



## *A Proposed Model for Measuring the Performance of Urban Form's Aesthetics*

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### **Abstract**

The research discussed the theoretical concepts related to beauty in general and the aesthetics of urban formation in particular, which is concerned with the interpretation of sensory perception of the aesthetics of visual formation and the perception of the urban environment in its functional and intellectual dimensions. The research also discussed the different approaches to explain the visual formation or the image of the city, in order to derive the criteria for measuring the performance of the aesthetics of the urban formation of the city centre, which was based on the eleven Edinburgh criteria. The research added a new criterion representing modern technologies and smart materials to become twelve criteria. The research was able to analyse the main criteria into a set of sub-criteria with 76 criteria, then extract their characteristics and performance indicators (KPIs) for each criterion with a total of 291 indicators. The relative weights of these indicators were also calculated in a mathematical way based on the frequency of the indicator through the analysis of (9) experiments (including 5 global & 4 regional). These indicators were established to produce the proposed model for measuring the performance of the aesthetics of urban formation, which is the main objective of the research, and it was tested by applying it to the Egyptian experience on city centres of different generations represented in the 6th. of October, Al-Rehab, the New Administrative Capital and Madinaty. The performance ratios were: Al-Rehab 81.69%, and the New Capital 80.70%, Madinaty 69.35%, and 6th. of October 69.00%.

**Keywords:** A Proposed Model, Key Performance Indicators (KPIs), Urban Form's Aesthetics



## 1. Introduction

Man deals in his life with a series of formations, either aesthetic that mimics his sense and taste, or expediency that leads him to a specific function, or formations in which the concept of benefit and beauty is integrated. There are arts such as sculpture, drawing and photography that may be free of the utilitarian element in their formations, and there are other formations, such as mechanics, that are dominated by the utilitarian side far from aesthetics. As for the applied arts, including architecture, urban formation is linked to a utilitarian and aesthetic purpose because it is a figurative void space that the person perceives, containing within it a certain human activity aimed at achieving a specific benefit or purpose.

The urban formation consists of two basic elements, mass and space. Each of them carries characteristics, features and other secondary elements within a specific organizational framework, accompanied by visual perceptions of the person in which he performs a specific activity. These visual perceptions often constitute a certain spontaneous feeling that can be separated from emotional, moral or rational feeling, and can be called aesthetics [1],[2]. These Aesthetics are mainly concerned with the aesthetic feeling or perception resulting from the interaction between creativity in the urban formation and the human being. This is the extent to which aesthetics is effective in its scientific purposes, and here is confirmed by the fact that the elements that belong to a particular category when realistic comparison based on factual foundations establish what is known as aesthetic value, [3].

Determining the distinguishing characteristics on which aesthetic value depends is a vital problem of aesthetics, and aesthetic judgments are mostly managed by a number of factors, for example, symmetry, unity, coherence, ... etc. [4] and change over time. Aesthetic judgments are related to two main groups in meaning. The first group is related to the procedures of cognition, as evidenced by its derivatives, the absence of cognition, and the instinctive awareness. The second group is related to the concept of aesthetics as it is circulated in the humanities, philosophy and art history.

The study follows the term aesthetics as defined by Jacobsen (2010) and [5], which can be summarized as follows: The neurological phenomenon in which stimulation of a sensory or perceptual factor influences the judgment of satisfaction or dissatisfaction. In other words, it creates an immediate response to a person's perceptual stimuli. As much as the urban formation carries new creative images and ideas, the more this becomes a motive for the human mind to absorb this formation (immediate response), so the formation is an expression of the identity and urban uniqueness of the study.

### **1.1. Research problem:**

The research problem lies in the fragmentation and excessive randomness of the urban environment that is not governed by any controls of urban formation or a mechanism to measure the performance of the aesthetics of this formation for the urban designer and the extent of satisfaction or dissatisfaction of the members of the community according to the degree of awareness, cultural level and awareness of the aesthetics of the urban formation of the urban environment in which they live and belong to it .

### **1.2. Research objective:**

The study aims, at the local level, to develop and improve the theoretical understanding of the impact of the selected urban design principles on the judgments of the visual aesthetic qualities of the city centre, and to reach a mechanism that contributes to supporting the awareness of the aesthetics of urban formation for community members, and also helps the urban designer to measure the performance of the aesthetics of visual formation in the preparation design stage. before implementation, as well as measuring the performance of the urban formation of the urban centres of the existing cities.

### **1.3. Research Methodology:**

The research follows the inductive approach to find out the concepts of urban formation and urban centres. The research also adopts the Edinburgh criteria for urban formation with the addition of the criterion of modern technologies and smart materials.

Then, the research follows the deductive approach, by analysing some global and regional experiences, to extract the criteria, characteristics and performance indicators (KPIs) used to support the realization of the aesthetics of urban formation. Depending on these indicators, a proposed model is produced to measure the performance of the urban formation.

### **1.4. Research significance:**

This research contributes to raising the degree of awareness and the cultural level and awareness of the aesthetics of urban form, raising the efficiency of urban design, in addition to the possibility that the results related to measuring the aesthetic values of urban form.



### **1.5. Research limits:**

The research is concerned with studying the urban form of the city centre (CBD), or the spaces that contain public buildings.

## **2. Perception of the aesthetics of visual formation:**

The city, with its landmarks and its physical structure, are reflections of its natural and cultural heritage throughout history. Therefore, every city formed through time has its own visual formation and identity. (Thomas Jacobsen, R. I, 2006).

### **2.1. Aesthetics' concept:**

This concept is "the positive value that stems from the nature of the thing, and it is a dynamic and changing phenomenon that includes all the positive perceptions generated by the recipient that are accompanied by a feeling of pleasure" [6].

Certainly, waking behaviour can be considered "spontaneous" from a physiological point of view, such as the response to any action without the intervention of thought, but there is a sense of effort that forms an important part of the general feeling characteristic of the state of interest.

### **2.2. Aesthetic perception:**

The work of awareness and perception of the aesthetic entity begins with the feeling of effort in the aesthetic experience from the psychophysiological perspective, where the sensory organs (auditory or visual) are stimulated and this stimulation continues to ensure that the act of perception is effectively achieved that suits the interest in awareness. Al-Hariqi (2006) mentions several theories related to the aesthetic visions of the environment and space, focusing on the analysis and understanding of these values. Some believe that the aesthetic aspects are part of the daily experience, and that the aesthetic taste is just an innate response to the place, thus confirming the idea that a person obtains aesthetic pleasure from satisfying his innate needs. Others believe that beauty does not stem from the general view only, but rather from the source of comfort and satisfaction stemming from the spatial formation [7].

### **2.3. Aesthetic judgment:**

The axis of the aesthetic judgment is the most important aesthetic' expert. This judgment is usually based on sensory or mental judgment or the influence of

both [8]. The type of judgments in terms of their relation to the nature of aesthetic values is divided into two types of judgments, which are, [9]:

### **2.3.1. Pro forma value judgments:**

The aesthetic judgment of this style is related to the sensory values of formal formations such as the morphological and organizational properties of formations such as colour, size, rhythm, symmetry and dominance [10].

### **2.3.2. Symbolic values judgments:**

It is related to the symbols reflected in the formal formations, in which the role of form is limited to controlling the perception of the scenes, guiding them and directing their attention to the content, [11].

Halabi 1998 study deals with the issue of aesthetic judgment in the architectural form by analysing the effect of the formal characteristics of the product on the degrees of aesthetic response. The study concluded that the change in the formal characteristics at the level of the part does not affect the degrees of the aesthetic response compared to the formal characteristics at the level of the whole, which confirms the association of the aesthetic response with the overall characteristics of things without their molecules.

