

Elements of Architectural Formation as a Vital Demand in Environmental Design	العنوان:
مجلة العمارة والفنون والعلوم الإنسانية	المصدر:
الجمعية العربية للحضارة والفنون الإسلامية	الناشر:
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ع27	المجلد/العدد:
نعم	محكمة:
2021	التاريخ الميلادي:
مايو	الشهر:
74 - 100	الصفحات:
1151037	رقم MD:
بحوث ومقالات	نوع المحتوى:
English	اللغة:
HumanIndex	قواعد المعلومات:
الهندسة المعمارية، التصميمات المعمارية، التصميم البيئي، المباني المستدامة	مواضيع:
http://search.mandumah.com/Record/1151037	رابط:

Elements of architectural formation as a vital demand in environmental design

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Abstract:

Formation is the important elements in architectural design, it links between architectural design, cultural, social, historical and heritage aspects influencing the design. As heritage does not only mean the past, but it has a cultural extension that relates with the contemporary age, and dealing with the physical environment.

The world has witnessed at the present time the issues of sustainable development and environmental design, with attention to the local environment and the elements of architectural formation in buildings.

The problem of the study is the need to create new formation elements that are concerning with the natural, cultural aspects in environmental design and compatible with modern thought, therefore it focuses on an architectural thought from the early stages of design by identifying its elements, and developing strategies to achieve an environmental design as modern trends in architecture.

The study importance is to enrich the architectural elements form and create new elements in the architectural facades dissemination to the cultural identity and heritage with a new thought. The research aims at developed and innovative alternatives to design architectural elements that are in harmony with the urban environment, and confirmation of the architectural identity and cultural heritage to enrichment of the architectural elements in environmental designs.

The study results presented in combination of the cultural heritage and the modern technological aspect to create beautiful architectural formations, achieve a distinctive environmental design, appropriate environmental requirements are the most important factors integrated with architectural formation in the modern era. They are recommended to design architectural formations with environmental aspects to achieve a distinctive environmental design.

Key words:

Elements of Architectural Formation, Environmental Design, Technology, Form.

الملخص:

يمثل التكوين أهم عناصر التصميم المعماري؛ فهو يساهم في الربط بين التصميم المعماري، والمؤثرات الثقافية والاجتماعية، التاريخية و التراثية المحيطة بالتصميم، حيث أن التراث لا يعني انتمائه للماضي فقط، بل له امتداد ثقافي يعيش العصر، وينفذ في حياة المعاصرين فيكون له أثراً على الحياة السياسية، والاجتماعية، والثقافية، والروحية، والتعامل مع البيئة المحيطة عمرانياً. وقد شهد العالم في الوقت الحاضر إهتماماً متزايداً بقضايا التنمية المستدامة والتصميم البيئي والإهتمام بالبيئة المحلية وانعكس في عناصر التشكيل المعماري في المباني، حيث ترتبط إمكانات تحقيق التنمية البيئية المستدامة بتوفير خليط متوازن من المصادر التقليدية والمتجددة. ومع تطور تقنيات ونظم البناء كان لابد من دراسة التشكيل المعماري الذي يتوافق مع التصميم البيئي للمبني، لذا ركز البحث على التشكيل المعماري لبناء فكر معماري بدأ من مراحل التصميم الأولى ووضع الاستراتيجيات لتحقيق التصميم البيئي في المباني لتواكب التوجهات الحديثة في العمارة.

تكمن مشكلة الدراسة في الحاجة الى إبتكار عناصر تشكيل جديدة في التصميم البيئي تعبر عن الثقافة والتراث و تتلائم مع الفكر الحديث. وتتمثل أهميته في إثراء عناصر التشكيل المعماري في العملية التصميمية وخلق عناصر تشكيلية في الواجهات المعمارية تساهم في نشر الهوية الثقافية المستوحاه من التراث بفكر جديد وتتكامل مع التصميم البيئي. و من أهم أهداف الدراسة وإيجاد بدائل مبتكرة لتصميم عناصر التشكيل المعماري تتناغم مع البيئة العمرانية. و تأكيد الهوية المعمارية خلال الإثراء البصري والحسي لعناصر التشكيل المعماري في التصميم البيئي. توصلت الدراسة الى المزج بين الموروث الثقافي والجانب التكنولوجي الحديث يساعد في خلق تشكيلات معمارية تتسم بالجمال. أوصى البحث الإهتمام بتصميم التشكيلات المعمارية التي تراعي الجوانب البيئية لتحقيق تصميم بيئي متميز.

الكلمات الرئيسية

عناصر التشكيل المعماري، التصميم البيئي، التكنولوجيا، الشكل

Introduction

Heritage has an inclusive meaning to everything that can be inherited from cultures that have values, visions and traditions, and that doesn't mean it only belongs to the past as if it is an ancient incidence but it is a cultural extension that copes with age and can be executed during the contemporary life. It has an effect on political, social, cultural and spiritual life and dealing urbanely with the surrounding habitat. (Shawky, Galal, 1995).

Composition is the most important element of architectural design, it contributes in linking the architectural design to cultural, social and historical influences that surround the design and help enhancing its integration with the society.

The world has witnessed in the present time an increasing interest in causes of sustainability, environmental design and paying attention to the local environment which was reflected on the elements of architectural formation in buildings, where possibilities of realizing environmental sustainability is linked to the availability of resources and the balance between traditional and renewable resources. With the development of buildings' technics and methodologies, architectural formation which matches the building environmental design had to be studied. The research focused on architectural formation to build an architectural intellect starting with the first stages of design by identifying its elements and means, put some strategies to realize environmental design in architecture to cope with the modern trends in architecture.

Studying architectural treatments in architectural formation is considered essential as buildings have to cope with the surrounding environment to create buildings that match the climate diagnosis and human environmental needs, in addition to studying of external and internal environment of the building.

Problems of the study:

- The need to create new formation elements that express culture and heritage but at the same time matching the modern intellect.
- Avoidance of dazzling with modern, technological treatments and the architectural vocabularies in the architectural formation.
- Ignoring elements of architectural formation that care about culture, heritage and nature of the place.

Significance of the study:

Enriching the elements of architectural formation in the design process to create formation elements in the architectural interfaces that cope with the environment and contribute in spreading the cultural identity inspired from heritage but with new intellect.

Objectives of the study:

- Putting a frame and finding creative alternatives to design elements of architectural formation to harmonize with the urban environment.
- Confirming architectural identity and the cultural heritage in the environmental design.

Hypothesis of the study:

- The contemporary intellect trends in architectural formation and its elements don't care about the cultural inheritance.
- Elements of architectural formation aren't linked to goals and strategies of the environmental design.

