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Local Architectural Freeform: Between Theory and Practice

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ABSTRACT

The formation of the building is the first thing that the viewers receives and draws his attention for the purpose of exploring the identity of this building because of the questions that this formation raises in the mind of the viewer. These architectural formations came as a result of different environmental conditions, including natural, economic, and social, especially technological, and the architectural formation must address the present and the future, especially The future is a call to change the existing situation and develop for the latest. The future is the field of achieving goals and objectives, and the past is the field of experiences. The modern era, and by extension the future, is characterized by dynamism, movement, and rapid transformation, as well as mutual enrichment between technologies and sciences, the most important of which is the field of architectural sciences, especially architectural formation, which has produced for society Architecture with free sculptural forms and compositions is spreading in many international national projects at an accelerating rate that is not equal to the local rate in this field. It was necessary to conduct this research study entitled “Free Architectural Formation at the Local Level between Theory and Practice,” which aims to Studying the concept of development in general and the concept of free architectural formation, the motives that led to the emergence of this trend globally, the extent of the need for it locally, and how to deal with this trend at the level of design and implementation, in a serious attempt to answer the following question: - What are the material reasons for the limited spread of architectural formation? Freedom at the local level, and will this concept remain a theoretical study or will it move to the stage of application on the ground in keeping with the global development occurring in this field, to achieve a higher goal, which is an attempt to raise the level of contemporary Egyptian architecture, especially at the level of architectural formation, from the current state of stagnation, as the research aims To determine the local position compared to the international level, as an attempt to codify the situation and find out the reasons for the limited interaction with this trend and study the obstacles and challenges that limit the spread of this trend locally, and thus develop a mechanism to try to overcome these obstacles, through a scientific methodology that follows the inductive approach of previous literature in this field. The experimental approach is based on conducting a questionnaire study targeting a sample of academics, architectural designers, and specialists in the field of building and construction as part of the study sample, to determine the proportions of the study elements, then the results are drawn and a number of recommendations are made that serve the research community and civil society in the future.

KEYWORDS: Architectural Evolution, Free Form Architecture- Advanced implementation methods.

التشكيل المعماري الحر على المستوى المحلي بين النظرية والتطبيق

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الملخص

تشكيل المبنى هو أول ما يتلقاه المشاهد ويلفت انتباهه بغرض استكشاف هوية هذا المبنى لما يثيره هذا التشكيل من تساؤلات في ذهن المشاهد ، هذه التشكيلات المعمارية جاءت نتيجة ظروف بيئية مختلفة منها الطبيعية والإقتصادية والإجتماعية وعلى رأسها التكنولوجية ، والتشكيل المعماري لا بد أن يخاطب الحاضر والمستقبل ، وخصوصا أن المستقبل هو دعوة لتغيير الوضع القائم والتطور للأحدث ، فالمستقبل هو مجال تحقيق الأهداف والغايات ، والماضي هو حقل الخبرات ، ويمتاز العصر الحديث وبالتبعية المستقبلي بالديناميكية والحركة والتحول السريع فضلا عن الإثراء المتبادل بين التكنولوجيات والعلوم ومن أهمها مجال العلوم المعمارية وخصوصا التشكيل المعماري ، مما أفرز للمجتمع عمارة ذات تشكيلات وتكوينات نحتية حرة ، آخذة في الإنتشار في العديد من المشروعات القومية العالمية بمعدل متسارع لا يتكافأ مع المعدل المحلي في هذا المجال ، فكان لا بد من إجراء هذه الدراسة البحثية بعنوان " التشكيل المعماري الحر على المستوى المحلي بين النظرية والتطبيق" والتي تهدف إلى دراسة مفهوم التطور بشكل عام ومفهوم التشكيل المعماري الحر ، والدوافع التي أدت إلى ظهورهذا التوجه عالميا ، ومدى الحاجة إليه محليا، وكيفية التعامل مع هذا التوجه على مستوى التصميم والتنفيذ ، في محاولة جادة للإجابة على التساؤل الأتي:- ما هي الأسباب المادية لمحدودية انتشار التشكيل المعماري الحر على المستوى المحلي ، وهل سيظل هذا المفهوم دراسة نظرية أم سينتقل إلى مرحلة التطبيق على أرض الواقع مواكبة للتطور العالمي الحادث في هذا المجال ، لتحقيق هدف أعلى وهو محاولة النهوض بمستوى العمارة المصرية المعاصرة خاصة على مستوى التشكيل المعماري من حالة الركود الحالية ، كما يهدف البحث إلى تحديد الموقف المحلي مقارنة بالمستوى الدولي ، كمحاولة لتقنين الوضع ومعرفة أسباب محدودية التفاعل مع هذا التوجه ودراسة المعوقات والتحديات التي تحد من انتشار هذا التوجه محليا ، وبالتالي وضع ألية لمحاولة تخطي هذه العقبات ، وذلك من خلال منهجية علمية تتبع المنهج الإستقرائي للأدبيات السابقة في هذا المجال والمنهج التجريبي الذي يعتمد على إجراء دراسة استبيانية تستهدف عينة من الأكاديميين والمصممين المعماريين والمتخصصين في مجال البناء والتشييد باعتبارهم جزء من عينة الدراسة ، للوقوف على نسب عناصر الدراسة ، ثم يتم استخلاص النتائج ووضع عدد من التوصيات التي تخدم المجتمع البحثي والمجتمع المدني مستقبلا.

الكلمات المفتاحية : التطور المعماري، التشكيل المعماري الحر-أساليب التنفيذ المتقدمة.

1. INTRODUCTION

This topic is classified among the topics of architectural thought, which is the philosophical field that is concerned with studying architectural work from a comprehensive perspective and seeks to extrapolate the conditions affecting the formation of architectural products and analyze the level of interrelation between them. This research specifically addresses the issue of development in the field of architectural formation, as development is an important issue that occurs It is in the circle of interest of many disciplines, and affects all aspects of life. Development is a dynamic process that depends on movement and change, which take a path towards achieving and finding the best. Architecture, as a physical entity in appearance and intellectual in essence, has undergone over time many changes and transformations on the material level, represented by formation. The architect, and at the intellectual level of the theories of architectural thought, which represents the living entity that drives the movements of change and transformation in this formation, and the issue of development in the field of architectural formation is an urgent necessity in keeping with the data of the times, which means that architecture must constantly respond to the changing conditions of society, and that Development is an attempt to achieve balance in aspects of disorder, and therefore it is an amount of conscious transformation with a degree of non-fanatic continuity of the past. In short, this research analyzes the issue of development in the field of

architectural formation through analyzing the factors affecting the limited issue of development and, consequently, the limited spread of free architectural formation. Which is synonymous with the concept of development in the field of architectural formation.

2. Architectural Evolution

The concept of development in general is a type of change that takes the form of growth from a simple form to another, more complex form, which is change from one state to a better state. Development benefits from the accumulation of previous knowledge and experiences, which have changed and developed before to reach more complex cognitive facts. Development is the common conscious demand of all peoples, as it is heading towards the better and towards achieving happiness and reducing human suffering. Development in the architectural field means improving the existing situation and improving it at all levels of the architectural process in design and form, by accepting its positives and advantages, identifying its negatives and working to limit them and reduce their impact. In the best cases, eliminating these negatives, taking advantage of modern technology and keeping pace with the current development and the social, cultural, political and technological variables that surround the system, and the concept of development is synonymous with several other concepts such as progress, advancement, change, transformation, creativity, and renewal, and it is opposite and contradictory to the concept of decline and the concept of stability [1].