Abu-Ghazaleh 2006 assumed that the visual evaluation of the external appearance is the basis for the aesthetic evaluation in architecture, and that a model can be developed to measure and estimate the quality of the architectural and urban formation and composition visually, focusing on the element of the architectural facades where it determines the elements of formation on the facades (line, direction, shape, size, texture, luminous value and color). It divides the principles of formation and composition with facades into (unity, stability, rhythm, proportionality and scale). As for the forms of relationships between the vocabulary of formation, they are divided into compatibility, opposition and gradation. It also defines composition strategies with (elimination, grouping, addition, all). The process of measuring the quality and determining the value of the architectural formation aesthetically will always remain a relative process that differs from one individual to another, and that each environment and era has its own aesthetic philosophy that affects the formulation of criteria of aesthetic in architecture.

Gajender 2007, discusses the concept of aesthetic in design and its link to pleasure, emotion and experience of the recipient as he attempts to describe aesthetics in purely design terms without getting bogged down in mundane terms such as nice, appropriate and efficient. This is consistent with the writings of Cziksent, Dewy mihaly, and Gelernter in the fields of philosophy, psychology, and mathematics, which focus on terms such as attention, attraction, involvement,



active participation, and spoilage in shaping the recipient's overall aesthetic experience. The harmonious balance between the designer's intent and the viewer's expectations is directed towards the completion of the aesthetic experience, and it raises the importance of the damage between the recipient and the designer's product through the use of familiar formal vocabulary and then merging or dissolving them in new contexts and with unexpected relationships and transformations, which leads to attracting the recipient to what he is familiar with [12].

Mako 2007 was able to discuss the change of the concept of aesthetic in the twentieth century, taking the European experience as an example focusing on the impact of local and global concepts in the aesthetic judgment on architecture. Modernity and its later currents, where it focuses on the aspect or concept of locality and its connection with aesthetic judgment, [13].

Al-Halabi (1998) shared the principle of Wholeness as a basis for the unity of formation with the ideas forming it, where he suggests that the form always expresses its specific individuality through its expression of unity through the diversity of ideas it presents and their interrelationship in one unit.

From this analysis to realize the aesthetics of urban formation, it becomes clear that the first aesthetic judgment operates at the global level of the pattern related to the principle of free self-creation and the second develops at the local level as it relates to creative subjectivity with local creative imagination and collective memory. It is necessary to separate the local and international experience in interpreting the aesthetic judgment, just as the overall picture is a basis in the unity of formation [14].

### **3. Visual Perception of the Built Environment:**

The process of realizing the urban environment is done by drawing a mental picture of the elements of urban formation and its aesthetics, which is a complex process in which the human senses and memory contribute, and in which the person sees the urban environment at once and then tries to analyse its elements and link them with relationships with each other. The stages of perception include: receiving influences, then giving meaning to them, and ending with forming an impression or a mental image. In terms of characteristics, they include attention, simplicity, and composition. A number of factors affect the perception of the built environment, including: meaning, exposure, formation, and composition [15].

There are three levels involved in the process of human perception of the elements of the built environment

### **3.1. Realizing the visual dimension:**

The term "perception" is used to express the method of individuals acquiring their direct sensory experience of all the material elements surrounding them [16].

### **3.2. Awareness of the functional dimension:**

The term cognition is used to express the method of understanding the environment and is a method of mental mapping.

### **3.3. Realizing the intellectual dimension:**

It is the psychological method for giving preference to the quality of the environment that people like, and the term evaluation or preference is used to express this. Also, the psychological and mental needs of the human being must be taken into account when designing urban spaces (such as balance and safety), and the clarity of visual perception depends on several factors, including the following:

#### a) viewing conditions, including:

Speed of sighting: when watching is from a person walking on his feet, watching him is better than when he is riding a means of transportation. The way of viewing: the person who enjoys the freedom to watch during his movement between parts of the city, the presence of the means of transportation leads to a restriction of movement and freedom of viewing, and vice versa for the person who walks on his feet. Lighting: viewing the item during the day with the availability of natural lighting that highlights all its parts clearly to people is different from viewing the item at night with the availability of artificial lighting.

#### b) Design features include:

The value of the element: since the elements of historical, religious, cultural and aesthetic value are a source of attraction to them more than other elements. Levels of elements: high elements attract attention more than relatively short elements, (contrast). Spatial control of the element: that is, the presence of an element such as a monument in the middle of a public square, so it is the dominant element. Colour sovereignty of the element: as the elements with prominent or distinctive colours are a source of attracting attention in a distinctive way from the surrounding elements. Item size: Large-sized items are quick to catch the eye, unlike small items. The beauty of design: the element that has a distinctive architectural design has a striking visual perception from other similar and traditional elements.



c) The place the element, including:

Axiality: the element that is placed in a pivotal place, such as the mediation of an aesthetic element at a crossroads, leads to its visual perception from various directions. Proximity: the near elements can be looked at and understood visually better than the distant elements. Repetition: The repetition of the presence of the element helps to better visualize it, such as the repetition of arches in the portico or columns in the Greek temple.

d) The composition of the elements, including:

Clarity of design the clarity of a network of roads leads to the ease of understanding it mentally, unlike a complex network of roads. The simplicity of the design (uncomplicated), as the complex design is an element of visual distortion and an element Distinguishing the element: the element is characterized by either its repetition or gradation or the achievement of the element of surprise or the difference in size, or the presence of a tower in which the glass was one of the basic elements of its composition in the middle of the colour or the materials it is made of, for example, a commercial area with similar buildings to some extent with close heights, the distinctive height and the type of materials From which the tower is made, it attracts attention to it

Yard, Apple, 1969 indicated that the ease of seeing and perceiving buildings depends on

- Viewpoint Intensity
- Viewpoint Significance
- Immediacy

**4. Criteria governing the aesthetics of the urban formation of the city centre:**

Urban shaping depends on a set of aesthetic criteria governing the performance of the vocabulary used by the urban designer to draw the visual image [17]. which affects the perception of users and beneficiaries. These standards agree in one goal, which is to try to reach the urban environment to the mind and emotion of the residents and visitors, or more precisely the interaction of these terms used with the awareness of the recipient to generate and draw his mental image, which makes these standards a means of measuring the performance of the aesthetics of urban formation. [18].

Based on the criteria of urban design in accordance with the "Edinburgh Urban Design Criteria", which were identified in eleven criteria, but they did not include modern technologies and smart materials, which is a major criterion



influential in measuring the performance of the urban formation of the city center, so it can be added to the Edinburgh standards. The following is a presentation and analysis of these criteria into sub-criteria and distinct characteristics for each criterion, then determining the key performance indicators (KPIs) for each criterion, Figure (1), and the tables (from 1 to 12).