The theoretical frame of the study**1st elements of architectural shape and formation:****The basic elements that form a shape are:**

- 1- **Lines:** a line has many kinds such as, straight, broken, curved, circular, or follow specific rules such as waves and compounds.
- 2- **Planes:** they locate lines, dots, levels, flat, cylindrical curved, coned, waved, circular, cycled, transitional and broken surfaces
- 3- **Bodies:** they locate surfaces (among them) (some of them) or interior space or a mass that forms bodies with symmetrical outline in the composition or semiregular or irregular.
- 4- **Spaces:** is what the body defines inside its cover, it is the void or the hole.
- 5- **Masses:** is what the body defines inside its surface, it is the architectural mass and its geometrical characters that resemble the same characters of the body that enclose it.

Composition is what appears from the external mass and is made of elements of the shape on various scales. (Hamouda, Yehia, 1972).

Sensory and moral characters of the architectural shape:**1st: external characters of a building that are manifested in:****1- The embodied characters for architectural interface; That are represented in;**

- a- Formative architectural vocabularies:
 - openings (doors- windows; horizontal, vertical, narrow, wide, etc.)
 - bows; with all its types (Ottoman, Amoy, Abbasid, Andalusian, European, Romanesque, gothic, etc.)

- Oriel.
- Columns.
- motifs.

fig (1) shows the various architectural vocabularies that are represented in Mecca architecture in oriels, bows and the use of motifs.



Fig (1) the use of architectural vocabularies at a residential building in Mecca.

- b- **Architectural formation (huge masses, small, vertical, etc.)**
- c- **Ceilings (domes, free, gabled, diagonal).**

fig (2) shows elements of architectural formation and motifs in local Yemeni architecture.



Fig (2) elements of architectural formation and motifs in the local Yemeni architecture.

Many of current or old buildings are connected to human minds through their unique and distinguished formations. In this case it has a special, sustainable characters. The more the formation of a building carries new images and ideas, the more it becomes a motive for human mind to absorb that formation. So formation is the expression about the identity and uniqueness of the building among all those amounts of buildings (Wayne, William,1981).

In fig (3) an example of buildings that are connected to our minds through their distinguished architectural formation like Giza Pyramids in Egypt and Taj Mahal in India.



Giza Pyramids in Egypt



Taj Mahal in India

Fig (3) an example of buildings that are connected to our minds through their distinguished architectural formation.

Second: the environmental design

Identification of environmental design concept:

Environmental architectural design means designing a building in a way to cope with the surrounding environmental, climate, geographical circumstances and the change in sun energy at the building site to elevate its thermal and lighting efficiency. The characters of the building site are being studied to determine the shape and the direction of the building in the most suitable way, choosing size, positions of the openings and how to treat them within the interfaces in a way that can ease controlling how much sun light and temperature are allowed into the building in summer and in winter which lead to decrease in thermal loads of the building (Seraj, Nadia, 2005). Environmental architecture is considered one of the modern direction of the architectural intellect which pays attention to the relation between the building and its habitat whether it was natural or unnatural. One of the most significant aims of sustainability is preserving the architectural wealth which can be done through creating buildings that live, being maintained and controlled under variable social and economic circumstances. The initial specifications of this kind of architecture are their cohesiveness with the surrounding, its habitat and preserving its resources whether natural, industrial or economic in addition to mixing all that with a successful artistic look that encourages individuals and societies to keep, respect and give them a proper treatment and maintenance.

The call has started for sustainable architecture that is compatible with the environment due to the effect of the architectural projects as a part of the progress system through its life cycle starting the operation of building, occupation, manufacturing till the final stage of disposal, whether the effect was direct or indirect on the natural environment and the biosphere.

<http://www.wbdg.org/design/sustainable.php>

History of environmental architecture:

It appeared at the ancient civilizations in human trials to adapt and survive in his own habitat. The trials for adaptation varied from using the available materials within the urban habitat to the ways of using them and ending with the methods that human dealing with the environment had to follow.

Its limitations are rain, wind, temperature, sunlight, etc.

In Egypt we find that people of the ancient Egyptian civilization used elements of protection such as adobe, papyrus and wood within their architectural systems such as workers' houses, while they used natural bricks and they sculptured mountains to create their holly architectural systems such as temples.

In the Islamic civilization they made many environmental treatments like the use of domes, voids, internal spaces, as well as the use of wood in building oriels, etc. all that happened through human trials to adaptation and that was the dominant tend throughout ages. Human never ignored his environment but tries in each possible way to adapt with its elements till the industrial revolution. (Jalloul, Akaba, 2010).

Pillars of environmental architecture:

Environmental architecture can be discussed through 3 basic pillars which are:

1- Using environmentally benign materials:

That don't cause any destruction or bad influence on the environment; for instance:

Using wood in buildings at areas which are near to forests, using mud at areas near rivers and rocks at areas near mountains.

2- Realization of environmental shape:

Referring the shape and the projection to the location, region and climate. All measures and procedures should be taken to harmonize the relation between human and the surrounding natural environment.

3- Achieving quality of the design:

All procedures that can realize sustainable efficiency should be taken; tailored relations, architectural shapes, constructional techniques, mechanical systems, as well as historical, symbolic relations, spiritual dimensions and connection with earth. That will all lead to efficiency of the environmental design. (Jalloul, Akaba, 2010).

Factors that affect architectural formation:

The shape is produced from both cultural and natural environments that human lives in, both environments create basic influences and specifications to reach a shape that is compatible with human needs, intellect and culture. The 4 factors are:

a- **Natural factors:** include natural environment, civil environment and climatic factors.

b- **Technological factors:** include building materials, constructional theories and available technology.

c- **Humanitarian factors:** include religion, policy and society.

d- **Essence of the age:** economy, values and architectural trends.

Those last 2 factors represent the spiritual and intellectual sides of the shape.

The shape is a sum of the interaction among materialistic and functional factors with psychological, humanitarian and spiritual factors. It is the sum of interaction of the group with the various factors that determine the shape (Al Zaaby, Yehia, Youssef, 1981). The power affecting the shape was classified into physical and cultural, any one of them on its own can't become a main reason in producing the shape, there is always a total presence for all influencing forces that can be concluded from the physical translation of the shape (Farghaly, Yasser, Ahmed, 2004).