2.2. Architects' styles about the architectural formation process

Architects are classified according to their desire for change and renewal into three types of architects, as follows [2]: -

2.2.1. Traditional style

The traditional style is the one that seeks to preserve the ancient plastic heritage, and seeks to revive it out of its belief in the importance and greatness of this heritage, especially since it is not the product of one individual or one generation, but rather the cumulative product of successive generations of creators.

2.2.2. Old style developed

The second style is the developed style of the old, as it is linked to the old, but with a degree of objectivity and choice. It is also convinced of the possibilities of the present, its ability to imagine a better future, and its belief in emphasizing the temporal dimension in architectural work. When he mixes the two visions, he can come up with a new equation, which is contemporary architecture that expresses the present and is continuous. With the past.

2.2.3. Innovation style

The third type is the Innovation type, which is the one who strives to distance himself from the old and search for modern formulations and vocabulary for architectural formation and has the potential to create for that. This type of architect believes that ancient formulations appeared to solve the problems of the past, which must differ in their appearance and essence from modern problems, and he is like this. He is convinced that architecture has a future dimension as well as

the need for it to meet the needs of the present and respond to the past. The role of this type of Innovatoer architect, for example, is to create new and non-stereotypical architectural formations, such as the concept of free architectural formation.

3. Free Form Architecture

Free architectural formation is the formation that results from several shapes with multiple curvatures. Free formation emerges from organic formations, where nature is considered the primary source of inspiration for free formation. The word free formation is used to describe buildings with curved and arched surfaces, moving away from blocks and projections with explicit geometric formations that They are called Euclidean configurations, and the free configurations go beyond the traditional configurations of the design process, and are produced thanks to applications of digital technology through mathematical equations and functions that determine their denominators [3].

3.1. Motives that led to the emergence of free formation

In the late twentieth century, a generation of architects appeared that sought change as a result of the circumstances that occurred in the world in terms of technological development in the field of communications, information, and construction technology. They developed new and innovative architectural designs that renounced all the rules and styles in the history of architecture, and they developed new methods of design and construction in accordance with Due to the technological development that was introduced, it provided them with the necessary capabilities, and they formulated a new architectural language to address contemporary peoples, and expressed it using modern building materials and construction methods. The concept of globalization also appeared in this period, and this concept is very similar to the concept of free formation, as the former calls for dissolving The barriers between different countries, cultures, economies, and peoples. The second concept calls for dissolving the intellectual barriers entrenched in architecture and calls for the launch of unlimited horizons of thought and creativity [3].

3.2. The extent of the need for free formations

This type of formation has become a fait accompli and a new trend in the field of architecture, so it must be exposed and studied, and its characteristics, methods, and tools studied. It becomes clear through the following points the extent of the need for this type of formation [3].

- Based on the cultural development of societies, we find it very important to keep pace with architectural development and constantly strive to keep pace with everything new and modern, and we notice this in all areas and requirements of countries.
- Countries need, from time to time, to establish specific projects that meet their needs, express their civilization, shape their future, and showcase their cognitive capabilities. When this opportunity is provided, architects try to open the way for their awareness and imagination in making these national projects to be unique, iconic projects with a symbolic image. The best example of this is what There is now an unprecedented boom in the construction of new cities and urban communities in Egypt, led by the New Administrative Capital, the New City of El Alamein, and the City of Galala. These major projects include symbolic iconic buildings such as the tallest skyscraper in Africa, the El Alamein Towers,

the Grand Egyptian Museum, the Museum of Civilization, and before them the Library of Alexandria. This approach is an ancient approach initiated by the ancient Egyptian civilization, represented by their interest in establishing Pharaonic temples, pyramids, and the Way of Rams, which were and still are a source of inspiration throughout the ages[15].

- This type of formations is a kind of display of the architect's creative thought, and the technological capabilities and digital tools in implementing and creating such kind of formations on the ground.
- This type of formation is suitable for national and unique projects, as it carries many symbolic meanings for the countries of origin, while being easily perceived visually and leaving a distinctive mental image. This formation is linked to the country of origin and to the creative architect. There are many examples of this (Sydney Opera House in Australia - Heydar Aliyev Cultural Center in Azerbaijan - Guggenheim Museum Bilbao, Spain - Library of Alexandria and the Grand Egyptian Museum, Egypt).
- At the level of study for students in architecture departments and schools, this approach to formation has become essential in the students' work. We notice this in the graduation projects of the final study teams, without the presence of these projects in the working drawings and building technology materials.

3.3. Elements of creating free formation

There are a number of components that contribute significantly to the creation and spread of free formation. These components are as follows:

- **The desire to find new types of buildings that did not exist before:** Industrial progress and technological development led to the emergence of an urgent need to find special buildings and facilities that were not known before, and that express the spirit of the times and the extent of technological and technical development that countries have achieved, so the free formation was It is one of its outcomes in the field of architecture.
- **Economy:** After the end of the World War period, engineers simplified buildings and stripped them of decoration out of a desire to reduce costs and speed implementation, and to meet the increasing human needs and the needs of workers and their families, unlike the present time, in which the field of architecture has become a track for competition and competition in the construction of unique buildings and projects. They are distinguished in shape and size, and various countries and institutions devote a large part of their economy to this matter, as these projects are investment projects and achieve a high income return, and this is clearly evident in many national projects in the Arab world and the international community.
- **The development of the construction and architectural materials used:** The development of building and construction materials has helped in the emergence of unique architecture, through the presence of a flexible material that is easy to shape and mold to obtain flowing lines that achieve the desired configuration.
- **Architectural genius:** Architectural genius lies in the refusal of a number of architects to imitate and borrow from the past. Their goal was to produce architecture that expresses the current era, as predecessors did in their era. Each of them tried to produce architecture commensurate with the capabilities available now, and to harness technology and smart tools to realize his architectural ideas.

- **Marketing:** It is a social administrative process through which individuals and groups obtain what they need, and this is achieved through the production and exchange of products of value with others. Marketing is the most important factor in the field of architecture, through the concept of real estate marketing, which greatly promotes architectural projects and highlights through them Free formation and unique sculptural formations, through advertising leaflets and real estate exhibitions.
- **Economic feasibility**: Free formations can have an important and effective role in reviving the urban environment of many areas and giving them international fame, as happened in the Spanish city of Bilbao, where the city was poor and the state set out to revive it by establishing a national museum project affiliated with the Guggenheim International Museum Group, and it was achieved. The project was assigned to international architect Frank Gehry, and the unique design of the museum played a fundamental role in the city's fame and made it a tourist attraction, as were the role of the Sydney Opera House in Australia, the Qatar National Museum in Doha, the Bird's Nest Stadium in Beijing, and the Walt Disney Concert Hall in America, where many films were filmed. cinema because of its fame.

