

The Role of Modern Atriums in a Framework of Sustainable Architecture

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ABSTRACT

In order to create efficient spaces and to improve the quality of life in a sustainable development, architecture besides reducing energy consumption and environmental pollutions, must function its elements as smaller systems to coordinate aims of sustainable development. Since the mid-1960s, the modern atrium has become prevalent in many designs and buildings within contemporary architecture and has attempted to find its position amidst our current technologies and design aspirations by continuing to offer a capacity for assisting in urban strategies, providing strong economic returns on investment, conserving or recycling existing buildings, and for its potential to reduce energy consumption. Today, as concerns for energy and the environment have risen to prominence within contemporary opinion, the reliance on more integrated conservational design strategies such as what the atrium offers in the matter of material and energy conservation is more relevant than ever. According to the objectives of sustainable architecture, not only can atriums be designed to have low dissipation of energy, but also on the one hand, it can create a sense of integration and interaction in indoors, on the other hand, it can establish a connection between building and city by a common border and consequently, aims of sustainable architecture are manifested to improve the quality of urbane life and public participation. This research is presented to identify and determine the position of these spatial elements to achieve a sustainable architecture.

KEY WORDS: Atrium, Energy, Sustainable Development, Sustainable Architecture.

1. INTRODUCTION

During the seventies with the start of energy crisis in the world stability era began, followed by three effective areas – social values, environmental resources and designing skills – entered into the realm of development. The concepts as designing skills and technical knowledge have been redefined with regard to three major themes of energy, environment and ecology and in sustainable development approach have been evaluated in the scale of city to building.

Today many scholars believe that sustainable development with no reference to energy consumption and human life environment is impossible. Therefore, human activities in relation to environmental resources and designing skills should be in accordance with social values and strengthening human values. Sustainable architecture aligns with environment, energy, and ecology. In this architecture, interiors as interconnected and integrated components, have independent identities and at the same time the overall process with harmonious building form will characterize a stable architecture. This architecture has the least impact on the environment and has an ecological relationship with it.

2. Historical background of Atrium

The purest and the most innovative form of sustainable architecture can be seen in the primitive houses and traditional buildings. Forms of these buildings have been obtained on the basis of available materials in the environment, human experience and direct observation of climate and maximum adaptation to it. One of the most efficient spaces of these buildings are rooms with opening in ceiling or private courtyard(interior), they have had various forms from ancient Rome to the Far East and especially Iran and today is generally known as Atrium in public buildings. Atrium phenomenon goes back to 200 years ago when glass and steel structures came forth. But Atrium is an old idea.

Today's Atrium has the minimum age of 3000 years, and is known with names as big internal space, central courtyard and non-governmental indoor areas. Today, the current Atrium is trying to find its place among the current technology and its ideal design. In fact, today's Atrium began to work in the second half of twentieth century. With the re-emergence in the late 1960s, Atriums were mainly covered in North America, and they in large scale, have provided conditions for public and private spaces. At first, these Atriums have found new power in offices, hotels and shopping malls. With the promotion of this idea, Atriums were almost in all parts of architecture including health, education and residential buildings. In the West the driving force for Atrium is its efficiency in new construction technology. Technological advances have always been developed with the spread of Atriums. In fact for the past forty years, their socio-economic status and their technical efficacy have been proven and now they are essential component in the building design. On the whole, Atriums are classified in five categories including central, integrated, linear, connected and environmental, they are usually introduced within the section of greenhouses. Atriums have considered regarding the role of heat mediator and possible energy saving, the impact of comfort of the surrounding areas, types of glass installation, the amount of thermal storage and the amount of dark surface within it, effect of sound reduction or dispersion, amount of natural light and the formation of public spaces inside and outside.

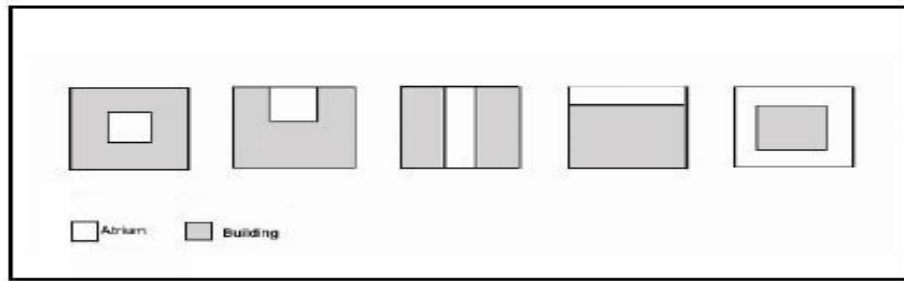


Fig 1. Types of Atriums: central, integrated, linear, connected and environmental

3. Concept of the Modern Atriums

The concept of modern or new Atrium first developed in the early nineteenth century. The contemporary concept takes its roots from Classical domestic Roman architecture, yet the modern atrium distinguishes itself by its intrinsic features. In other words Atriums no longer belong to the outer parts of the building as did in the Roman houses, but they have maintained some manner to connect to the outside (door, window and skylight). In the course of the modern atrium's conception during the 19th and 20th centuries, Atriums have been changed to spaces with different applications and different forms and shapes among different buildings. Diversity in development, has left no accurate definition for the modern Atriums, Atriums include large multi-story space which by using the visual or direct connection such as windows, skylights and doors can be connected to the outside of the building. Today's Atriums are internal volumes which work as a place of spatial destination orientation and building organization. However, Atriums are constantly changing and evolving the architectural design elements. With the development of Atrium design in today's architecture this term suggests application of forms and different appearance which include various parts [1].