From the previous we can tell that the culture of the society is reflected on the shape and it is considered the society familiarity with aesthetical aspects, color choices and the knowing of its symbolic significances and their effects on the architectural interfaces from all cultural aspects of the society which mean aesthetical significances of the city that reflect the culture.

a- **Natural factors:** we can read environment and climate data of a certain site (table 1) whether that site is in hot or cold region, through some elements in the interface of that building which characterize each region (Wadah, Hany

	Openings	Materials	Roofing shape	Colors
Hot	Small, triangular, overhead to Reduce sunrays.	According to the available, mostly clay or bricks.	Flat or domes/	Cold colors like white or blue sky.
Cold	Big to absorb all possible amount of sunrays.	According to the available, mostly wood.	Diagonal at one or two directions.	Hot colors like red or crimson.

Table (1) reading for environment and climate data of a certain site

Methods of using self-systems in environmental design:

Using self-systems is one of the most perfect methods to create an environmental and sustainable design for urban environment:

Self-design through building formation:

depending on the present environmental surrounding (urbanely or naturally) for maximum benefit of natural energies, formation is on both horizontal and vertical levels of the building and urban environment. Such strategy that links the shape or the appearance of the building to rules of sustainable, architectural design strategies in reducing the negative effects on the urban environment, in addition to directing inside the site will be according to sun and wind movement with rectangular oblong shape that has certain proportions as it is considered the best shape of a building where it is elongated to the east and west. Reducing the roofs when compared to the total size and design a high level of isolation and building masses contrast to reduce the thermal gain and loss, reducing the building planning depth to deliver the biggest possible amount of natural lighting. Local weather is considered one of the most significant factors in the building shape. That principal was invested in modern residential housing as air moves from areas of high pressure at the interior spaces to areas of low pressure at the street with what it creates from air currents, it can minimize the use of air conditioners inside the residential unit.

Self-design through design of interfaces:

formation of interfaces and their relation with the surrounding on both horizontal and vertical levels with the urban space gives the best solution for self-design as such interfaces can be designed through specific computer programs to determine their response rate to the environmental effects. Materials are considered the most influencing factor in self-design in addition to shading systems that are used for good ventilation and prevent entrance of the heat. The same principal could be applied inside the building to create the effect known as efficiency and prevention of direct sunrays (stack effect) self- movement of a building is when hot air rises up to be replaced by cold air, the air cycle when hot air gets out through an

opening at the top of the building creating a movement due to difference in air pressure within the air trapped between the doubled wall to increase the air movement inside the building.

Self -design through sun control:

It can be achieved through several factors, inhibition of sunray from getting inside the building or space, mass formation at the urban environment as the relation between the building and the urban space and the way it was directed and formed have an importance in keeping away the sunray throughout the various seasons. It can be controlled by interfaces by shading methods or type of the used openings and their sizes, that's how the amount of sunrays coming inside the building can be controlled, and the principal used in interfaces of traditional residential units can be benefited from as the lighting depends on indirect light entrance through what's known as (Shanashel) which is the modern bays, to the interior spaces to prevent from increasing temperature of the interior space hence controlling sunrays.

Self -design through the color of the building cover:

Self -design calls for the use of light colors especially at roofs that gain high temperature in the summer.

Self -design through gardens:

They help in reducing temperature gain within the individual building and on the urban level as well, gardens reduce reflected rays on the urban environment (urban design), constructed by the group of unified design (Xieli Garden). At (shape 4) the building of the kinder garden, the building with the 3 floors was designed on the shape of elliptic ring spirally mounting to create a perfect educational environment for the kids through the direct contact with the exterior spaces and providence of natural daylight.



Fig (4) self-design through gardens in the kinder garden building (Xieli Garden).

The source: <https://www.arch2o.com/kindergarten-in-xieli-garden-udg-seu/>

b- Technological factors:

They include building materials, construction theories and available technology.

1- Effect of technological development at fields of building and construction on the architectural formation:

Role of contemporary, modern technology isn't limited to just developing and adaptation programs to draw new languages and vocabs for architectural formation but the role of technological development has extended, it was witnessed by fields of construction, building

and developing building materials, also other developed technologies that were created by digital revolution in many modern fields such as light techniques industry, plastic industries and other applications, to play a major and effective role in order to push architects towards innovation, hence all that have effects on intellectual trends for contemporary, international architecture (Heba, Mahmoud Khaled, 2013).

Many of the progress and innovations in the field of construction had major role into pushing architects towards creativity to realize their innovative, architectural ideas and dreams as the technology used in constructing many buildings has become the main drive for the architectural intellect in particularly during the 20th century. Requirements of construction and what it needs from creating new materials and what resulted in from constructional shape to the emersion of the architectural idea from the logic of construction of the building (Hassan, Nubi, Mohamed, 2005).

One of the most important examples that clarify how the technological development affected architectural formation during the 2nd half of the 20th century is (Sydney Opera House 1957-1973) designed by the Danish architect (Jørn Utzon) modern technology helped in executing the concrete, cortical roof that is made from cortical concrete in the shape of interlocking sails, that are forming the architectural configuration of the building to become a distinguished sightseeing in the city of Sydney and to become an icon for architects. (fig 5)



Fig (5) the architectural configuration of Sydney Opera House

One of the most significant models for buildings that were executed through that architectural orientation is Pavilion at the Expo 67, Montreal, 1967 designed by the German constructing engineer Frei Otto, as the light origin he used in the shape of tent to cover the huge space of that exhibition is considered one of the most creative ideas(Farghaly, Yasser, Ahmed,2004) the idea of a tent on its own is an old one but the architectural formulation of it that matched the building projection and the interior space, in addition to its constructional development, created an innovative, architectural shape (shape 6) shows the effect of technology on construction in the architectural formation of buildings in Pompidou cultural center- France.



Fig (6) shows the effect of technology on construction in the architectural formation of the buildings of Pompidou cultural center- Paris-France. Designed by the architects (Rogers and Piano)

2- Effect of nanotechnology on contemporary, environmental design:

The world is suffering from increase in the environmental problems, desertification, forest fires, soil erosion, pollution, Ozone depletion and consumption of fossil fuel, beside their overall effects on human health, thus the phenomenon of nanotechnology is going to help in limiting all that. The most significant modern applications in environmental design using nanotechnology which helps in solving the environmental issues from air and water pollution, also revealing and detecting the pollution, limiting human wastes as it reduces radiation that cause global warming with 2% for the time being and will increase to reach 20% by the year 2050 (2009 ←M.H.Van de voorde ←H.dosch). nanotechnology allows working inside particles of the matter in order to improve its characteristics and giving it tremendous potentials that can help it in performing applications that it never had, so it gains more possibilities than the original matter, that will help the architect in overcoming the design and construction obstacles as nanotechnology offers new materials for building that assist in elevating the quality and function of several materials such as glass, wood and dry walls. In the field of isolation, it also provides superiority in the potentials of regular isolating materials from its toughness, lightness, flexibility and elevation such as thin isolating slabs, energy absorbing windows (Ahmed, Mohamed, 2017).