3.4. How to embody free formations at the design level

The design of free compositions is based on digital software, such as (Maya - Rhino and Grasshopper - Catia), as these programs work with 3D technology, such as the 3D Max program, in new and improved ways and with simpler commands, where 3D elements are used instead of 2D, so that instead of... It uses the line and the curved arc. [16] It will use pre-fabricated three-dimensional shapes with some modifications made to them and transform them into more dynamic and fluid elements, as shown in **Figure (1)**. The model will then be ready to carry out structural designs on it and extract the working drawings and details, to move it to the implementation stage on site [5].

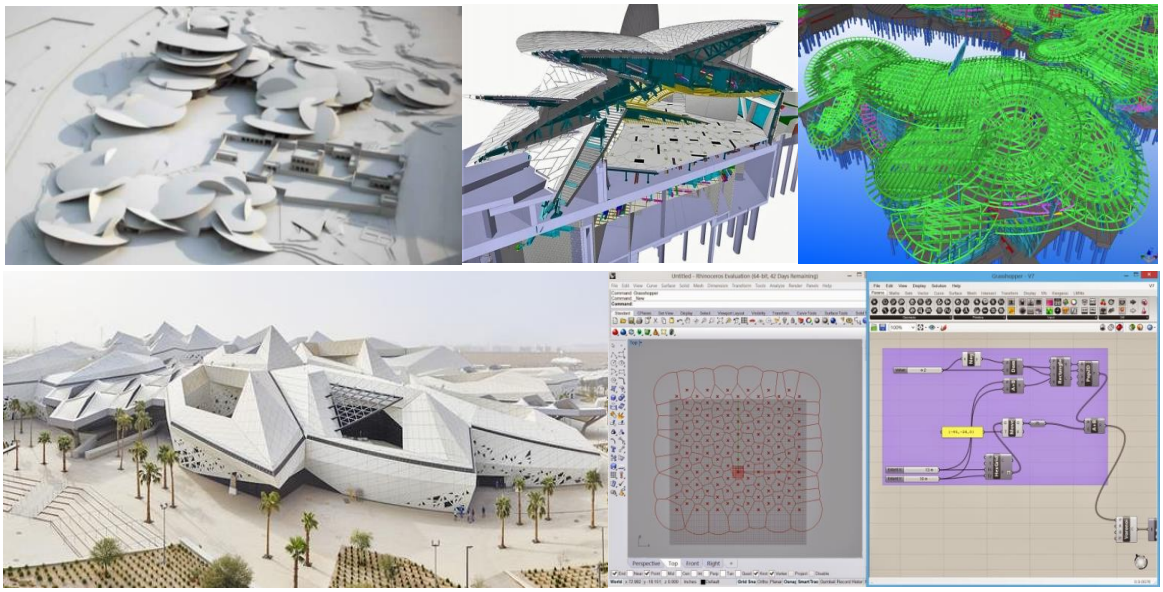

Figure (1): shows how to design free formations.

3.5. How to embody free configurations at the implementation level

After the architectural model completes the final design stage, it is included in the structural design stage, also using digital programs such as (CATIA-Tekla Structure) and other programs that will contribute to producing calculations and preparing drawings. The model then moves to CAD technology\ CAM aims to segment the building's structural elements and cover works, code them, prepare them, and then transport them to the site to assemble them in their places. Automated equipment, various cutting and drilling machines, and carbon templates are used in this stage to be used in preparing unified models and templates by applying the principle of standardization for all the different elements and parts, as shown. From **Figure (2)** [3].

Figure (2): Shows examples of free-form projects during implementation.

4. Obstacles facing constructions with free architectural formation

There are a number of obstacles and challenges facing free formation construction processes, including:

4.1. Legislative obstacles

There are a number of legislative and regulatory obstacles that greatly hinder the process of architectural formation, as laws and legislation in general are what organize any society's affairs and arrange the relationships between its members. Perhaps these values are what form the common denominators between individuals and different groups, elevating them to the concept of society. [6] , and many studies have shown that the negatives in Egyptian building laws outweigh the positive aspects in many provisions, and among the most prominent negatives is the building legislation's interest in rigid physical standards and dimensions that restrict the process of architectural formation within a fixed building cube, which does not allow flexibility for change. Or innovation without waste in many cases. They also neglect to take into account the aesthetic, cultural, social or environmental dimensions of construction. Legislation does not criminalize the construction of a deformed building or a building that infringes on the dignity of a valuable area, while it is possible to obstruct a free-form building simply because It is unconventional, and it does not change with the geographical scope of the place, but rather it is constant for all of Egypt in all of its large and changing geographical scopes. The reason for this is that it is taken from external

contexts and therefore the conditions and reality of the local community were not taken into account. Also, although building laws are primarily directed to serving architectural work, they are rarely discussed popularly, professionally, or intellectually, nor is their technical implementation effectively discussed and then developed, which is the task of architectural criticism and architectural institutions, and this can be achieved by seeking the opinions of experts and those with experience. And directing part of the scientific research movement to study, discuss and present the problems of laws so that they can be amended and developed appropriately. Thus, the research aims at the necessity of making a thoughtful development of building legislation that allows providing a degree of flexibility and freedom to the architect so that he can create his designs and release architectural thought without restrictions and strive to keep up with the work. Architecturally at the international level, as well as the need for legislation to include standards that add a degree of specificity to some other dimensions, such as aesthetic, cultural, and environmental aspects derived from the Egyptian reality, thus providing more opportunity to produce Egyptian architecture that expresses the technology of the era and addresses the present and the future [4].

4.2. Economic obstacles

The economy can put society in a state of stagnation or in a state of economic recovery, which in turn is reflected in the architectural formation, and it is one of the basic influences on the architectural product because the economic potential strongly controls all stages of design and implementation, and the economic aspects have witnessed radical changes in recent years, as Buildings reflect the economic level of people and individuals, and there are a number of factors that control the economic system related to the field of construction, which we list below [8]:

4.2.1. Financing

Financing is the main driver of the building and construction process, and it is the main influence on the economics of construction. Lack of financing is one of the most important obstacles to project implementation, whether by increasing implementation time or decreasing the quality of work implementation. As for projects with complex and complex configurations, they require huge budgets that double the expected budgets in the case of constructing buildings with traditional configurations. This makes this type of building avoided, which creates a psychological barrier for many investors by not being able to penetrate this thorny aspect of the design process[8].

4.2.2. Building materials

Building materials have a direct impact on the quality and quantity of the implementation of architectural projects, in terms of quality, cost, or implementation time, as building materials represent from 40% to 60% of the total construction costs, and among the most important building materials affecting the economics of construction are the basic materials for construction, which are iron and cement. Bricks are in addition to the materials included in the finishing items, such as paints, tiles, etc. As for the materials with free formations, additional materials are included in the cladding and outer covering works, which are often made of new materials or materials with high plastic properties, and plastic works, laser engraving, and other works are performed on these materials. CNC, bending and pulling, all of these things raise the cost of items which overall increases the final budget of the project [7].

