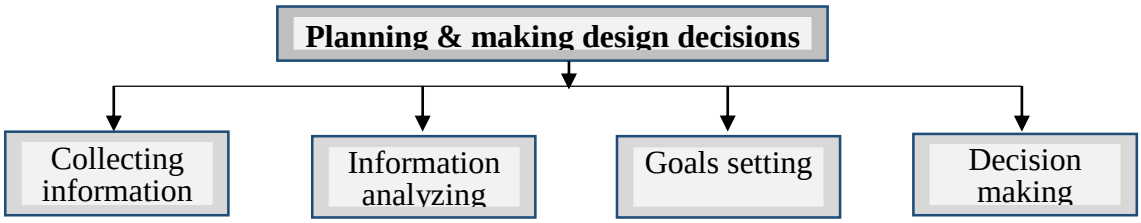
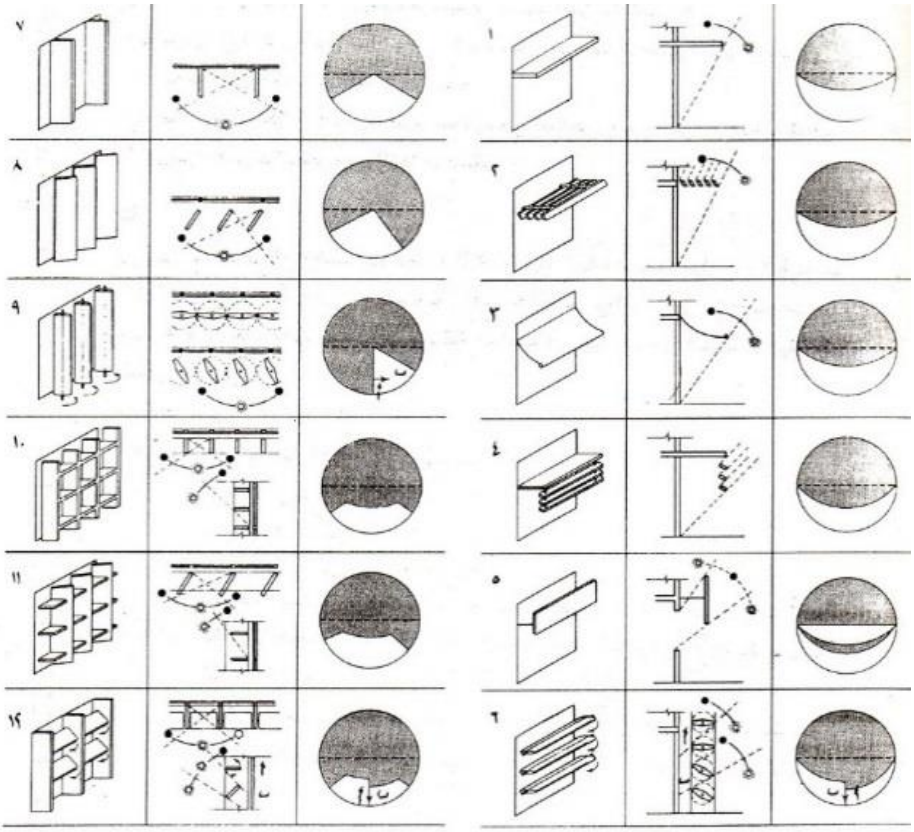


Figure (2) shows the steps of the planning stage.
Source: Author

4.1. Collection & Analyzing information:

The appropriate selection of shading devices depends on several factors including the façade direction , which determines shading devices shape (vertical, horizontal, slanted, movable) and position (inside the cavity or outside the cavity).

- There are many options for using sun shading methods, horizontal sunshades is suitable for southern façades wide angles of the sun where vertical types are suitable for western facades. **[5]**, The vertical shades are also suitable for the eastern facades where the vertical angle of shadow is small. **[5]**



From 1: 6 illustrate the sun-shading used in the southern façades (the sun is high), and from 7: 9 the vertical shading in the eastern and western façades, from 10: 12 the composite facades.
Figure (3) shows the shape of the solar shading devices according to the direction of the different interfaces.
Source: (A, Shafq, "The Climate and Construction of the Warm Areas)

- The composite sunshades (vertically and horizontally) are used in the south-eastern and southwestern façades. **[5]**

Figure (3) shows the differences between sun shading types, the moving shading device are better in case of the maximum use of sunlight in the heating, the northern façades need almost no shading. **[6]**

Sun shades are important for protecting the internal spaces from the solar heat in the summer, As soon as the solar radiation enters; the air temperature rises in the internal spaces. **[7]**, as shown in Figure (4), Therefore, it is preferable to have shading devices on the outer skin of building in summer, and the lack of shades in winter to take advantage of the sun in the heating of the interior spaces, that in the case of buildings with a single envelope, as showing in figures (5), (6), (7).