There are many factors that can rely on nanotechnology in architecture due to:

- Increase of demands of green buildings.
- Countries and educational and research foundations care about applying nanotechnology.
- Spread of nanotechnology applications in devices and materials.
- The clear environmental benefits of applications and products of nanotechnology
- Lower costs with time.

c- Humanitarian factors:

They include religion, policy, society, culture and heritage. The powers affecting the shape were classified into physical and cultural powers, (Rapoport) any of those powers alone doesn't represent a main reason in production of the shape, there is always a whole presence of all the affecting powers that can be concluded from the physical translation of the shape (Farghaly, Yasser, Ahmed,2004) from the previous we can tell that the culture of society is

reflected in the shape, the society awareness with aesthetical aspects, color choice and knowing its symbolic significances, its influence on the beauty of the city and its reflection to their culture. By studying each society of the world societies we will find that there is a group of factors that has to be taken into consideration which is:

- Time data till the current moment.
- Outcome of the current period of time.
- The future development look which includes continuity, fully charged with knowledge and previous experience till the current moment.

d- Essence of the age factors:

That include economy, architectural values and trends which represent spiritual or intellectual aspect of the shape, the shape is the sum of interaction among material, functional factors and spiritual, psychological and humanitarian factors.



Fig (7) integration between modern technology and traditional intellect to design a bay (mashrabiya)
The source (Kamel, Ahmed Samir, Gamal, Dina Fekry)

Intellectual, architectural trends in the architectural formation:

First: local and heritage intellectual trends:

The building that was built without an architect expresses the look of the society and its way of handling natural, social, economic and artistic local circumstances. And it could be a source to produce new, artistic design values away from all the imported thoughts from the western architecture, hence Islamic heritage architecture which is known as Islamic architecture has become a source of inspiration to many architects to connect authenticity with modernity (Ibrahim, Abd Al-Baky, 1987).

The invitation to originate the civilizational values in building contemporary city, shouldn't be only understood as originating artistic and architectural values in the materialistic building of cities, but it has to become parallel to the main foundation of the society itself according to the right Islamic curricula till both material and moral images integrate together (Ibrahim, Abd Al-Baky, 1987). There is no doubt that in order for Arabic, architectural intellect to produce genuine architecture, a similar role has to be carried out in the fields of developing traditional crafts that are about to be extinct such as arabesque, glazing, coloring, decorating, and engraving bricks and textiles, which are all elements contribute in adding a local privacy on the contemporary architecture. (the student, student, 2014) encouraging rational progress that is more convenient and includes color, style, decor, touch, building material, technique and creativity to produce and develop buildings. Shape 8 is an example of environmental architecture in Al-Qurna village that was designed by Hassan Fathy and he used domes and local building materials (fig 8)



Fig (8) is an environmental design in Al-Qurna village, designed by the architect Hassan Fathy.

It's obvious that not all the ancient or what was built in the past should be inspired from, but also it's so dangerous to ignore the historical background, as by ignoring it we lose belonging, and the identity and personality of the society are lost. That's why previous experiences should be introduced scientifically and develop what could be used and confirm its civilizational continuity. That doesn't prevent the introduction of technology as a mean not as a goal as in what happened in what they call the international architecture. (Ibrahim Maged, 1985).

Second: contemporary architectural trends in formation of interfaces in the environmental design:

The creative shapes and the development in the possibilities of formation in the 20th century architecture are considered a natural result for the development in the building materials and constructional systems, in addition to the progress in life style and its requirements from facilities and places for new occupations that appeared with the industrial and economic development of the 20th century societies. Those shapes are a clear result to the used technology whether from construction systems or materials to fulfil their functions (Salem, Abd Al-Rahim, 2000). New and traditional building materials provided wide possibilities for contemporary architecture and created multiple chances to make variable configurations, that

variation could be a blessing in achieving wide horizon of sensual and visual pleasure, but it also can be an indignation in reaching chaos and turbulence. Dr. Ali Rafaat confirms that Frank Lloyd has a famous samous sentence that was connected to all of his work which is “each material has its own song” architect becomes a maestro when dealing with materials and surfaces, he plays with his material a unified, integrated melody or it may be disconnected and cacophony. Architectural melodies have visual effect that reflects on emotions either with comfort and quietness or chaos and turbulence (Dr. Ali Rafaat,1997).

Fig (9) is a comparison between factors of architectural formation for hotel buildings in both Dubai and U.S.A. from the similarity in the building materials, the architectural formation and configuration of the general features to create the architectural masses. With the variation in climate between the both countries.



Sofitel Dubai downtown hotel

courtyard residence inn Central America hotel,

Fig (9) comparison between factors of architectural formation for hotel buildings in both Dubai and U.S.A.

The influence of digital technology technics on architectural formation:

With the emerge of digital revolution that has reflections and influences on the field of architecture and developing of digital technology and adapting to create new vocabularies for architectural formation, capabilities of the modern digital technology weren't limited to just creating design innovation for architectural shape but they extended to include methods of execution and building materials, as digital technology interacted to create new, smart materials that were created as a result to interference of traditional substances with the specific electronic systems, those smart materials are known as (materials with developed, technological characteristics that have the ability to change and adapt to the surrounding environment, have the ability to sense energy, store it and release at the time of need, in addition to being light, strong, controllable from distance, and easy to detach or combined. Many new materials have been utilized in an innovative way in the architectural shape for what they have of big potentials in the field of artistic formation (Wadah, Hany Hashem, 2005). Fig (10) shows the use of technology in London city hall.



Fig (10) shows the use of technology in London city hall- London- England.

The architect Norman Foster 2000-2002

The source: [http://en.wikipedia.org/wiki/City_Hall_\(London-2012\)](http://en.wikipedia.org/wiki/City_Hall_(London-2012))

as examples of that, the use of screens at buildings as parts of the walls, those walls are used to transfer information to be involved in many modern and futuristic designs, its impact differs according to the used technique. There are many types of electronic facades with this advanced technics, LED. technic, PIX. Light technic, LCD. Liquid crystal screen technic, and many other modern light techniques. (Wadah, Hany Hashem, 2005).

One of the most important models of contemporary models that used that contemporary technology, the Korean mall interface at Seoul city- south Korea- 2003,2004. Designed by UN Studio, fig (11).



Fig (11) The use of LED. Technic in the outer interfaces of the Korean mall at Seoul city- south Korea- 2003,2004. Designed by UN Studio.