4.2.3. Project implementation time

There is a method for preparing time plans for the implementation of any project, which is the schedule. This schedule depends on representing the various project activities in a time-divided schedule for each activity that begins at the time the activity is implemented and ends at the time its implementation ends. In the case of free-form projects, the schedule rate increases, and the periods slow down. The time allocated to complete each item is doubled, and the time period required to complete the project is doubled due to the overlapping and complexity of the items and the difficulty of producing and installing them, as they require more precision, review and follow-up. There are many examples of architectural projects whose schedule extended for many years, such as the Sydney Opera House in Australia and the Walt Disney Concert Hall in the United States of America [8].

4.3. Technical obstacles

The technical obstacles include several things, including:

4.3.1. Architectural and construction design software

The technical obstacles are the lack of availability of a number of specialized engineering software due to the high price of some of them or the lack of human cadres proficient in dealing with such software, which causes a technical barrier in dealing with such projects that use such software and creates a state of reluctance and avoidance to engage in such an adventure. Which may waste a lot of time and cost. Examples of these programs include CATIA and CAD/CAM programs [9] , [12].

4.3.2. Implementation methods.

Free formations find a major obstacle in the implementation phase, whether in the processing phase and preparing matching drawings for the different specializations, as such projects contain many different operational systems such as sanitary, mechanical, and electrical equipment and smart systems, so a complex conflict occurs between these systems and the structural structure of the building and the architectural works. There are also very complex obstacles in preparing and preparing chopping, formwork, site preparations, and distributing equipment to begin implementation work, as well as the unavailability of part of the automated equipment and machines to assist in completing some tasks for a number of items in the construction process, such as structural works and cladding works [3].

4.3.3. Scarcity of skilled labor

Skilled and trained workers (supervisors, technicians, and craftsmen in all specialized fields in the construction system) are one of the elements influencing the economics of building and construction in terms of the quality of construction and the optimal operation of building materials. Therefore, this workforce must have a high degree of training, craftsmanship, and specialization in dealing with such projects. , as it affects the cost and quality of implementing projects with free and complex configurations[8].

4.4. The importance of developing the architectural education system to keep pace with the process of free architectural formation

Architectural education systems in Egypt have received the attention of many studies recently, and it is noted that although they contain some positives, they are full of negatives, which means that they need to reconsider the objectives, methodologies and implementation mechanisms, in order to graduate architects capable of dealing with the many problems and developments. The era is of revolutionary diversity in the fields of complex and complex design and implementation, as the practice of architectural work depends greatly on a set of artistic, scientific, mental and psychological abilities. From this standpoint, the architecture student's possession of a sufficient amount of these abilities guarantees his graduation as a conscious and mature architect capable of bearing the burdens. This can only be done by developing and updating the regulations and laws regulating the educational process, as well as developing the educational curricula periodically, which is every five years in accordance with the regulations of the Education Quality Assurance System, so that we obtain a graduate who is contemporary with the surrounding environment and meets the requirements of the labor market. It is not right to At present, the architecture student continues to study traditional curricula that have passed for more than fifty years without revision or addition. We present below two models, one positive and the other negative, for the issue of development in the architectural educational process.

- First, the positive model: The positive model appears in the noticeable development in architectural design tools and methods, as in the past the architectural designer relied on manual sketches to translate his ideas, and then transform them into executable engineering drawings. With the passage of time and the emergence and development of digital software, this software was used. In architectural design processes, manual sketching was transformed into digital sketching, and advanced digital programs helped in creating more complex and complex blocks and configurations that were not easy to obtain using traditional methods. Hence, we find a development in architectural thought accompanying this digital thought, and this has become evident in recent years. In the architectural education system, many students have adopted these ideas and free formations with the help of many digital programs such as 3d MAX & Rhino, through architectural design projects and graduation projects.
- Secondly, the negative model: The negative model appears in comparison with the previous positive model, where we see that the educational system was affected in one field, which is the field of architectural design, as a result of its influence on digital software development, and this development occurred spontaneously as a result of keeping pace with modern technology without making amendments to the governing regulations, but the negative side is that This development was not reflected in the rest of the educational materials, especially the working drawings materials, as these materials have an important role in studying how and how to implement these complex configurations, the configurations of which the student designs in the architectural design materials. To develop the working drawings materials, development must be introduced to the curricula from By presenting projects of this type to students in the higher academic groups and introducing the student to the foundations of implementing this type of buildings, and communicating with engineering offices and contracting companies working in this field and similar projects by organizing online lectures, for example, presenting similar projects and making field visits.
- Targeted academic subjects: There are a number of academic subjects that need revision because of their interrelation with each other, and as a result of the introduction of such new developments into them. These subjects include: -

Table 1: Targeted academic courses.

Architectural courses	Structural courses
Architectural design course	Structure analysis theory course
Executive designs course	Reinforced concrete course
Building technology course	Steel structure course
Computer science course	Materials properties course
Bill of quantities and specifications course	
Shadow and perspective course	
Materials and models course	

5. Questionnaire

The questionnaire will be conducted through a sample of academics, architectural designers, and workers in the field of building and construction (as specialists in the field of study preparation), consisting of 40 samples, in order to reach the extent of their impressions and information about free formation as a new concept, in line with modern trends concerned with free formation designs. As well as knowing the most important obstacles and challenges facing this new style, through which we can determine whether the study is valid, positive or negative.

5.1. Motives for conducting an opinion survey

Presenting the issue, discussing it, and polling the opinion of a sample of specialists expands the scope of the research vision to horizons beyond the limits of the theoretical study, so that at the conclusion of the process of conducting the questionnaire, the researcher will have a set of proposed perceptions, thus maximizing the opportunity to produce the desired results from the applied study. The questions were as follows.

Q1: Do you have information about the concept of Free Form Architecture?
A. I have good information.
B. I have simple information.
C. I have no information about this concept.
Q2: Through the designs attached in **Figure (3)**, for buildings with free formations. What is your impression of the design?
A. Good.
B. Acceptable.
C. Not acceptable.

Figure (3): Shows examples of free-form projects.

Q3: Through the designs attached (to the previous question), can you adopt the concept of free formations and then use them in your future works?
A. Yes.
B. No.
C. This is possible after learning about the mechanisms used.

Q4: Through the designs attached to Question No. (2), do the free designs add aesthetic values different from the traditional designs?
A. Yes.
B. No

Q5: In your opinion, to what extent do the following elements affect the limited spread of free architectural formation in architectural projects at the local level? A vision can be added to solve these obstacles, if any.
1. Legislative reasons (A-influential – B-uninfluential –C- to some extent).
2. The presence of financing obstacles due to the high cost of implementing these projects (A-influential – B-uninfluential –C- to some extent).
3. Avoid technical obstacles to implementing these projects (A-influential – B-uninfluential –C- to some extent).
4. The state or investor does not move towards this type of formation (A-influential – B-uninfluential –C- to some extent).
5. Suitable infrastructure and urban planning to accommodate this type of project (A-influential – B-uninfluential –C- to some extent).
6. Waste of space and irregularity of spaces (A-influential – B-uninfluential –C- to some extent).
7. This type of formation is suitable for national and iconic projects (A-influential – B-uninfluential –C- to some extent).
8. The length of the timeline for the project implementation stages (A-influential – B-uninfluential –C- to some extent).
9. Lack of specialized digital programs to help implement these projects, such as CATIA and CAD/CAM programs (A-influential – B-uninfluential –C- to some extent).
10. Real estate marketing for these projects (A-influential – B-uninfluential –C- to some extent).