4. Function of Atrium and Energy Saving

One of the main concerns of designing is sustainability. Climate control plays an important role in the issue of sustainability. Architects have always mentioned the Atrium's power in this field. By changing the climate people prefer the indoors rather than the outdoors to enjoy their social life. Hence the covered building with an empty space grew more between it and more popular. Atrium as a buffer space, in the form of thermal interface typically has a 15-18° C internal temperature, but Atrium's temperature along with fluctuations of the surrounding environment temperature and delay time is changing.

Atrium's surrounding space has been protected from drastic changes of environment and due to their transparent surfaces reduce thermal dissipation. The amount of this savings depend on Atrium's internal temperature, state of airtight and Atrium's ventilation, coefficients of thermal conductivity of formative elements and its insulation of its surfaces. Atriums will increase in temperature during summer; the temperature can be reduced by using proper methods.

These methods may include ,for example a wind deflector, overcasting the surface by using trees or suspended plates or canopies attached to the Atrium's structure, ventilation and usage of thermal mass and radiant cooling. Energy efficiency and other aspects of it largely depends on the choice of glass transition in Atrium, because this factor effects on the amount of supplementary day- light intake, thermal loads and thermal stratification [2].

5. Role of Atrium in Sustainable Architecture

One reason that we regard atrium as an integrated space is its Geometrical characteristics. In such a space, besides movement facilitation inside the building and availability, presence of people accompanies with thought, concentration, solidarity feeling and interaction. The architect can organize different spaces in line and in the direction of Atriums with different programs. By using Atrium, the architect can control activities inside of these areas so that a process for all the users be clarified. For example, the Eaton center in Toronto works well. In the internal atrium people from offices and car park floors can do shopping on the way to the entrance. The entrance may be in the underground or in the gallery's courtyard, at the same time, in some quiet places you can sit on a chair and drink tea if you like and enjoy your time there.



Fig. 2. Eaton center

Atrium is one of the delightful spaces, the students use that in order to rally and present their own work in a non-official way. In this kind of space, passing spare time, talk and friendly meetings regardless of weather conditions and noise on the streets and besides using services like restaurants, cafes, trees and fountains has been very favorable. Therefore atrium has provided the close communication among people and in educational environments has encouraged the consistency of learning outside compulsory scheduled classes and can strengthen human activities along with social interactions. Atrium's public nature is a ground for manifestation of popular arts such as music, painting or holding festivals and opinion exchanges. Case examples of these projects include the Max Planck Research Center in Dresden, Germany and the college of Hertfordshire which an important aim of atrium design is to create a unified identity among scientists and students. By atrium, designers are seeking to encourage the sense of synergy and collectivism. Atrium has collected all the public spaces such as rooms, laboratories and offices and itself, symbolically is in the center of building [2].



Fig 3. Human presence in atrium- interaction, learning and convergence in college of Hertfordshire

6. Role of Atrium in Creation of Relation of Building and City in the framework of sustainable architecture

One of the new goals which architects have considered in design or develop the buildings is the creation of new relationship between urban space or the space within the building. This will create convergent relationships among people inside and the community outside the building. The atriums play a key role in this change. This relation will redouble when atrium joins the old building to the new one. In this way, atrium acts as a joint to start an essential relationship between two buildings and emphasizes on the presence of old building. Through this space ramps and stairs movements to the floors will begin and the possibility of creating three dimensional perception of space will be provided.

although by creating atrium between two buildings the extent of direct current and light received from building windows has reduced compared to an earlier state, but a proper distribution and steady temperature, humidity and ventilation in all rooms overlooking the atrium will bring about every one's satisfaction.

In LSE building designed by Nicholas Grimshaw, atrium is a central space which all the entry routes are connected and it's a key location for orientation and visual connection throughout the building and clients' reception. Design of this building is based upon active development and passivity of place and is in the form of linear sequence has this feature, which dynamically is associated with active fields such as atrium and front yard. A place where visual communication is formed and public movements occur is where the public and social spaces will localize. Right here you can perceive living a building and participate actively in it [2].