The source (Heba, Khaled, 2013)

Third: the concept of innovation at the architectural formation:

It is known as shaping the matter and the space in spatial masses that meets the humanitarian needs not just the materialistic needs to satisfy psychological, social, artistic and intellectual needs. (Raafat, Ali, 1997).

Resources of formative innovation in architecture:

Architect inspires his formations from surrounding resources, his creativity in architectural formation is inside his capability to handle those formations, adapting them to fit their functions. Resources for formative innovation in architecture are divided into 2 sectors which are nature and heritage with the previous experiences.

1st: nature: it is considered the biggest and most stable subjective resource for architectural innovation as it contains multiple faces of life whether botanic, animal or humanitarian in addition to non-living things and other natural elements such as water and mountains, all these made nature an infinite collection of divine formations that human could inspire from all his formative innovations.

2nd: heritage and previous experiences: they are considered the second resource for formative innovation and they represent the humanitarian product of a certain society at specific circumstances, it is an inheritance for all the people and they have the right to inspire anything they want at any field.

The innovative process for formation:

it may result unconsciously without paying attention to the basic methodology or foundation that control that formation, subjective trials and basics that are placed to control the innovation process don't really represent the actual methodology of the creator behavior during this process, the basics of formation are extracts of the features of the creative, formative product. The reason for some of the methodologies that are placed for the innovation process is that the creator during this process focuses on achieving his target and keeps thinking about all possible ways to realize his goal, so his mind might skip the way that he took to realize the target, they assume that a man's mind can't be occupied with more than one way of knowledge, hence he can't observe himself during the innovation process (Al-Sayed, Abd Al-Halim, 1971).

Models and examples for architectural formation and their elements in the contemporary architecture:

1- The dynamic building, Dubai:

The design idea of the dynamic building in Dubai is to create a skyscraper for a rolling building designed by the Italian architect David Fischer with cooperation with the architectural British group. The building consists of 80 floor, the top 10 floors are designed as a villa, the 35 floors beneath them provide more residency, the 15 floor beneath them are hotels and the 20 floors beneath them are commercial stores, fig (12)

The design of the tower is based on each floor will move independently using the technology of voice recognition to give a different view each 1-3 hours.



Fig(12) elements of architectural formation at the dynamic building in Dubai designed by David Fischer

The source: www.astucestopo.net > Accueil > architecture

The building uses light cells technology and wind turbines to collect sufficient energy to work itself, no. of turbines is 79, cells that are placed at the top of each floor of the 80 floors will be opened by 15% for sun rays during the whole day to help in activating the building (www.astucestopo.net › Accueil › architecture)

2- Al-Doha tower, Qatar:

Previously it was known as Qatar tower, one of the highest towers in Qatar, it is located inside the capital Qatar and it belongs to El-Sheikh Saud son of Mohamed the second, it was designed by the French architect Jan Novel at the year 2004 and all the construction ended at the year 2012.

It is consisted of 46 floors and 3 floors beneath surface of the earth, its total area around 110,000 square meter, its length is 230 M. and its outer look is more like a giant thimble, the tower was designed within Islamic and Arabic architectural traditions, where Mashrabiya(bay) technique was used that was used in Islamic architecture in mud houses, but this time it was made out of concrete and aluminum of 4 layers. Lights sneaks inside the tower in regular, geometric way inside the rooms. The tower contains a perpendicular garden in addition to many sporadic green landscape that all contributed in making the tower among the list of environment preserving skyscrapers, and it is characterized by:

1st: Al-Doha tower outer structure looks more like a giant thimble, the tower was designed within Islamic and Arabic architectural traditions, where Mashrabiya(bay) technique was used that was used in Islamic architecture in mud houses, but this time it was made out of concrete and aluminum of 4 layers, that gave a nice appearance of the tower emerging from the Arabic culture in the region, especially that Lights started to sneak inside the tower in regular, geometric way inside the tower rooms. It is worth mentioning that this technique was used for the 1st time at Al-Doha tower where a skyscraper was built as (Aldia net) that contributed to some extent to minimize the exposure of the internal structure to the sun with keeping cold air breeze which contributed as well in minimizing the costs of mechanical cooling.

2nd: The tower contains a perpendicular garden inside of it, in addition to many sporadic green landscape that all contributed in making the tower among the list of environment preserving skyscrapers, Jan Novel usually follows those strategies in his designs of environment preserving skyscrapers which works on light influences but this time he added the Arabic architectural style to his design, in addition to having a previous experience in the making of Mashrabiya (bay) when he designed the Arabic world institute in Paris during the eighties, so Al-Doha tower expresses past, present and future of Qatar in urbanism ,fig (13).