11. The general audience that is the recipient of the marketing process (A-influential – B-uninfluential –C- to some extent).

Q6: Which of the following patterns do architectural education systems and methods focus on establishing in the architectural education system?
A. Traditional style.
B. The upgraded style of the old.
C. Creative style.

Q7: There is a legislative regulation regulating construction work in Egypt. Please express your opinion on its role in the design and formation process?
A. It organizes and controls urbanization.
B. The architect's freedom is restricted within a framework that prevents him from developing, advancing and creating.
C. Another opinion.

Q8: The implementation stage is the process that completes the architectural work. What is your assessment of the level of construction technology currently used in Egypt, along with the sizes and nature of the architectural projects in which this technology is used?
A. Relatively advanced.
B. Convenience.
C. Relatively late.

Q9: How do you evaluate the Egyptian architect's level of familiarity with the dimensions of global reality at the level of free architectural formation?
A. Good.
B. Acceptable.
C. Weak.

Q10: Based on the above, and from your point of view, what are the advantages and disadvantages of free architectural formation?
A. Positives.
B. Negatives.

The results of the questionnaire on the questions were as follows:

1- Regarding the first question, the results of the questionnaire showed through the proposed sample that 25% of the sample had good information, 70% had simple information, and 5% did not have any information **Figure (4)**.

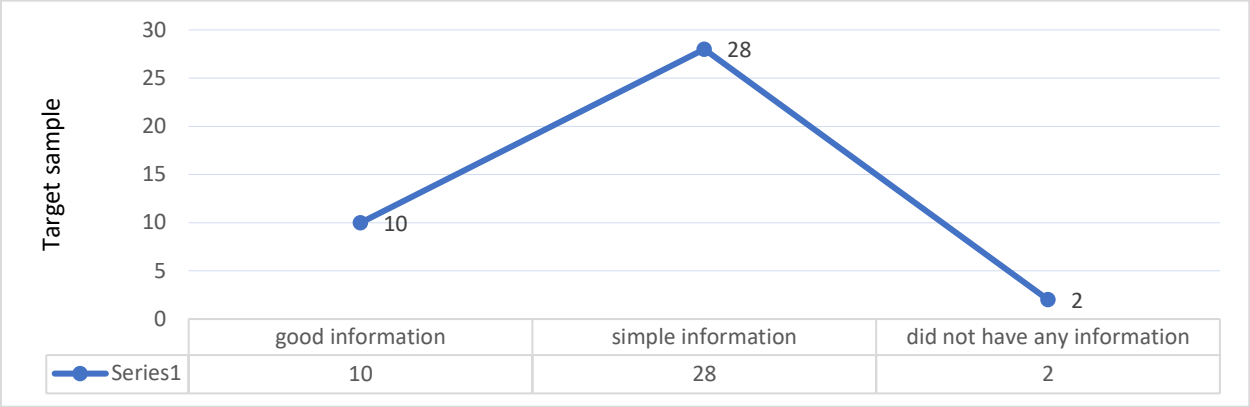

Figure (4): Statistical percentages for the first question.

2- Regarding the second question, the results of the questionnaire showed through the proposed sample that 60% of the sample had a good impression of the principle of free formation, 25% had an acceptable impression, and 15% had an unacceptable impression. Therefore, the value of 60% + 25% can be combined and the percentage of acceptance of this approach becomes The percentage of rejecting it is 85% **Figure (5)**.

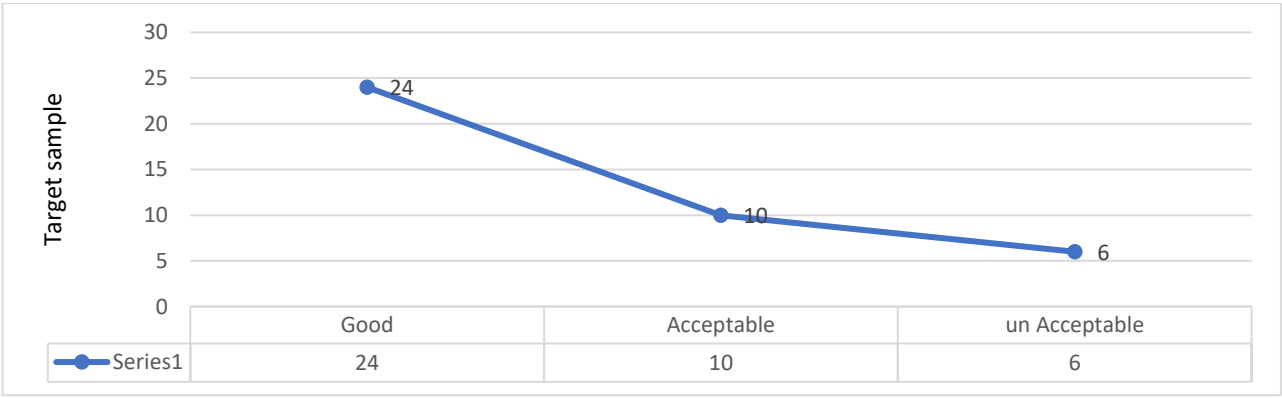

Figure (5): Statistical percentages for the second question.

3- Regarding the third question, the results of the questionnaire showed through the proposed sample that 15% of the sample can adopt the concept of free formations and then use them in their designs, 20% cannot adopt this concept, and 65% can adopt this concept after learning about its mechanisms, and through this percentage it is possible Combine the ratio of 15% + 65% so that the ratio becomes 80%, and this total percentage does not mind adopting this concept in its designs **Figure (6)**.

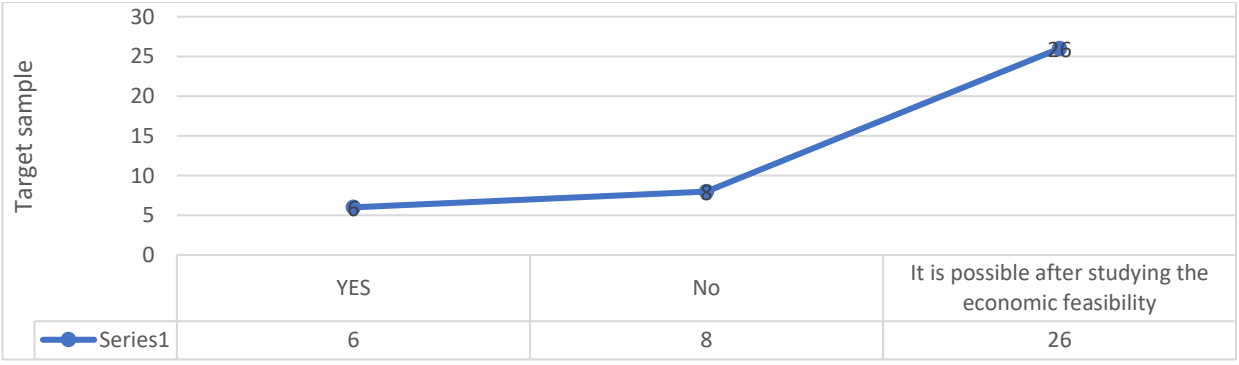

Figure (6): Statistical percentages for the third question.