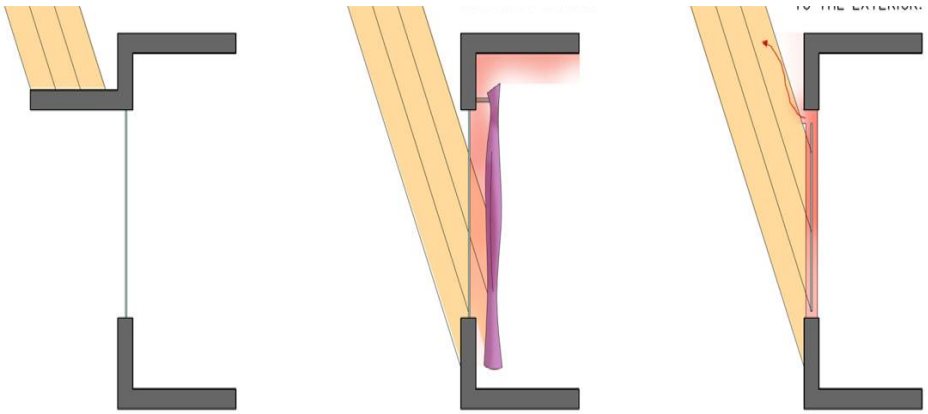


Figure (4) Internal blinds are good for glare, but not preventing solar gain. Once the heat is IN, it is IN!
Source: T, Boake , GREEN BUILDING ENVELOPES

In the case of double-glazed facades, the cavity is mainly work to prevent solar radiation from reaching the internal spaces and reduce thermal acquisition inside the interior spaces. So the placement of sunshades inside the cavity is more appropriate in the case of double-sided facades, as showing in figure (8).

One of the biggest advantages of the Double Skin Façade System is the shading devices and ventilation inside the cavity. When the solar radiation beings to be absorbed by the shading devices the air temperature in cavity is increased due to the stack effect. Approximately 25% of this heat can be removed by natural air circulation. Increase cavity temperatures lead to increased temperatures spaces, and as a result improved thermal comfort for the occupants. **[8]**

4.2.1. Goals determined:

The objectives are divided into the main goals, sub-objectives, and the objectives of the use of shading projects for the establishment of the double skin-facades system can be defined as follows:

4.2.2. Main Goal:

The main objective can be defined as: "contributing to the thermal comfort of users".

4.2.3. Sub-objectives:

The sub-objectives system can be defined as the following:

- Reduce the air temperature of the internal spaces in summer.
- Increase the air temperature of the internal spaces in winter.

- Natural lighting.
- allow air flow.
- Rationalize energy consumption in buildings.

Figure (5) wood blinds of windows. Source: (Z, Salah)

Figure (6) external mobile shading. Source: (X. Loncor)

Figure (7) large external shading in the Microsoft building in Smart Village, Egypt. Source: (Author)

Figure (8) shading inside the cavity. Source: (R William)

4.3. The choice of shading devices:

By defining the main goal, the sub-objectives can be set to choose the appropriate shading devices for achieving the objectives.

4.3.1. Natural lighting:

Natural lighting should be checked without glare with each alternative designed shading device, as this reduces the energy needed for industrial lighting.

4.3.2. Reducing air temperature of the internal spaces:

It is necessary to verify that any of the designing alternatives can contribute to the reduction of the temperature of the internal spaces, as this contributes to the achievement of the main objective of achieving the thermal comfort of the users.

4.4.3. Reduction of heat gain of internal spaces:

Check whether any of the designing alternatives can contribute to reducing the heat acquisition of internal spaces, as this will consume a large amount of energy to cool the spaces.

4.5.4. Rationalization of energy consumption:

Check whether any of the designing alternatives can contribute to reducing the heat acquisition of internal spaces, as this will consume a large amount of energy to cool the spaces, this is done by reducing air temperature of the internal spaces.

4.5.5 - Air flow:

Check whether any of the designing alternatives can contribute to the smooth flow of air inside the cavity and thus into the spaces, which helps to reduce the heat of the interior spaces.

4.5.6 - Maintenance: Check the appropriate shading devices location for easy maintenance.

5. Demonstration of the available designing alternatives:

It can be inferred the possibility of achieving the objectives of each of the design alternatives available through the study shown in the following table No (1).

6. Appropriate decision-making process: This is done by comparing the design alternatives to reach the appropriate decision, as shown in the table No (2), Figure (9) shows the most appropriate solution for shades position on the double-faced system to achieve the desired subjective.