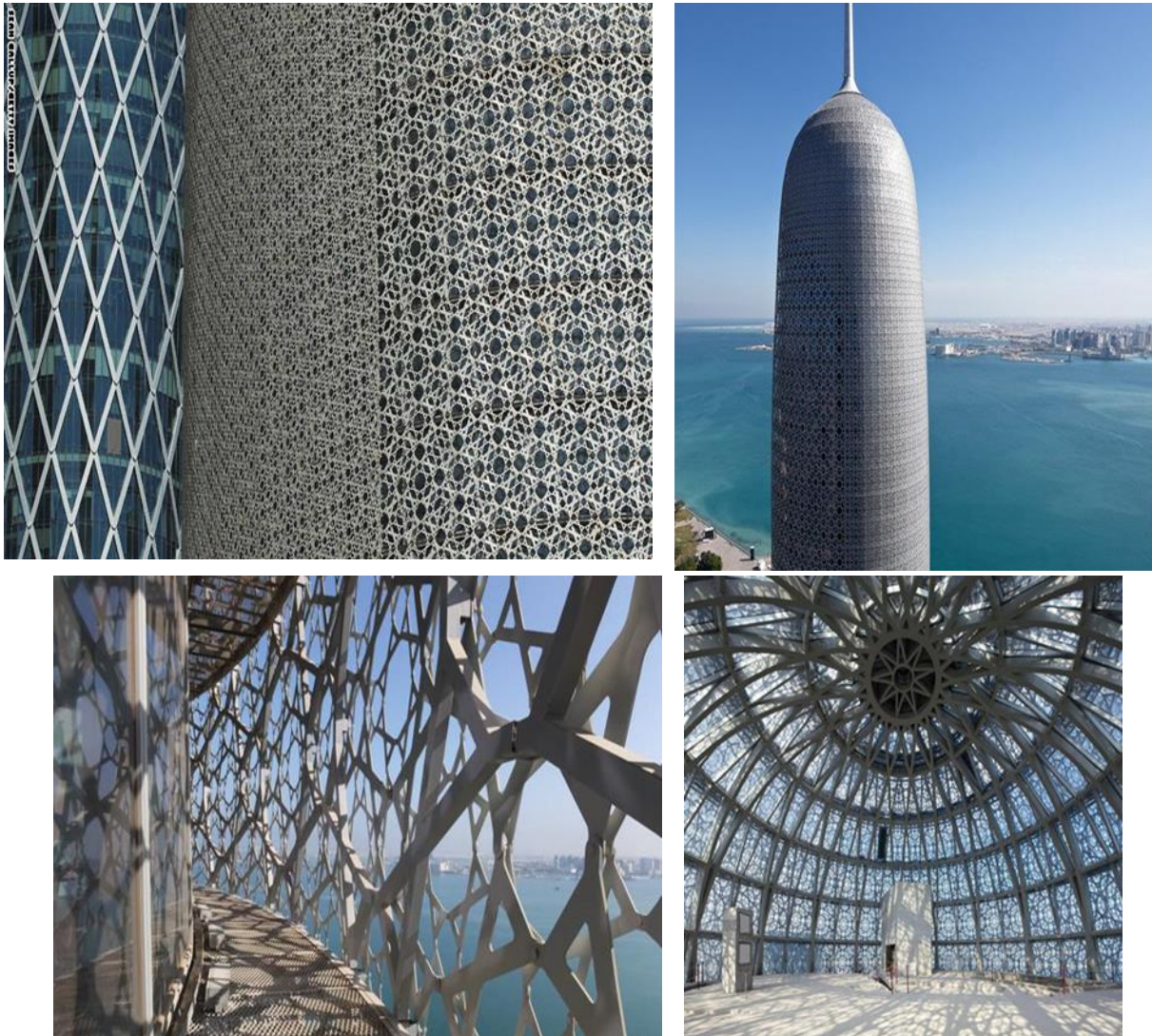


Fig (13) architectural formation and its elements in designing Al-Doha tower, the source (http://images.skyscrapercenter.com/building/doha-tower_terri-meyer-boake2.jpg)

3- A private house with contemporary design:

At this modern house, the architect created a Mashrabiya (bay) with modern vision to overcome the strong sun, adjustable wooden planks were used in making that Mashrabiya (bay) as it opens and closes according to the need of total vision of the porch behind it. The 2 floors house is located in the coastal Portuguese city, Villa Nova Digi. The idea was to create a house that is capable to adapt with the hot climate with the hot sun and the design aims to create an energy saving house with comforting temperature and full of daylight. That's how the design idea was created as a porch covered with Mashrabiya (bay) that is capable of closing and opening and made of thermos-insulating, pine, wooden planks. The house design isn't just about the external treatment, a major space was created inside that was linked to the external garden, a glass façade was made at the ground floor, the separators among the dining room and the kitchen were made also from wooden planks that acted like stairs that go to the 1st floor and form a desk at its base. At the 1st floor there are 3 bedrooms with wooden walls, that overlook the porch which is covered with the moving Mashrabiya (bay). 2 bathrooms with red and green mosaic walls, roof extension with black walls and huge roof hole that can

be reached through black, metallic stairs. At the top there is a working space that has a desk and 2 levels reading room with panoramic bathroom. You can exit this level to the planted roof which has been prepared for relaxation and seating.



Fig (14) architectural formation at a private house using Mashrabiya (bay).

The Mashrabiya (bay) is considered an element of attraction for all admirers of Islamic architecture at the Arabic region. Some consider it a significant sign for the architecture at this region. A Portuguese architecture office designed a house that provides an extraordinary interior space experience and provides a unique environmentally air conditioned atmosphere. A developed Mashrabiya (bay) was used to change the role of the window from a layer of protection from outside to an element of attraction from outside. In addition to that, modern reception devices and data techniques tell us that Mashrabiya (bay) will stay closely related to the future and effective control of shades to get the perfect internal atmosphere, see fig (14)

4- Sea towers, Abu Dhabi:

The Sea towers which are located at El Sheikh Khalifa son of Zayed (previously known as El Salam) street, the most recent 2 towers were designed by Edas company and the work was done at 2012, those towers were equipped by the Islamic shading system Mashrabiya (bay), also they are enhanced with crystals in the shape of beehive that cover the exterior of the building which protect the building from sunrays and reduce the energy consumption by 50% and guaranty getting minimum amount of sun energy at all times.

The CTBH “The supreme council for tall buildings” has chosen the sea towers project as the best architectural design last year, in innovation, automation and compatibility the environmental standards.

The council head quarter which is located in Chicago has given the innovation annual award for the sea towers, the report confirmed that the interface of the tower was dynamic and innovative that can close or open according to the need and according to the sun movement, aiming to reduce energy consumption by 50%, the towers were recently included within the list of the most innovative 20 buildings that includes skyscrapers at the 21st century, last year.

Mashrabiya (bay) was used at the sea towers in Abu Dhabi that was designed by Edis as a covering, sensitive system, the dynamic cover that is sensitive to the sun is reducing the heat gain of the towers, the glass and light colors also reduces the daylight entering the building at all times, that system includes around 2000 unit at each tower that are looking like umbrella and enhanced with solar panels.

The moving Mashrabiya (bay) system doesn't just reduce the gained sunrays but it reduces the use of heavy, colored glass so it allows viewing the largest area of sightseeing from the building beside less use of artificial lighting in addition to providence of best interior environment for users, see fig (15)

Al-Bahr Towers, On the right tower, the screens are open to let in light on the shaded portion of the building. On the right side of the left tower, the screens in full sun are closed, while on the left side those in the shadow are open (Joseph J. Hobbs, 2016). The design concept take the bioclimatic features of Gulf vernacular architecture have found a footing in modern design



Fig (15) architectural formation at sea towers in U.A.E.

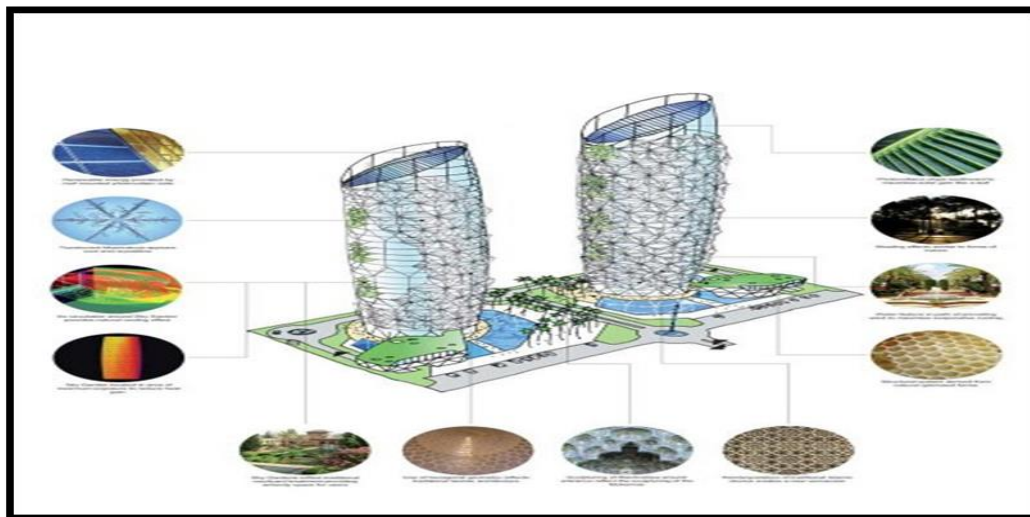


Fig (16) architectural formation and environmental design at sea towers in U.A.E.