4- Regarding the fourth question, the results of the questionnaire showed through the proposed sample that 80% of the sample confirmed that the free formations added new aesthetic values over the traditional formations, and 20% said that they did not add new plastic values **Figure (7)**.

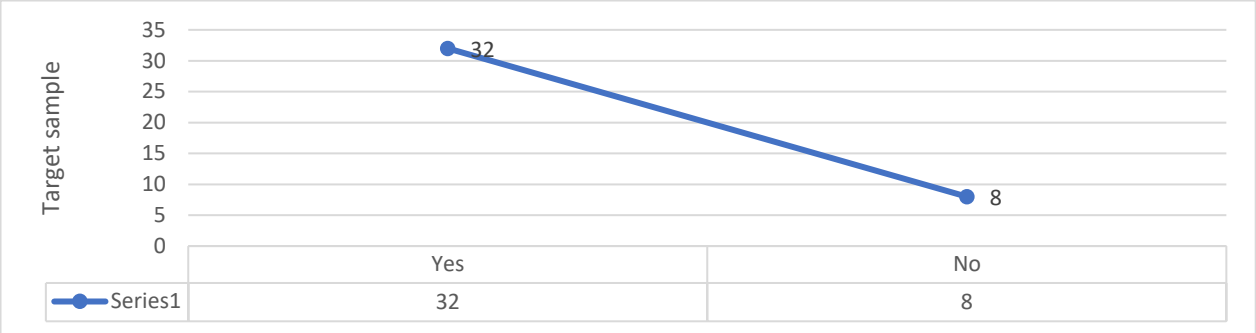

Figure (7): Statistical percentages for the fourth question.

5- Regarding the fifth question, the results of the questionnaire were as shown in the following figure **Figure (8)**.

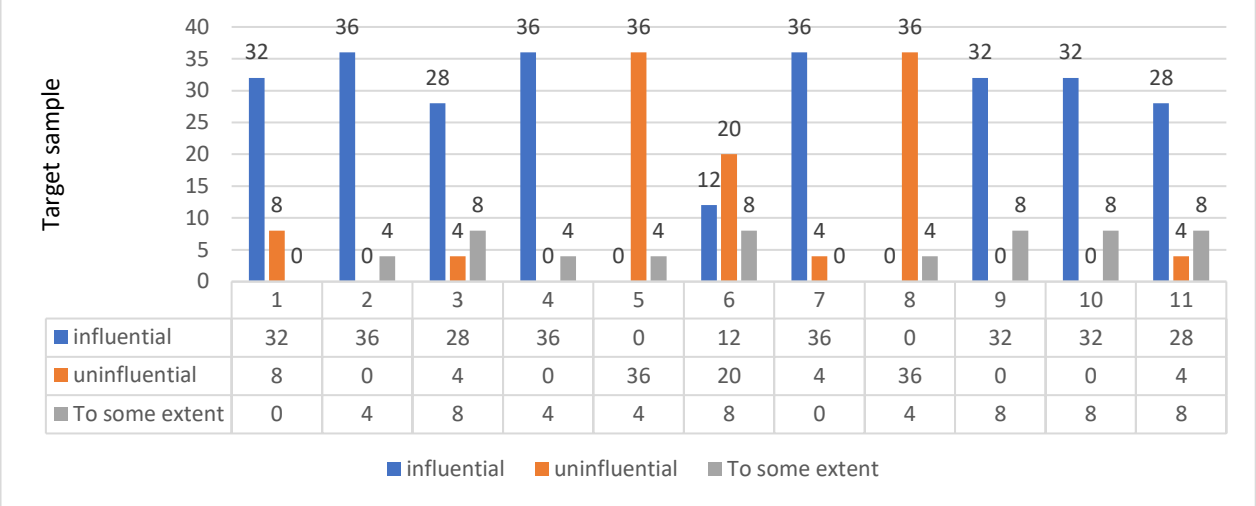

Figure (8): Statistical percentages for the fifth question.

6- Regarding the sixth question, the results of the questionnaire showed through the proposed sample that 70% of the sample confirmed that the systems and methods of local architectural education focus on the traditional style, 20% that they focus on the developed style of the old, and 10% on the creative style **Figure (9)**.

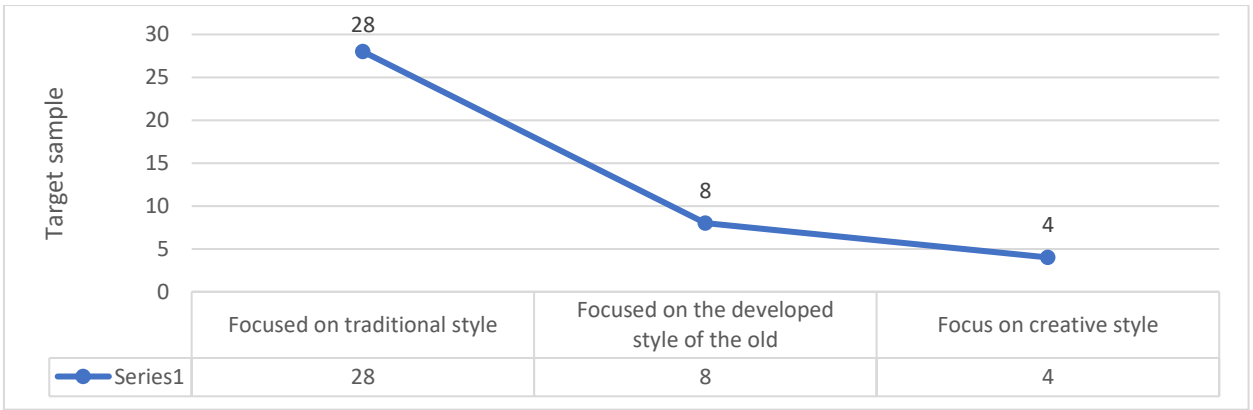

Figure (9): Statistical percentages for the sixth question.

7- Regarding the seventh question, the results of the questionnaire showed through the proposed sample that 38% of the sample emphasized that building laws regulate and control urbanization, and 50% that they restrict the freedom of the architect in a framework that prevents him from progressing and creativity, and 12% had another opinion (we present the most important opinions below follows) **Figure (10)**.