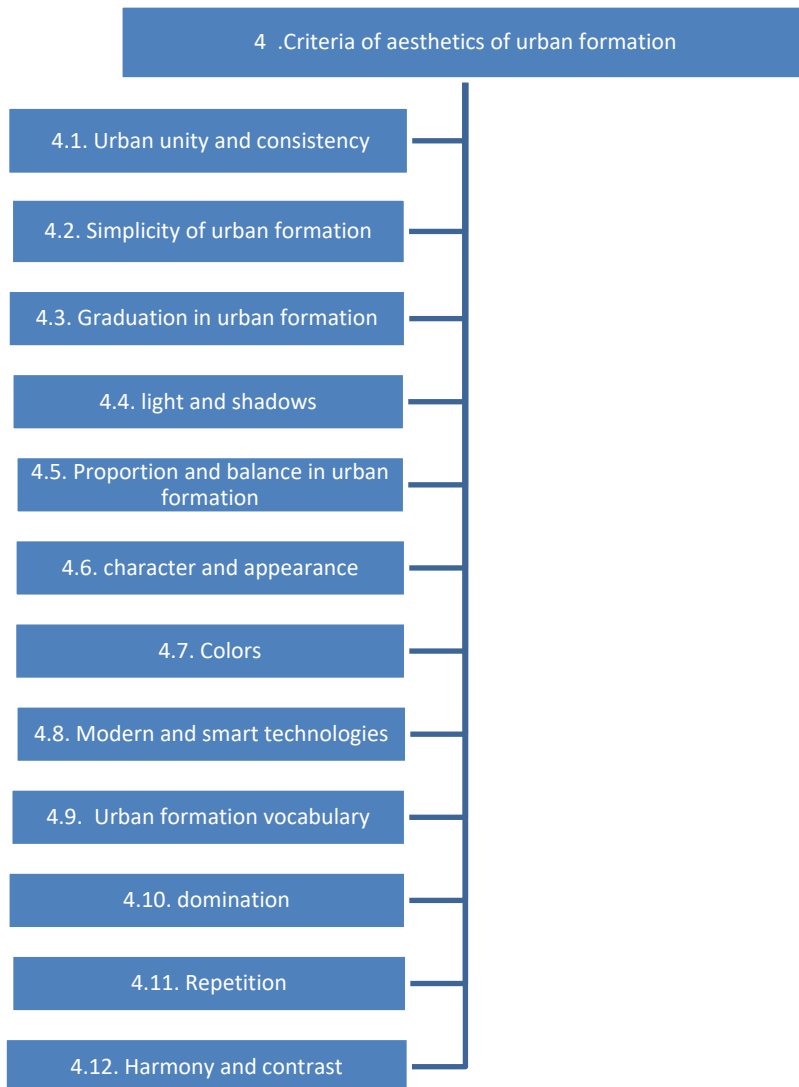


Fig. (1): Criteria of aesthetics of urban formation Analysis of the criteria for the aesthetics of the urban formation of the city centre.



Table (1): Analysis of the 1st. criterion for urban formation, "Urban unity and consistency"



Main criteria	Sub-criteria	characteristics	urban formation models
4.1. Urban unity and consistency	4.1.1. building unit	Unity in urban design expresses the presence of common characteristics between groups of buildings, highlighting the importance of the common characteristic between buildings.	
	4.1.2. briefing		
	4.1.3. bonding		
	4.1.4. continuity		
	4.1.5. vitality	Unity does not mean the similarity between all parts of the architectural work, but there can be a lot of diversity, and these parts must come together to become a coherent whole, creating a kind of continuity and visual homogeneity between the elements of the urban formation	
	4.1.6. homogeneity		
	4.1.7. Integration into configuration		
	4.1.8. The buildings are similar to each other	Unity in design is achieved when the designer succeeds in achieving two basic considerations: the relationship of the parts of the design to each other, the relationship of each part to the whole	<p>source: archdaily.net source: behance.net</p>
	4.1.9. visual diversity	The principle of unity in design stems from the contemplation and awareness of nature and life	

Table (2): Analysis of the 2nd. criterion of urban formation "simplicity of urban formation".




Main criteria	Sub-criteria	characteristics	urban formation models
4.2. Simplicity of urban formation	4.2.1. Clarity	Simplicity means abstraction and avoidance of fetishism and embellishment, and it has new ideas in employing materials and needs as well as lifestyles.	 <p>source:</p>
	4.2.2. Absorption capacity		
	4.2.3. Induction and comprehension of the elements	The more the elements of urbanization are simple and easy to comprehend in the mind, the greater their chance to represent part of the mental impression	 <p>aurora.hopefuls14.com source: menblogs.net</p>
	4.2.4. Shaping elements	One of the trends that are subject to simplicity in its composition is the architecture of modernity, which simplifies the forms and rejects the decoration, and depends on the use of straight lines and simple vocabulary	
	4.2.5. Clarity of focal points		

Table (3): Analysis of the third criterion for urban formation, "gradation in formation".

Main criteria	Sub-criteria	characteristics	urban formation models
4.3. Gradient formation	4.3.1. gradient motion paths	Granularization contributes to improving the quality of the built environment, and avoiding large and sudden shifts between spaces.	 <p>source www.startimes.com</p>
	4.3.2. space gradient		
	4.3.3. gradual rhythm	Security and safety are linked to the hierarchy of urban spaces	



		<p>They range from public to semi-public spaces, then semi-private, to end with the private.</p> <p>Be a basis for the development of social relations and human requirements.</p>	
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Table (4): Analysis of the 4th. criterion for urban formation "light and shadows".



Main criteria	Sub-criteria	characteristics	urban formation models
<b>4.4. light and shadows</b>	4.4.1. Read urban formation and its vocabulary	Light is able to bring about a tangible change in terms of its physical nature in the urban formation.	 <p>Source: landezine.com</p>
	4.4.2. lighting functionality	Light with shape and material contrasting and intersecting elements that mainly affect the quality of urban spaces and formations	 <p>Source: Designboom.com</p>
	4.4.3. urban formation		
	4.4.4. Comfort and psychological effect	Light is a rich element because of its distinctive properties and artistic methods	
	4.4.5. Improving the function of urban space	<p>Every built or decorated part acquires presence and beauty by the effect of the light formed in it.</p> <p>Realizing the effect of contrast between shadow and light confirms and shows urban formations</p>	

Table (5): Analysis of the 5th. criterion for urban formation "proportionality and balance in urban formation".


Main criteria	Sub-criteria	characteristics	urban formation models
4.5. Proportion and balance in urban formation	4.5.1. fit the scale	The importance of observing proportion and proportionality in the urban formation lies in highlighting the beauty of its composition and the relationship of its elements with each other between height, depression, mass and emptiness.	 <p>source: <a href="http://www.cabe.org.uk">http://www.cabe.org.uk</a></p>
	4.5.2. Scale sections		
	4.5.3. Aesthetic proportions of urban formation		
	4.5.4. degree of containment	Formation does not complete its beauty unless it achieves the aesthetic proportions such as the golden ratio.	
	4.5.5. balance		
	6.5.6. shaping equilibrium		
		The aesthetic of urban formation is achieved by balancing masses with space	

Table (6): Analysis of the 6th. criterion for urban formation "personality and appearance".

Main criteria	Sub-criteria	characteristics	urban formation models
4.6. character and appearance	4.6.1. clarity of identity	The formation clearly expresses the use or function it performs for easy extrapolation.	
	4.6.2. character privacy		
	4.6.3. urban character		






	4.6.4. functional expression	It is that the composition expresses his personality.	
	4.6.5. selection		
	6.6.6. Personality	Awareness of the activities that occur through the mental image drawn to the recipient.	
	4.6.7. urban fabric	The difference in the mental image of the recipient depends on culture, experience, and others.	
	4.6.8. historical function		
	4.6.9. Avatar and meaning		
	4.6.10. visual enrichment		
	4.6.11. blocks and surfaces		

Table (7): Analysis of the 7th. criterion for urban formation "colours".