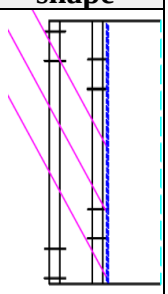
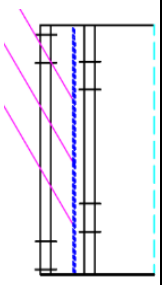
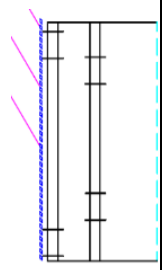
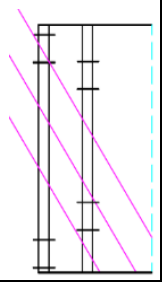
Cases	Analysis	shape
Case (1) shading inside the building	- Solar radiation enters to interior spaces, increasing the temperature of the skins surface, and the temperature of the interior air spaces, thus not contributing to the thermal comfort of the users, and increases the heat acquisition of the building, leading to increased energy consumption for cooling and air conditioning. - Helps to easily for flow air movement within the cavity. - Easy maintenance.	
Case (2) shading in cavity	- Solar radiation enters inside cavity, which increases of air temperature in cavity, Thus, the air temperature of the spaces is reduced by moving of hot air into the cavity and then outward through the chimney property, Thus contribute to the thermal comfort of the users, And reduces the heat acquisition of the building, resulting is reduces energy consumption for cooling work And air conditioning. - Its help to flow of air within the cavity easily by chimney property. - Relatively less at ease of maintenance than the previous situation.	
Case (3) shading outside building	Sunlight does not enter the air cavity, and thus leads to: - Reducing the actual temperature of the skins of facades, - increase the temperature of the internal spaces, because the hot air is not moving by the chimney property. Thus does not contributing to the thermal comfort of users. - increases the heat acquisition of the building. - increases energy consumption for refrigeration and air conditioning. - Relatively less in ease of maintenance than the two previous cases.	
Indirect exposure to radiation of the three cases	The three cases contribute to the achievement of natural lighting without glare in the times of indirect exposure to hot sun, which saves on the consumption of electrical energy needed for natural lighting.	

Table (1) shows the extent to which the design alternatives have been achieved for the specific objectives.
Source: Author

NO	Comparative elements	Type and position of shades			Notes
		External	Inside the cavity	internal	
1	Natural lighting	**	**	*	Relative value of reducing the actual surface temperature of the facades, reducing the temperature of the interior spaces, and allow air to flow easily within the cavity is huge greater than the rest values
2	Reduce air temperature of internal spaces	**	***	*	
3	Rationalize the energy consumption	**	***	-	
4	Air flow	*	***	*	
5	Maintenance	*	**	***	
6	Total of score points	8	13	6	
-	The Best sequence	2	1	3	
-	The decision	-	√	-	

Table (2) shows the making of the design decisions by choosing between the suitable designing alternatives for the placement of the shading devices.
Source: Author

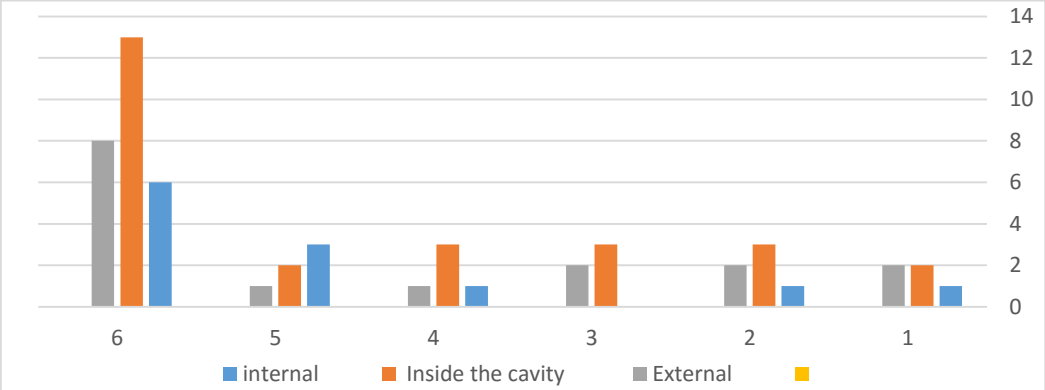


Figure (9) shows the most appropriate solution for putting the shades on the double-faced facade system to achieve the desired subjective.
Source: Author

1- Natural lighting, 2- Reduce air temperature of internal spaces, 3- Rationalize the energy consumption, 4- Air flow, 5- Maintenance, 6- Total of score points

7. CONCLUSIONS:

7.1 The process of collecting and analyzing information is very important stage in planning to contribute to making the right decisions.
7.2. Making design decisions to manage the strategies of double-skin facades, enhances the likelihood of the best decisions by comparing them to other choices.
7.3. The shading devices are placed inside the air cavity for the need to raise the temperature of the cavity and activate the chimney property in the double-skin facades.
7.4. The movement of the air through the chimney property pulls the hot air from in to out, thus reducing the air temperature within the internal spaces.
7.5. Through study and analysis, it is clear that the second Case (2) which shading inside the air cavity" is better than another cases for the following reasons:
- Solar radiation enters inside cavity, which increases of air temperature in cavity,
-Thus, the air temperature of the spaces is reduced by moving of hot air into the cavity and then outward through the chimney property,

-Thus contribute to the thermal comfort of the users,
-And reduces the heat acquisition of the building, resulting is reduces energy consumption for cooling work and air conditioning.
- Its help to flow of air within the cavity easily by chimney property.

8. Recommendations:

- It is preferable to use external shading in single-envelope buildings. but for double-skin facades, the use of shading is preferred within the air cavity between the skins, taking into account allowing air movement within the cavity.

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