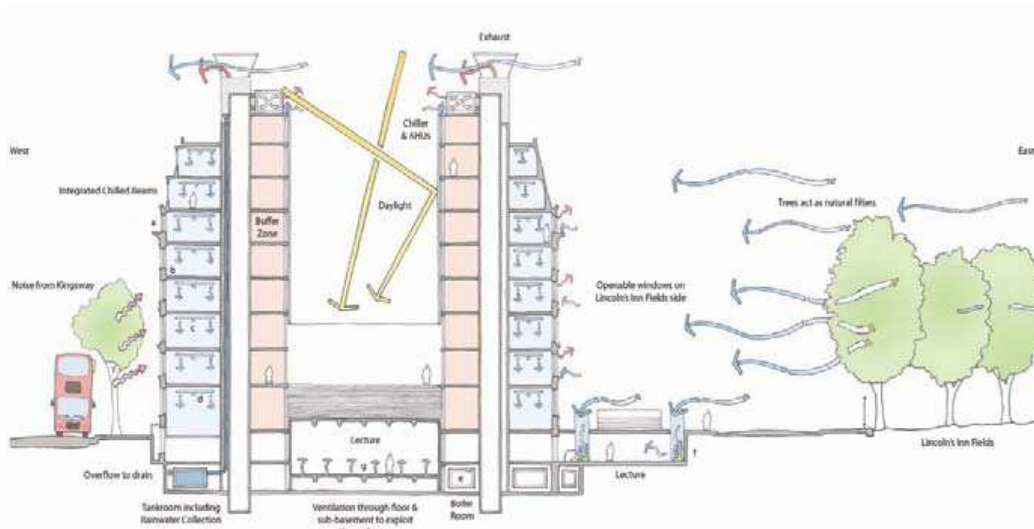


Fig 4. Role of atrium in taking advantage of climate factors and strengthen social relations in LSE building

7. The Role of Atriums in the Coordination between the Old city and new urban Spaces

The capability to help protect the older buildings is one of the atrium's functional abilities. In fact, by reusing the present buildings for covering, and therefore transforming old courtyard builds into exquisite atrium buildings, they are given a new role and purpose. Therefore, by inserting the atriums into such designs, the need for new buildings would be reduced, and also new urban equipment are suggested [3].

Atriums, with various sizes and forms, could perform as an interface between the present buildings, and connects their facade, and lead to coordination between the building facades. On the other hand, by inserting a huge glass space in the view, we exit it from its uniformity and rigidity, and lead to the facade's charisma. Thus that the atriums, by representing their inner concept, through the transparency of the surfaces connected to the street, in addition to a stronger communication with the city, is effective in introducing the building into the city, and its legibility. In better words, atriums could perform as an urban [4].

Similarly, its causes the expansion and renovation of the present buildings, by connecting them to each other, and preserve the old view, so to serve as the mediator between the old build and the new one. Therefore, atriums are considered as a tool to confront new constructions, and also regulating the city view. Additionally, by the use of atriums, the view of old and sensitive buildings, could be restored any protected, through reconstruction.

8. Atrium Role in Creating Sustainable urban public Space

The atrium's capability in helping the urban designing strategies, could be helpful on many accounts. Change in the modern era, from single-building projects into urban complexes and blocks, has caused the atriums to have an effective role in creating a relation between the phenomena, or construction volumes, alongside its activities as a basic interface element [5].

The atrium spaces, add more public areas to the city, and even causes them to confluence with public areas, or even expand them. Additionally, atriums protect the buildings from the water and air outside, and create an appropriate for the people, all over the year. Simultaneously, this space adds a continuity to the urban significant sidewalks, when the main sidewalks and the inner sidewalk systems, are connected to the building's internal atrium. Most of these factors permit the

atrium space to act as an urban renovation catalyst. The surplus equipment that could be presented in the atrium, such as shops and service areas, are located in an environment with green spaces, fountains, and exhibition [1].

By using the glass atriums, with different spaces qualities in their geometry, we could create various unified areas. In such spaces, in addition to the simplified connections and access, it creates a gracious area for gatherings and passing free time, talking and friendly meeting, regardless of weather conditions, and also permit the people's presence in the urban areas, all over the year. This factor, is most useful for the warm and dry, or cold environments, especially in the winter or Summer. In fact, the atriums as enclosed squares and plazas, cause increased social interactions, alongside the daily human activity. Such spaces, in addition to forging a more intimate space, cause a decrease in social unusual activities, and increase the public security. Atrium squares, are attended to as economic resources, and are considered an effective factors in improving the urban stable economy [6].

9. CONCLUSION

Since atrium is one of the most used spaces in the past and especially in modern architecture, now has gained a more important role and with this new role it can be useful in promoting patterns. By associating and reorganizing the old places to modern buildings and creating public, urban places among them, atriums can create a suitable spatial structure to these spaces with an identity and new definition and operational. Atriums as urban monumental elements, in new dimensions like socio-cultural and setting sense, can promote socio-spatial structure. Overall atriums can find a special place in the city because with respect to their sustainable characteristics, functionality in micro climate, they can strengthen temperature fluctuations, humidity changes and flow of outside air, moreover they can prevent heat loss significantly. In the building the atriums as core of the structure with the creation of different environment having high social values make exchange of ideas and visual communication possible.

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