Main criteria	Sub-criteria	characteristics	urban formation models
4.7. Colours	4.7.1. colour harmony	Colours give things life and give them different meanings	
	4.7.2. colour contrast	Colours are associated with social and cultural suits and meanings and differ from one people to another according to the cultural inheritance	
	4.7.3. Psychological effect of colours		source:
	4.7.4. texture		Colour plays an important role in the psychological impact on humans
	4.7.5. Raw materials (building materials)	The surface properties of materials are perceived through visual vision  Building materials reflect the nature and characteristics of the formation elements and their variation occurs diversity.	<a href="http://pdf.archiexpo.com">http://pdf.archiexpo.com</a>

		The distinctive formation achieves the harmony of the colours, texture and materials of the materials used	
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Table (8): Analysis of the 8th. criterion for urban formation "modern and smart technologies".

Main criteria	Sub-criteria	characteristics	urban formation models
4.8. Modern and smart technologies	4.8.1. Kinetic techniques	Smart materials are characterized by: Immediacy (immediate reaction), Transiency (reaction to more than one environmental condition), Self-actuation, Selectivity The ability to choose the reaction or predictive	They can be classified according to their intrinsic properties into: modifiable smart materials, color-changing smart materials, and smart materials capable of changing bonding.  It can also be classified according to its ability to convert energy into: smart light-emitting materials, smart electricity-generating materials, smart energy-storing materials  They are also classified according to their ability to respond to an external stimulus into: smart materials that are capable of changing properties, smart materials that have the ability to transfer energy, smart materials that have the ability to reflect
	4.8.2. smart building materials		
	4.8.3. smart covers		
	4.8.4. photovoltaic cells		

Table (9): Analysis of the 9th. criterion for urban formation "vocabularies of urban formation".

Main criteria	Sub-criteria	characteristics	urban formation models
4.9. Urban formation vocabulary	4.9.1. Architectural composition	It means the elements used in the architectural and urban formations and formations	
	4.9.2. Architectural character		







4.9.3. Optical unit	<p>Helps in understanding, perceiving and seeing the urban formation</p> <p>The success of urban design depends on the skill and experience of the designer in dealing with blocks and using the vocabulary of urban formation</p> <p>The vocabulary of urban formation varies from one era to another, depending on the customs, traditions, cultures and the different nature of life for each era from the other.</p>	  <p>:source: pooka preserve,2011 Source: elmogaz.com Source: www.google.com</p> 
4.9.4. Architectural balance		
4.9.5. Architectural Expression		
4.9.6. cultural and civilization identity		
4.9.7. Functionality		
4.9.8. the shape		
4.9.9. Site layout elements		
4.9.10. environmental functions		
4.9.11. permeability		
4.9.12. Diversity		
4.9.13. Sustainability		

Table (10): Analysis of the 10th. criterion for urban formation "domination".

Main criteria	Sub-criteria	characteristics	urban formation models
4. 10 Domination	4.10.1. The importance of the architectural element	Dominance is one of the most prominent visual characteristics of urban formation	 <p>source: albawabhnews.com</p>
	4.10.2. Size and scale of building block	The dominance of an element in the built environment over the surrounding environmental elements, in terms of size, density, and importance necessarily leads to its realization as an important	
	4.10.3. building block shape		






	<p>4.10.4. The nature of the building's relationship with the urban fabric</p>	<p>element, to which secondary elements are linked.</p> <p>It is required to achieve the concept of control in a public field, for example, that the field is directed towards an important building, or a group of buildings, to which the urban environment is connected.</p> <p>It is not necessary for the element to be a single element (it can be a group) in order to control the surrounding elements.</p>	 <p>source: Mosoah.com:</p>
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Table (11): Analysis of the 11th. criterion for urban formation "repetition".

Main criteria	Sub-criteria	characteristics	urban formation models
4.11. Repetition	4.11.1. repetitive unit	<p>Repetition adds visual interest to the design. Repetition helps identify groups of items. Repetition is a way to add consistency to the design.</p> <p>The intensity of the repetition of the elements serves to create a visual unity. It translates into simple elements such as colours, spatial interrelationships, shape, and texture. Repetition is one of the components of the law of unity, which is one of the most important pillars of beauty</p> <p>The properties of repetition are represented in the number of recurring elements, the dimensions of the elements in</p>	
	4.11.2. Repetition at the architectural level		<p>Complete repetition of more than four elements Source: www.explainer.com</p>
	4.11.3. Repetition at the urban level		
	4.11.4. homogeneity		<p>Complete repetition of less than four items</p>
	4.11.5. rhythm repetition		
	4.11.6. continuity of repetition		



		<p>relation to the spaces between them, grouping and hierarchy</p> <p>Grouping the items in a way that does not exceed three or four within the total repetition leads to focusing on each of them. Increasing the number of elements more than four without any divisions or breaks between them, leads to an increase in the neglect of the element itself.</p>	
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Table (12): Analysis of the 12th. criterion for urban formation "Harmony and Contrast".

Main criteria	Sub-criteria	characteristics	urban formation models
<b>4.12.Harmony and Contrast</b>	4.12.1. Contrast with the back perimeter	Contrast includes contrasts in the spaces. Harmony expresses the presence of harmony between the visual features of the different elements in the environment. There is no compatibility or harmony equivalent to the visual compatibility arising from a building that was built from the same materials as the surrounding landscape.	 <p>source: Expatliving.sg</p>
	4.12.2. overall contrast		 <p>Source: abrittonphotography.com</p>
	4.12.3. exposure		
	4.12.4. functional importance		
	4.12.5. Diversity	Clarity of the element's vision from more than one direction, and its clarity with its local surroundings. Variation is related to functional importance, for example, his money and an important job vary with his position, due to the lack of visual clarity of the site.	

#### **4.2. The proposed model for measuring the performance of the aesthetics of urban formation and its application to a city centre:**

From the previous analytical presentation, the criteria for measuring the performance of the urban formation of the city centre were identified and extracted, which consisted of 12 main criteria and contained 76 sub-criteria and a set of characteristics for each criterion. Table (13 at middle) shows the derivation of measurement indicators for each criterion with a total of 291 standard indicators. The table also includes the mathematical analysis by measuring frequency on a group of city centres, including (9) experiments, (5) global and 4 regional), in order to calculate the relative weights for all indicators and criteria, which are the basis for producing the proposed model, Table (13 at left), for measuring the performance of the aesthetics of the urban formation of the city centre, in preparation for its application on the Egyptian experience, Table (13 at right).

#### **4.3. Criteria for selecting global and regional experiences:**

- That the city centre represents an important economic impact at the global level in relation to global experiences such as New York, London, Paris, Singapore and Amsterdam, at the regional level in relation to regional experiences such as Dubai, Istanbul, Rabat and Amman.
- A large density in the volume of frequent trips to the centre throughout the day, the social demographics of the visitors and their diverse activities and culture, and the diversity of the population according to the diversity of services and activities provided by the centre.
- Concentration of cultural and entertainment services such as theatres, theatres, museums, restaurants, and hotels such as New York, London, Paris, Dubai, Antalya, Izmir and Casablanca.
- Clarity of some of the basics of the aesthetics of urban formation, such as the urban character and cultural identity, as in London, Paris, Istanbul and Rabat.
- Clarity of the use of some modern technologies and smart covers, as in New York, Singapore, Amsterdam, Dubai and Istanbul.
- Some experiences enjoyed diversity in achieving some theoretical foundations for the aesthetics of formation, such as unity, urban consistency, simplicity, gradation in blocks and voids, dominance, repetition, diversity, harmony, contrast, colours and texture ... and others.
- The presence of diversity in the mental image and visual scenes, as in Istanbul and Paris.
- The presence of what stimulates the interaction between the visitor to the centre and the formation to realize its aesthetics.



- Existence of valuable architectural and urban landmarks as in London, Paris, Istanbul and Dubai.
- There is a similarity in the urban environment of some experiences with the Egyptian environment in one or more of its dimensions, as in Rabat, Casablanca, Amman, Dubai, Istanbul, Antalya, London and Paris.