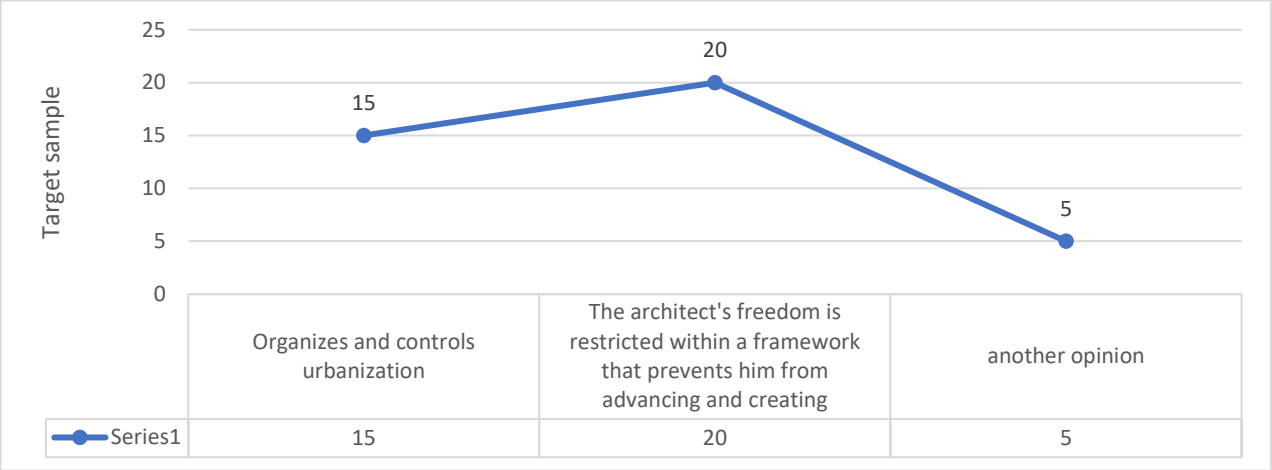

Figure (10): Statistical percentages for the seventh question.

Other opinions were as follows:-

- Legislative laws for urbanization are superficial and do not influence the field of desired and positive urban control.
- Laws are often made for the sake of specific interests and therefore do not reflect a natural, environmental, social or economic reality.
- Building laws are flawed by randomness, frequent amendment, and the lack of good mechanisms for follow-up and implementation.
- Sometimes it gives freedom to the architect in some points that harm the general content of the environment and heritage.

8- Regarding the eighth question, the results of the questionnaire showed through the proposed sample that 0% is relatively advanced, 40% is appropriate, and 60% is relatively behind **Figure (11)**.

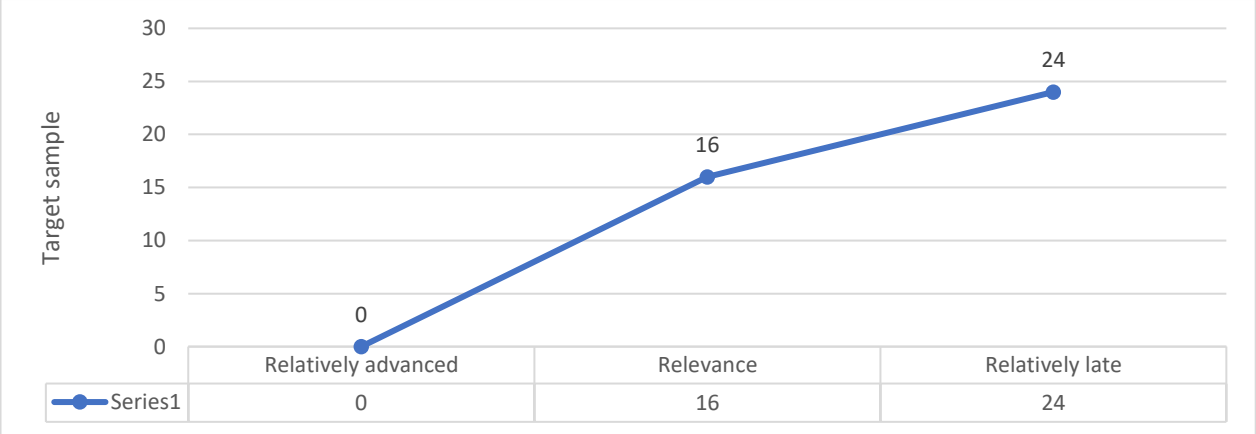

Figure (11): Statistical percentages for the eighth question.

9- Regarding the ninth question, the results of the questionnaire showed through the proposed sample that 5% is good, 30% is acceptable, and 65% is weak. Therefore, the two values 5% + 30% can be combined so that the percentage of the Egyptian architect's knowledge of the dimensions of global reality or not is 35% compared to 65% **Figure (12)**.

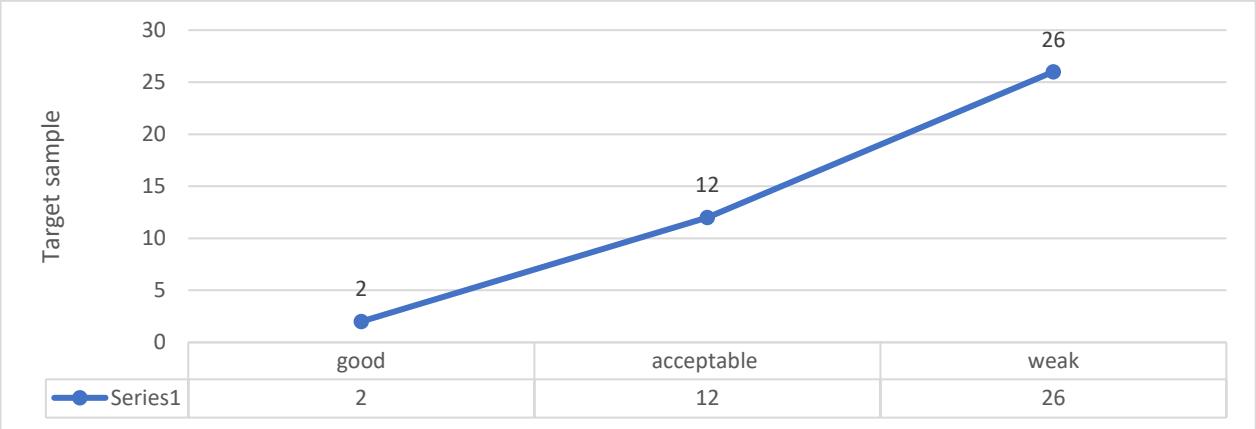

Figure (12): Statistical percentages for the ninth question.

10- Regarding the tenth question, the results of the questionnaire showed, through the proposed sample, a number of positives and negatives, which we conclude as follows: -

Positives.

• Free formations provide a distinctive and unique formation that suits national projects.
• Achieve flow and distinctive visual formation that contributes to drawing the urban image of the city.
• Good if the project is iconic and symbolic, such as the Egyptian Museum, the Library of Alexandria, and the Museum of Civilization.
• It gives an opportunity for freedom of creativity and inventing what is new and out of the ordinary.
• The value of excellence and uniqueness in the iconic architectural composition, which can be an urban branding value through the symbolism of the free and distinctive architectural formation, especially if it carries a certain intellectual philosophy expressed by Concept Philosophy.
• It reflects the technology of the era, the country of origin, the skill of the designer, and a measure of the extent of his knowledge and capabilities.

Negatives.

• Relatively expensive compared to traditional configurations.
• It requires a longer timetable due to its overlapping and many details.
• It affects the irregularity of spaces in buildings that require clear spaces, such as residential and educational buildings.
• There are some functional defects in terms of creating unexploited spaces as a result of the thickness and distortion of the walls, and exposure to complex construction solutions.
• Free formation requires trained manpower for this type of project, and it also requires the presence of specialized software and technical equipment that contribute to the implementation process.