5- Bank Muscat, Oman:

This project is located in Oman designed by Architect: Atkins, MACE to serve as a central hub for Bank Muscat, a financial services provider with offices scattered throughout Oman's capital. The headquarters will eventually be home to 2,000 employees, and was designed to provide a functional and attractive building firmly rooted in the Omani context. Security

measures were also paramount, given that the building is a fully operational bank as well as a workplace.

In fitting with Oman's architecture, both modern and traditional, the building is low rise and arranged in L and U shapes to create shaded courtyards, one of which is home to a Moroccan-style garden, and another forms the main entrance. The exterior is modern with traditional Omani and Arabic themes. While glass is used widely, some windows are part-obscured by patterned screens and some of the facade features terracotta tiles. Also reflecting Arabic style, water features and greenery are prevalent fig (17)

The internal arrangements combine the aesthetics of modern architecture with the functional requirements of a contemporary bank building. On the ground floor the building features an internal street, with coffee shops and restaurants.

Lead architect Rohan Thotabaduge explained that the building incorporated a number of sustainable initiatives, including anti-sun green low E-coated glass from manufacturer Pilkington. Bathroom taps and WCs work by sensors, while electric lighting



Fig (17) architectural formation and environmental design of Bank Muscat
source : <https://www.modanisa.com/ar/everyday-basic.shtml>

Automatically dims as the sunlight increases. “18m maximum office floor spans allow the optimum amount of daylight into the building,” Thotabaduge said. “The external mashrabiya screens are decorative, letting light through but also creating shade to help cool the building.”(<https://www.modanisa.com/ar/everyday-basic.shtml>)

“The finished building has pushed some architectural boundaries in Oman” says Thotabaduge. “The country often seems to play safe with new buildings simply copying the old. Here we have used the patterned external screening to produce a new interpretation of the mashrabiya. This combined with the vibrant internal street has produced something really different.

6- Masdar Institute, [United Arab Emirates](#)

The Masdar Institute of Science and Technology (Masdar Institute) located in United Arab Emirates, it was designed by Architect Norman Foster was a graduate level, research-oriented university focused on alternative energies, sustainability, and environmental research. In 2017

it merged with two other institutions in Abu Dhabi to create Khalifa University, and its previous structure now hosts the research backbone of the new university, referred as the "Masdar City campus". It was located in Masdar City in Abu Dhabi, United Arab Emirates. The UAE's contemporary adaptations of vernacular bioclimatic design also include a reinterpreted, computer-controlled wind tower rising 45 meters over Abu Dhabi's inspirationally sustainable city of Masdar (Yassine & Elgendy, 2011).



Fig (18) Masdar Institute environmentally facades

Its design depended on the Islamic look, with mashrabiya and tempered glass to combine the landscape with interior space. The building was also designed to achieve sustainability goals through the optimal use of renewable energy strategies, and the provision of an excellent quality of life for residents on campus fig (18)

The facades were made of cushions that completely isolate the heat coming from the outside, and a modern technical system was drawn from the traditional way of using the castor to attract winds to several yards and wide spaces occupying the bulk of the design of the institute, in order to ventilate the place in a natural way, so that it There is a technology that uses cold water vapor.

7- King Abdullah University of Science & Technology, Saudi Arabia

The campus consists of 10 main blocks that meet around one connected roof that covers blocks, squares and yards alike and its design allows the entry of natural light into the public spaces while providing a good opportunity for the movement of air currents without allowing sunlight to enter with the availability of green spaces and water massages in the yards The breezes that permeate the buildings become moist and fresh see fig (19)

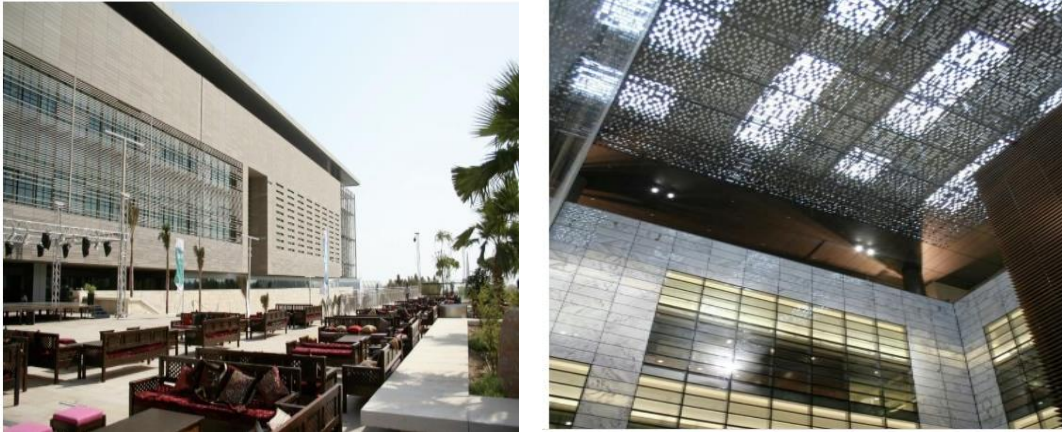


Fig (19) King Abdullah University of Science & Technology, Saudi Arabia

As for the external facades, their design is taken from Arab buildings, where small striped openings or glass facades are protected by the crushers, which is natural in traditional Arab buildings that open on their inner courtyards while their external windows are protected by mashrabiya.

High levels of recycled products can be found in the campus construction materials, and 75% of the construction material.

The physical campus and its operations will minimize the environmental footprint through efficient use of water, electricity and other resources, and through materials reuse and recycling.