Table (13): El-Nahas Proposed Model for Measuring the Performance of Urban Form's Aesthetic

The Proposed Model Component (Main Criteria, Sub-Criteria & KPIs)				Calculating the relative weights of the criteria and indicators (Frequency Method)										Evaluation of Egyptian Exp.				
Main Criteria	Sub-Criteria	Key Performance Indicators (KPIs)	KPIs Relative Weight %	Regional Experiments				Global Experiments				Total Frequencies	Sub-Criteria Relative Weight %	Madinaty	N Administration C	Al-Rehab	6th. Of October	
				Oman	Al-rabat	Istanbul	Dhobi	Amsterdam	Paris	London	Singapore	New York						
4.1. Urban unity and consistency:	4.1.1. building unit	Awareness of unity at the building level	0.0040	1	0	1	1	1	1	1	1	1	8	0.0135				
		Realizing unity on a group of buildings	0.0030	1	0	1	0	1	1	1	1	0	6					
		Unity mimics nature	0.0030	1	0	1	0	1	1	1	1	0	6					
		Philosophy of the formation of the structural unit	0.0035	0	0	1	1	1	1	1	1	1	7					
	4.1.2. briefing	The consistency of the formation with the activity	0.0040	1	1	1	0	1	1	1	1	1	8	0.0150				
		The reaction of the formation with the degree of containment	0.0040	1	1	1	0	1	1	1	1	1	8					
		Meet the feeling of proper containment	0.0030	1	1	1	0	1	1	1	0	0	6					
		Sense of overall consistency of shaping	0.0040	1	1	1	0	1	1	1	1	1	8					
	4.1.3. bonding	The relationship of the unit to the whole	0.0035	1	0	0	1	1	1	1	1	1	7	0.0140				
		General optical modulation coherence	0.0040	1	0	1	1	1	1	1	1	1	8					
		Recognize the general consistency of the formation	0.0035	1	0	1	0	1	1	1	1	1	7					
		The degree of bonding is	0.0030	1	0	0	0	1	1	1	1	1	6					

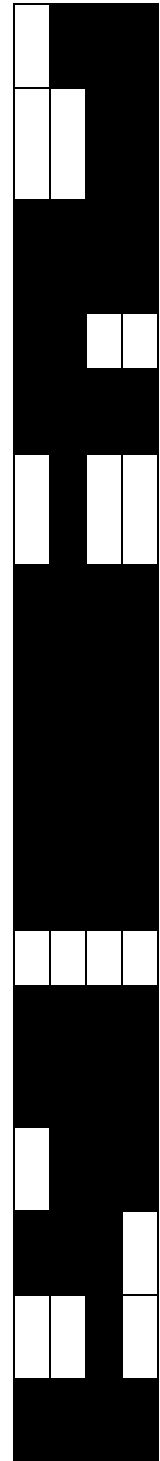








Improving the function of urban environment	4.4.2. Lighting functionality	The effect of light on reading composition	0.0040	0	1	1	1	1	1	1	1	1	1	1	8	0.0150		
		Contrasting light and shadow as a tool for reading composition	0.0040	0	1	1	1	1	1	1	1	1	1	1	1		8	
	4.4.3. Urban formation	4.4.3. Urban formation	Good use of natural lighting	0.0035	0	1	1	0	1	1	1	1	1	1	1		7	0.0160
			The ability of light to show materials	0.0040	0	1	1	1	1	1	1	1	1	1	1		8	
			Light interacts with shape	0.0045	1	1	1	1	1	1	1	1	1	1	1		9	
			The quality of the functionality of the lighting	0.0030	0	1	1	0	0	1	1	1	1	1	1		6	
	4.4.4. Comfort and psychological effect	4.4.4. Comfort and psychological effect	Perceive the composition by contrast between shadow and light	0.0035	0	1	1	0	1	1	1	1	1	1	1		7	0.0120
			The effect of light on highlighting blocks and voids	0.0040	0	1	1	1	1	1	1	1	1	1	1		8	
			The importance of artificial lighting to show urban formation at night	0.0040	1	1	1	1	0	1	1	1	1	1	1		8	
			The importance of light in drawing a mental picture	0.0045	1	1	1	1	1	1	1	1	1	1	1		9	
	4.4.5. Improving the function of urban environment	4.4.5. Improving the function of urban environment	Suitable illumination physiology	0.0035	0	1	1	0	1	1	1	1	1	1	1		7	0.0150
			Suitable lighting psychology	0.0030	0	1	1	0	1	0	1	1	1	1	1		6	
			Psychological comfort of light-affected formation	0.0020	0	1	1	0	1	0	0	0	0	1	1		4	
			Good use of lighting	0.0035	0	1	1	0	1	1	1	1	1	1	1		7	
	4.4.5. Improving the function of urban environment	4.4.5. Improving the function of urban environment	The effect of light on the quality and function of spaces	0.0035	0	1	1	1	0	1	1	1	1	1	1		7	0.0150
			The effect of light on the performance of leisure activities	0.0040	1	0	1	1	1	1	1	1	1	1	1		8	
			Raising the efficiency of urban space	0.0040	0	1	1	1	1	1	1	1	1	1	1		8	
			Improving the urban space environment	0.0035	0	1	1	0	1	1	1	1	1	1	1		7	





4	Sub-total of the 4th. criterion		0.0740
4.5 Proportion and balance in urban formation	4.5.1. Fit the scale	The effect of proportions on the perception of masses	0.0030
		The effect of proportions on showing the aesthetics of composition	0.0025
		The effect of proportions on highlighting the relationship of the elements	0.0035
		The effect of proportion and proportion in realizing the functions and philosophy of formation	0.0040
	4.5.2. Scale sections	Check the job-form relationship	0.0035
		The ability to express appropriately	0.0035
		The proportion between size and shape	0.0040
		The success of the plastic and expressive relationship	0.0035
	4.5.3. Aesthetic proportions of urban	Check aesthetic proportions	0.0020
		Check creativity using proportions	0.0030
		Aesthetic	0.0020
		The influence of the urban formation on the aesthetic proportions	0.0020
	4.5.4. Degree of	The designer influenced the golden ratio	0.0030
		Appropriate degree of containment of outdoor spaces with activities	0.0030

										0.0740
1	0	1	1	0	1	0	1	1	6	0.0130
1	1	1	0	0	0	0	1	1	5	
1	1	1	1	0	1	0	1	1	7	
0	1	1	0	1	1	1	1	1	8	
1	1	1	0	0	1	1	1	1	7	0.0145
1	1	1	0	0	1	1	1	1	7	
1	1	1	0	1	1	1	1	1	8	
1	0	1	0	1	1	1	1	1	7	
1	0	1	0	0	1	1	0	0	4	0.0090
1	1	1	1	1	1	0	0	0	6	
1	0	0	0	0	1	0	1	1	4	
1	0	0	0	0	1	1	1	0	4	
1	0	0	0	1	1	1	1	1	6	0.0115
1	1	1	1	0	0	1	1	0	6	