5.2. Statistical study of the questionnaire

Where the first cell refers to the question number, the second cell refers to the optional measurement elements indicated by the symbols (A), (B), and (C), and the third cell refers to the measurement value, graduated from (3) to (1), in the event that the questions are considered to be of the positive type. It is the one that is consistent with the objectives of the study. The fourth cell indicates the numbers of the sample participating in the questionnaire, then the fifth sample indicates the relative weight, and the sixth cell indicates the amount of the standard deviation, which symbolizes the extent of the dispersion of opinions about the measurement element. The seventh cell also indicates the percentage. The percentage of agreement of opinions on a particular item, and the eighth cell indicates the direction of the sample, meaning the direction of the opinions of the participating sample towards one of the types of measurement items. **Table (02):** Show Statistical study of the questionnaire.

Table (02): Statistical study of the questionnaire

Question number	Measurement elements No.	Measurement value	Measurement sample	SMA	standard deviation	percentage	Sample path
Q1:	(A)	3	10	2.2	0.52	73.33	(B)
	(B)	2	28				
	(C)	1	2				
Q2:	(A)	3	24	2.45	0.22	81.67	(A)
	(B)	2	10				
	(C)	1	6				
Q3:	(A)	3	6	1.5	0.75	50.00	(C)
	(B)	2	8				
	(C)	1	26				
Q4:	(A)	3	32	2.6	0.81	86.67	(A)
	(B)	1	8				

Q5:	Measurement Element no.			SMA	standard deviation	percentage	Sample path
	(A)=3	(B)=2	(C)=1				
1	32	8	0	2.8	0.4	93.33	(A)
2	36	0	4	2.8	0.61	93.33	(A)
3	28	4	8	2.5	0.82	83.33	(A)
4	36	0	4	2.8	0.61	93.33	(A)
5	0	36	4	1.9	0.3	63.33	(B)
6	12	20	8	2.1	0.71	70.00	(B)
7	36	4	0	2.9	0.3	96.67	(A)
8	0	36	4	1.9	0.3	63.33	(B)
9	32	0	8	2.6	0.81	86.67	(A)
10	32	0	8	2.6	0.81	86.67	(A)
11	28	4	8	2.5	0.82	83.33	(A)

Question number	Measurement elements No.	Measurement value	Measurement sample	SMA	standard deviation	percentage	Sample path
Q6:	(A)	3	28	2.6	0.67	86.67	(A)
	(B)	2	8				
	(C)	1	4				
Q7:	(A)	3	15	2.25	0.67	75.00	(B)
	(B)	2	20				
	(C)	1	5				
Q8:	(A)	3	0	1.4	0.5	46.67	(C)
	(B)	2	16				
	(C)	1	24				
Q9:	(A)	3	2	1.4	0.59	46.67	(C)
	(B)	2	12				
	(C)	1	26				

By extrapolating the theoretical study and the results of the questionnaire to the opinions of specialists and agreement among the largest number of the sample, the following results were reached: -

5.2. RESULTS AND DISCUSSION

5.2.1. At the level of free formation in general

• A high percentage of academics and architectural designers have knowledge of the concept of free architectural formation, but it stops at being purely theoretical knowledge.

• A high percentage of academics and architectural designers have a good impression of this new trend and there is no categorical rejection of it. This percentage also does not mind adopting this concept in part of their work if they are sufficiently familiar with its mechanisms.
• A large percentage of architects and specialists confirmed that free formations added new aesthetic values that did not exist before, and consequently these values and plastic vocabulary can be included in the list of traditional architectural vocabulary through educational curricula in architecture schools.

5.2.2. At the level of obstacles and challenges facing free formation

• The result of Question No. (5) revealed a number of challenges facing this new trend, the most prominent of which were urban legislation, financing obstacles, and the technique of implementing such projects due to their difficulty, and the lack of the state or investor's direction towards this type of project due to lack of sufficient knowledge about it, as well as the lack of some Specialized digital software and assistance in this field, and then these limitations can be overcome through the following:-

 Regarding the legislative obstacle: The legislative obstacle can be overcome through periodic reviews of building laws and requirements and linking them to developments in the labor market, academic studies and the development of architectural thought. There should also be a degree of flexibility in making some legislative exceptions related to heights, protrusions, the shape of openings and their proportions, the shape of the block and the architectural style. For some projects of a special nature and cultural and national projects.
 Regarding the financing obstacle: Creative free formations can be a source of income that achieves an economic return that exceeds many times their costs. Here we can mention a number of examples that confirm this vision. The first example is the (Sydney Opera) project in Australia, which has become a symbol not only of a city but of an entire continent and has become A shrine and tourist destination for many. The second example is the (Guggenheim Museum) project in the city of Bilbao, Spain. The city of Bilbao was suffering from a severe economic recession, so the government decided to enrich the city's tourism movement by constructing a distinguished building designed by a famous architect (Frank Gehry). This project actually achieved its desired goals. It achieved economic returns many times greater than its cost. The third and final example is the Walt Disney Concert Hall project. This project was exposed to major problems during implementation due to lack of funding. After overcoming these obstacles and implementing it, this project became an architectural icon and became a tourist destination and was used in many filming projects. From cinematic films and concerts, which brought him unprecedented popularity and achieved high financial returns.
 Regarding the obstacle to implementation methods: Implementation obstacles can be overcome by trying to reduce the number of models and standard units used in these types of projects, and resorting to standardization processes with advanced thinking.
 Regarding the digital software obstacle: The obstacle of the unavailability of some specialized software can be overcome by trying to import and localize this advanced technology, working to produce it locally, and training specialists in it, such as CAD/CAM & CATIA programs.

Conclusions

Egyptian architecture throughout history has been a fertile source of architectural formations and principles from which the world has drawn, but this situation has changed at the present time. Egyptian architecture has lagged behind the path of global civilization, abandoned its pioneering role, and occupied a marginal position in the global reality. There is no doubt that these negative aspects are reflected. On all aspects of life, including architecture and urbanism. Although contemporary Egyptian architecture contains some serious, distinguished and successful architectural works, whose designers worked hard to achieve and satisfy most human, cultural and material needs, many architectural thinkers attest to the scarcity of these works compared to the total architectural production. Locally, there are a greater number of buildings that do not live up to the status of architecture, as they failed to meet the needs and aspirations of society. The result is that the general impression of contemporary Egyptian architecture is that it suffers from chaos, neglect, and negligence. This was one of the most important motivations for conducting the study, which is concerned with the reasons for the limited integration of horizons. Free formation in architecture with the design mechanisms of architects. The study made it clear, through conducting a questionnaire study of a sample of specialists, that there is no objection to adopting this contemporary plastic trend and that this trend added and gave new plastic values that did not exist before, but this process faces a number of challenges. Some of the obstacles are related to the architectural designer in terms of the inability to engage in these new experiences and to rely on the traditional style more than the creative style. Some of these obstacles are related to urban legislation that imposes many rigid restrictions on the freedom of thought and architectural creativity and does not understand the nature of architectural work, and others are from These obstacles are represented by other elements, such as financing processes and processes related to the difficulty of implementing these complex models, and the length of the project schedule. There are also some technical obstacles, represented by the lack of availability of some specialized digital software and assistance in this field due to the high cost of some of them, and that the level of implementation technology is lagging behind. Relatively speaking, the study ended with developing a practical vision for dealing with these obstacles and working to solve them, which was presented in the section related to discussion and conclusions.

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