8. Sheikh Khalifa Medical City, Abu Dhabi, UAE



Fig (20) Sheikh Khalifa Medical City, Abu Dhabi, UAE

The new Sheikh Khalifa Medical City (SKMC) plans to include three hospitals under one roof spread over 300,000m². SKMC, managed by Cleveland Clinic, is part of the SEHA Health System and owned and operated by Abu Dhabi Health Services Company (SEHA).

The hospital is aiming for a Two Pearl rating under the Steadman guidelines for sustainable design, which is equivalent to a LEED Gold certification. The physical and its operations will minimize the environmental footprint through efficient use of water, electricity and other resources, and through materials reuse and recycling.

9-Nozuk Lusail Marina, Doha, Qatar:

The Location in Doha, Qatar, Anticipated Completion: 2021, Site Area: 5,300 m² and Project Area: 55,000 m². Located in the new Lusail Marina development north of Doha, this 25-story tower sits adjacent to the Arabian Gulf and includes both hotel and office components. The tower's striking form was largely driven by sustainability concerns. By eroding the building mass, SOM created deeply shaded areas and terraces that offer sweeping views of the Gulf. The perceived temperature on the balconies is up to five degrees Celsius cooler than the outside air. The building's facade is sheathed with a copper screen, which permits views while dramatically reducing heat gain Fig (21). All of these features combine to help reduce the building's cooling load, a significant concern in this desert region. (http://www.som.com/projects/nozul_lusail_marina_sustainable_design)

Fig (20) Nozuk Lusail Marina, Doha, Qatar

source :(http://www.som.com/projects/nozul_lusail_marina_sustainable_design)

10-The Vertical Medina, Saudi Arabia:

The Vertical Medina is located in Riyadh, Saudi Arabia with Anticipated Completion: 2020 and Project Area: 45,090 m²

The Vertical Medina is a mixed-use residential, office, and retail development that flips the traditional Arab medina city form — with its interlocking alleyways and courtyards — on edge to create a rich vertical network of shops, offices, and residences. The structure, clad in locally sourced limestone, is composed of 55 luxury apartments ranging from one to four bedrooms, with no two alike. The lower floors consist of Class A office space and retail shops. See fig (21)

Fig (21) The Vertical Medina, Saudi Arabia:

Source(http://www.som.com/projects/vertical_medina)

In traditional Arab cities, the courtyard was the center of life at home, providing privacy, ventilation, and visual interest. In the urban context of this high-rise district of Riyadh, the vertical terraces serve the same purpose and provide outstanding views of the city. The deep recesses of each terrace provide natural shading to the exposures and utilize passive sustainability strategies to cool the residences.

(http://www.som.com/projects/vertical_medina)

11- Al Ahmadi cultural center Mahboula, Kuwait:

Located in Mahboula, Kuwait it Anticipated Completion: 2020 with Site Area: 25,500 m² and Project Area: 43,010 m² Located south of Kuwait City in Mahboula, the Center consists of

two 800-seat theaters, a 400-seat concert hall, lecture hall/cinema, conference center, children's center, as well as galleries for the fine arts and historic cultural artefacts.

Fig (22) Al Ahmadi cultural center Mahboula, Kuwait
source: http://www.som.com/projects/al_ahmadi_cultural_center

Evoking the client's vision project's program, climate, and site. With various programmatic points of interest, the building called for a clear organization that is easy for visitors to navigate. Its courtyard plan is reminiscent of the inward focus of traditional Islamic architecture, which responds to the climatic conditions of the region. Serving as an orientation device, the courtyard provides the point of entry to the building, enabling direct access to the performance spaces that flank it on all four corners, as well as to the galleries that line the Center's eastern and western edges.

The desert climate, with extremely high average levels of solar radiation and temperatures, required an innovative and site-specific response for both the exterior and interior of the building.

The design filters sunlight into the building to achieve optimal levels for the display of art and historical artifacts, while providing thermal mass to reduce cooling loads. This indirect natural light animates the courtyard, galleries, and performance spaces throughout the day, providing a shifting experience of light that is specific to the desert site(http://www.som.com/projects/al_ahmadi_cultural_center).

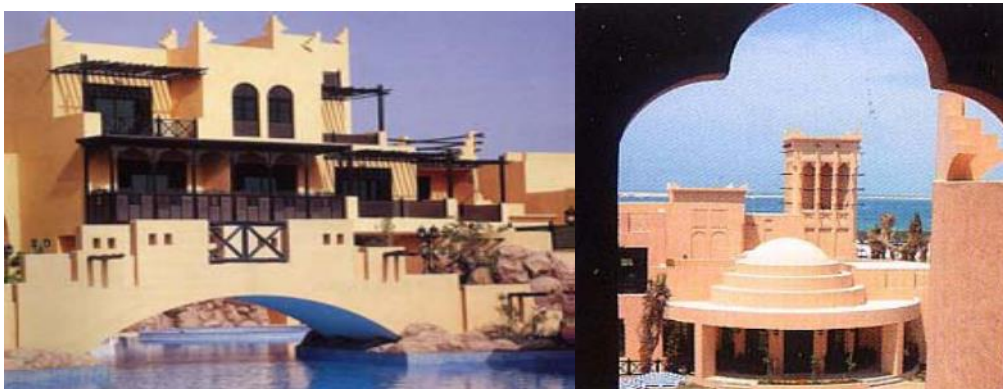


Fig (23) linking originality to contemporaneity in the architectural formation elements for some buildings at the Arabian gulf

linking originality to contemporaneity:

Shape 16 shows how the architect can link between the old and the contemporaneity, so he would be distinguished in creating innovative architectural formations where new architectural formulations are used with renovation and clear supremacy but also keeping the age spirit, where the architectural integration between the traditional and the contemporary formation can be realized, by borrowing some of the features of traditional, architectural formation and creation of new styles that enhance the visual taste of the contemporary formations, also benefiting from the technological aspects and functionalize them in a way that serves the environmental design.

Conclusion:

In spite of technology control over the field of architecture in the contemporary intellectual trend, and the realization of design creativity of the architectural shape, but the architect has to seek the intellectual trend that matches and is compatible with the environment of the produced architecture, also the spatial and local influences with their various characteristics, without neglecting the technological aspect that expresses the spirit of the age. The futuristic view is also essential as it guaranties continuity and compatibility with the local environment aiming to functionalize technology and its applications and development at the fields of architecture in a way that matches circumstances, potentials and demands of the society.

Results:

- 1- Mixing the cultural inheritance with the modern technological side, helps in creating architectural formations that are characterized with beauty and the best functionality to realize a distinguished, environmental design.
- 2- Achieving the appropriate environmental demands is one of the most important factors of the integrated architectural formation in the modern age.

Recommendations:

Caring about designing architectural formations that pay attention to the environmental aspects to create a distinguished environmental design.

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