0.0450	
0.0655	
0.0600	
0.0525	



		Originality of character according to geographical location	0.0020	1	0	1	0	1	0	1	0	0	0	4	0.0135
		Consistency with the philosophy of design and composition	0.0040	1	1	1	0	1	1	1	1	1	1	1	
	4.6.3. Urban character	Clarity of the urban character of the area	0.0025	1	1	1	0	1	0	1	0	0	0	5	
		Consistency of the formation vocabulary with the urban character	0.0035	1	1	1	0	1	0	1	1	1	1	7	
		The urban character emphasizes the character of the formation	0.0030	1	1	1	0	1	0	1	0	1	1	6	
		Consistency of the overall appearance of the formation	0.0045	1	1	1	1	1	1	1	1	1	1	9	
	4.6.4. Functional expression	Job expression	0.0035	0	0	1	1	1	1	1	1	1	1	7	
		Understand the use of configuration	0.0030	0	0	1	0	1	1	1	1	1	1	6	
		Ease of induction and clarity of the job	0.0030	0	0	1	0	1	1	1	1	1	1	6	
		Consistency of appearance with use	0.0040	1	1	1	0	1	1	1	1	1	1	8	
	4.6.5, Selection	Highlight the character and urban appearance	0.0045	1	1	1	1	1	1	1	1	1	1	9	
		The consistency of the visual scenes with the character	0.0040	1	1	1	0	1	1	1	1	1	1	8	
		Determine the intended mental image	0.0040	1	1	1	1	1	1	1	0	1	1	8	
		Perception of the mental image of the recipient	0.0040	1	1	1	0	1	1	1	1	1	1	8	
	4.6.6. Personality	The effect of culture on understanding the mental image	0.0030	1	1	1	0	1	1	1	0	0	0	6	
		Ease of self-perception of the formation	0.0030	1	0	1	0	1	1	1	1	0	0	6	
		The interaction of the formation with the culture and	0.0035	1	0	1	0	1	1	1	1	1	1	7	









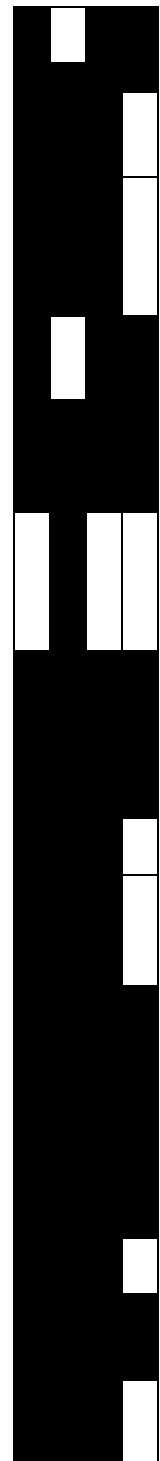
4.8. Modern techniques	4.7.4. Texture	Cultural heritage has a psychological impact on the use of colors in formation	0.0030	1	0	1	0	1	1	1	0	1	6	0.0175	[Redacted]		
		Awareness of the psychological effects of the recipient	0.0030	1	1	1	0	1	1	0	0	1	6				
		Surface properties contribute to the quality of the molding	0.0045	1	1	1	1	1	1	1	1	1	9				
		Ease of perceiving the formation by varying the texture of the materials used	0.0040	1	1	0	1	1	1	1	1	1	8				
		The harmony between texture and visual vision	0.0045	1	1	1	1	1	1	1	1	1	9				
		The interaction between texture, appearance and character formation	0.0045	1	1	1	1	1	1	1	1	1	9				
	4.7.5. Building materials	The consistency between the properties of the materials confirms the character and appearance of the formation	0.0035	0	1	1	0	1	1	1	1	1	7	0.0125			
		Raw materials play a positive role in shaping	0.0045	1	1	1	1	1	1	1	1	1	9				
		Perception of character and appearance depends on the building materials used	0.0045	1	1	1	1	1	1	1	1	1	9				
	7	Sub-total of the 7th. criterion		0.0800										0.0800		0.0585	
	4.8. Modern techniques	4.8.1. Kinetic techniques	Dynamic kinetic techniques have a positive effect in changing the appearance	0.0040	0	1	1	1	1	1	1	1	1	8		0.00150	[Redacted]
			Static kinetic techniques have a positive effect in changing the appearance	0.0035	1	1	1	1	0	1	0	1	1	7			
																0.0725	
														0.0630			
														0.0505			

	4.8.2. Smart building materials	Kinetic techniques interact positively with shaping	0.0035	0	1	0	1	1	1	1	1	1	1	1	7		
		Realizing the positive impact of technologies on urban formation	0.0040	0	1	1	1	1	1	1	1	1	1	1	8		
	4.8.2. Smart building materials	The ability of smart materials to have a positive impact on shaping	0.0035	1	0	1	0	1	1	1	1	1	1	1	7		0.0140
		Smart materials reaction to more than one environmental condition	0.0035	0	1	0	1	1	1	1	1	1	1	1	7		
		The ability of smart materials to selectively react or predictive	0.0040	1	1	1	1	0	1	1	1	1	1	1	8		
		Real-time reaction of smart materials	0.0030	0	1	0	1	1	1	0	1	1	1	1	6		
	4.8.3. Smart envelopes	Smart envelope contributed to raising the efficiency of the formation	0.0040	1	1	1	1	1	1	0	1	1	1	1	8		0.0150
		Smart technologies have contributed to changing the colors, shapes and features of interfaces	0.0040	1	1	1	1	1	1	0	1	1	1	1	8		
		Intelligent formation vocabulary has produced contemporary modern trends	0.0035	1	1	1	1	1	1	0	0	1	1	1	7		
		Easily perceive the change in formation efficiency and environmental protection	0.0035	0	1	0	1	1	1	1	1	1	1	1	7		
	4.8.4. Photovoltaic cells	Photovoltaic cells had an effect on raising the formation efficiency	0.0030	0	1	0	1	1	1	0	1	1	1	1	6		0.0110
		Using photovoltaic cells saves energy	0.0035	1	0	1	0	1	1	1	1	1	1	1	7		
		Design awareness of the consistency of the modulation	0.0045	1	1	1	1	1	1	1	1	1	1	1	9		





		architectural balance																			
	4.9.5. Architectural Expression	The perfect expression to show the design idea	0.0025	0	0	1	1	0	0	1	1	1	1	1	1	5	0.0145				
		Experience and skill of the designer in using the vocabulary of formation	0.0045	1	1	1	1	1	1	1	1	1	1	1	1	9					
		Easy to read architectural expression	0.0040	1	1	1	0	1	1	1	1	1	1	1	1	8					
		Realizing the reflection of the design idea through the urban formation	0.0035	1	0	1	1	1	0	1	1	1	1	1	1	7					
	4.9.6. Cultural and civilization identity	Awareness of cultural and civilizational identity through formation	0.0030	1	1	1	0	1	1	1	0	0	0	0	6	0.0130					
		Diversity of composition according to different customs, traditions and cultures	0.0020	1	0	1	0	1	0	1	0	0	0	0	4						
		Urban identity recognition	0.0040	1	1	1	0	1	1	1	1	1	1	1	8						
		The uniqueness of the formation civilized and culturally	0.0040	1	1	1	0	1	1	1	1	1	1	1	8						
	4.9.7. Functionality	Consistency of vocabulary used with job performance	0.0035	0	1	1	1	0	1	1	1	1	1	1	7	0.0105					
		The integration of the formation with the beauty of the essence and appearance	0.0040	1	1	1	0	1	1	1	1	1	1	1	8						
		Optimal use of blocks and voids	0.0030	0	1	1	0	0	1	1	1	1	1	1	6						
	4.9.8. The shape	Fit the initial shapes in the formation	0.0045	1	1	1	1	1	1	1	1	1	1	1	9	0.0135					
		The ability of shapes to draw a mental picture	0.0045	1	1	1	1	1	1	1	1	1	1	1	9						





	4.9.9. Site layout elements	Integration of shapes to show composition	0.0045	1	1	1	1	1	1	1	1	1	1	1	9	0.0165	
		Architectural coordination elements contribute to improving the efficiency of the formation	0.0040	1	1	1	0	1	1	1	1	1	1	1	1		8
		Consistency of hard and soft coordination elements	0.0040	1	1	1	0	1	1	1	1	1	1	1	1		8
		Optimal selection of the quality of plants	0.0040	1	1	1	0	1	1	1	1	1	1	1	1		8
		Optical Image Integration	0.0045	1	1	1	1	1	1	1	1	1	1	1	1		9
	4.9.10. Environmental functions	Taking into account the formation of the built environment	0.0030	1	1	1	0	1	1	1	0	0	0	0	6	0.0135	
		The distribution and direction of the masses control the movement of air	0.0030	1	1	1	0	1	1	1	0	0	0	0	6		
		Suitable for solid and open spaces	0.0045	1	1	1	1	1	1	1	1	1	1	1	9		
		Block heights match environmental functions	0.0030	1	1	1	0	1	1	1	0	0	0	0	6		
	4.9.11. Permeability	Provides flexibility in pedestrian movement	0.0045	1	1	1	1	1	1	1	1	1	1	1	9	0.0180	
		Diversity of movement paths	0.0045	1	1	1	1	1	1	1	1	1	1	1	9		
		Running tracks are suitable for all ages	0.0045	1	1	1	1	1	1	1	1	1	1	1	9		
		Availability of tracks for people with special needs	0.0045	1	1	1	1	1	1	1	1	1	1	1	9		
	4.9.12. Diversity	Diversity of visual scenes	0.0045	1	1	1	1	1	1	1	1	1	1	1	9	0.0135	
		Diversity of vocabulary and its interrelationship	0.0045	1	1	1	1	1	1	1	1	1	1	1	9		
		Variety of activities for blocks and spaces	0.0045	1	1	1	1	1	1	1	1	1	1	1	9		
	4.9.13. 3.	Use available local materials	0.0040	1	1	1	0	1	1	1	1	1	1	1	8	0.0115	

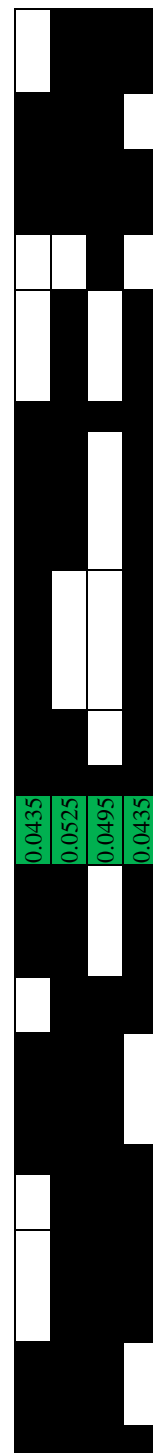

		Zero carbon vocabulary	0.0015
		Shaping contributes to reducing energy consumption	0.0025
		The urban fabric contributes to supporting sustainability systems	0.0035
9	Sub-total of the 9th. criterion		0.1670
4.10. Domination	4.10.1. The importance of the	The visual scene contains a dominant element	0.0045
		Clarity of distinctive signs in the urban center	0.0045
		Consistency of the distinguishing mark with the importance of mass	0.0045
	4.10.2. Size and scale of building block	The size of the dominant block on the scene contrasted with the rest of the formation	0.0040
		The extent of the audience's awareness of the dominant element of the scene	0.0035
		Seeing the dominant element from multiple angles	0.0040
		Pay attention to the importance of scale	0.0045
	4.10.3. Building block shape	Distinguish the shape and formation of the dominant mass	0.0045
		Impact on the mental image of the recipient	0.0045
		Use vocabulary that supports the distinction of form	0.0045

1	0	0	0	1	0	1	0	0	3
0	1	1	0	0	1	1	1	0	5
1	1	1	0	1	1	1	0	1	7
									0.1670
1	1	1	1	1	1	1	1	1	9
1	1	1	1	1	1	1	1	1	9
1	1	1	1	1	1	1	1	1	9
									0.0135
1	1	1	1	1	1	1	0	1	8
1	1	1	1	1	1	1	0	0	7
1	1	1	1	1	1	1	0	1	8
1	1	1	1	1	1	1	1	1	9
1	1	1	1	1	1	1	1	1	9
1	1	1	1	1	1	1	1	1	9
									0.0160
1	1	1	1	1	1	1	1	1	9
1	1	1	1	1	1	1	1	1	9
1	1	1	1	1	1	1	1	1	9
									0.0135

0.1275	0.1335	0.1430	0.1040



4.12. Harmony and contrast	4.11.5. Rhythm repetition	Ease of perceiving harmony with repetition	0.0035	1	1	0	1	1	1	1	1	0	7	0.0105	
		Optical Image Smoothing	0.0035	1	1	0	1	1	1	1	0	1	7		
		Consistency of rhythm with formation	0.0035	1	1	0	1	1	0	1	1	1	7		
		Support Diversity Through Rhythm	0.0040	1	1	0	1	1	1	1	1	1	8		
		The interaction between rhythm, repetition and visual unity	0.0030	0	1	0	1	1	1	1	1	0	6		
	4.11.6. Continuity of repetition	Clarity of the continuity of repeating the unit throughout the scene	0.0030	1	0	0	0	1	1	1	1	1	6		0.0070
		The interconnection of the parts of the formation arising from the continuity of repetition	0.0020	0	0	0	0	1	1	1	1	0	4		
		Gradual iteration continuity reaction	0.0020	0	0	0	0	0	1	1	1	1	4		
	11	Sub-total of the 11th. criterion		0.0605											0.0605
	4.12. Harmony and contrast	4.12.1. Contrast with the back	Clarity of contrast between the composition and its background	0.0040	1	1	1	1	0	1	1	1	1		8
uniqueness or distinction			0.0045	1	1	1	1	1	1	1	1	1	9		
Recognize the contrast between the formation and its surroundings			0.0040	1	1	1	1	0	1	1	1	1	8		
4.12.2. Overall contrast		Contrast visual scenes	0.0045	1	1	1	1	1	1	1	1	1	9	0.0120	
		Variation of activities accompanying the formation	0.0040	1	1	1	1	1	0	1	1	1	8		
		Contrast in substance and general appearance	0.0035	1	1	1	1	1	0	0	1	1	7		





12	4.12.3. Exposure	Pivotal in highlighting the formation	0.0035
		See the formation from different scenes	0.0045
		The extent to which you perceive and comprehend the scene	0.0035
		mental image impression	0.0035
	4.12.4. Functional importance	Variation by function	0.0040
		Functional Importance Review	0.0035
		Contrast with the site	0.0035
		Interact with the surroundings of contrast	0.0030
	4.12.5. Diversity	Perceive diversity by contrast	0.0035
		Diversity with difference	0.0035
		Diversity in shape	0.0035
		Diversity with contrast and harmony	0.0035
Sub-total of the 12th. criterion		0.0675	
Total		100%	

1	0	1	0	1	1	1	1	1	7	0.0150
1	1	1	1	1	1	1	1	1	9	
1	0	1	0	1	1	1	1	1	7	
0	1	0	1	1	1	1	1	1	7	
1	1	1	1	1	1	0	1	1	8	0.0140
0	1	0	1	1	1	1	1	1	7	
0	1	0	1	1	1	1	1	1	7	
0	1	0	1	0	1	1	1	1	6	
1	0	1	0	1	1	1	1	1	7	0.0140
0	1	0	1	1	1	1	1	1	7	
0	1	0	1	1	1	1	1	1	7	
0	1	0	1	1	1	1	1	1	7	
										0.0675
1992										100%

69.35	0.040
80.70	0.063
81.95	0.046
69.00	0.056
Positive	
Negative	

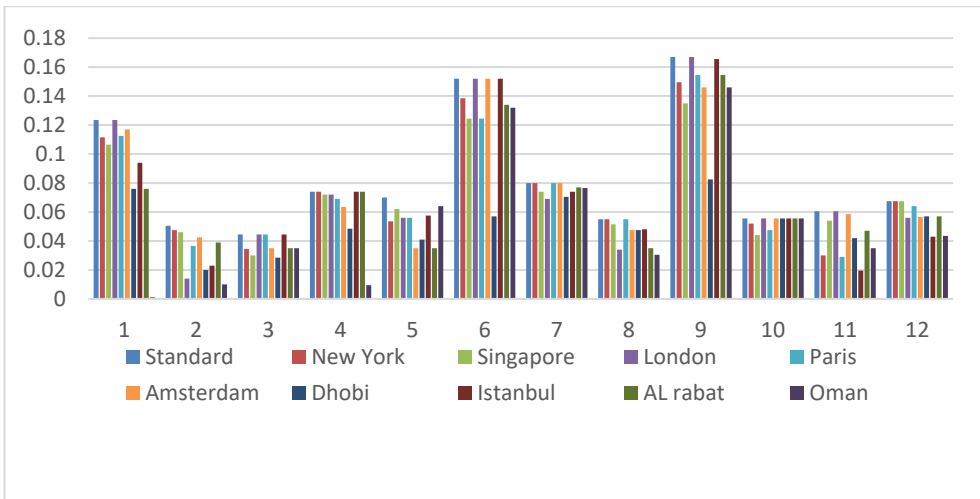


Fig. (2): Comparison of Main Criteria achieved in global and regional experiences

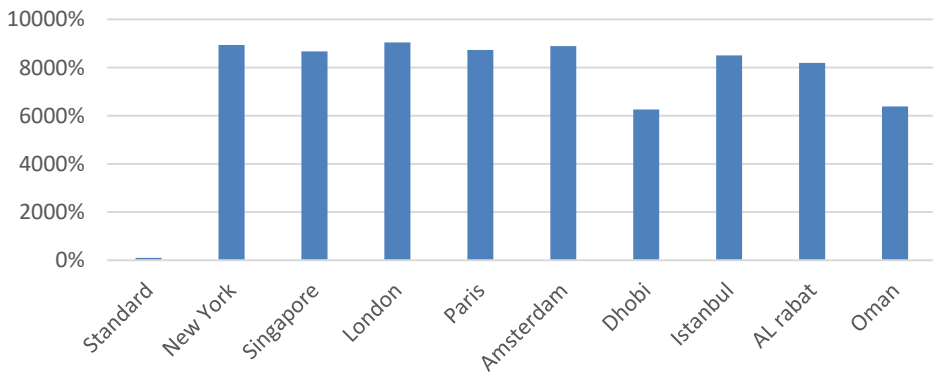


Fig. (3): Evaluating the performance of the aesthetics of urban formation with global and regional experiences

## 5. Results:

Figure (4, 5) show an evaluation of the Egyptian experience and a comparison of the percentages of achieving the main criteria for the four Egyptian city centres, which came in the following order: Rehab with 81.95%, the New Administrative Capital with 80.70%, Madinaty with 69.35%, and October 6, with a rate of 69.00%.

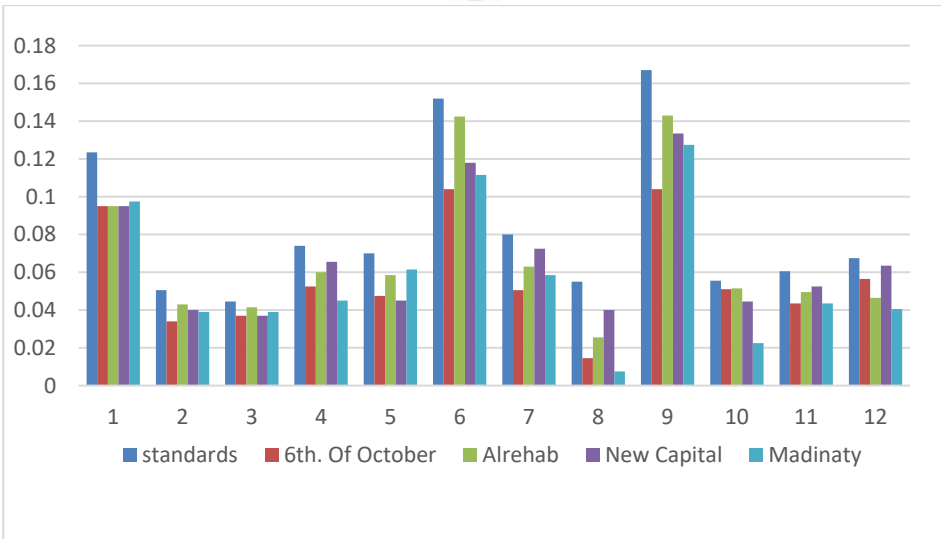


Fig. (4): Measuring the performance of the aesthetics of urban formation in the centers of Egyptian cities

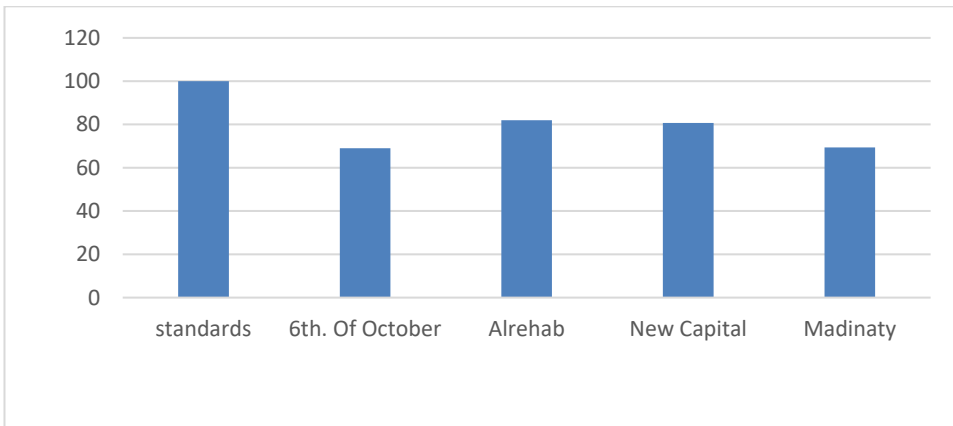


Fig. (5): A comparison of the performance of the aesthetics of urban formation in four Egyptian cities

## 6. Conclusion:

The research concluded, through the theoretical study, to identify some concepts, most notably Jacobsen's concept of aesthetics. The research also concluded through the analytical study to extract the criteria for measuring the performance of the aesthetics of urban formation based on the criteria of Edinburgh with the addition of the criterion of modern technologies and smart materials. The



research was also able to analyse these criteria into sub-criteria. The indicators were determined for each sub-criterion based on its characteristics.

These criteria were divided into (12) main criteria, (76) sub-criteria, and (291) measurement indicators, as well as determining the relative weights of each indicator so that a quantitative evaluation can be done.

The research produced the proposed model to measure the performance of the aesthetics of the urban formation, which helps the urban designer in the stages of design and development of the formation, as well as his contribution to raising the efficiency of what has been implemented, and developing what has been evaluated according to the observed negative indicators, through the development of future improvement plans to raise its performance.

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