Innovative Sustainable Technologies in Heritage Revival

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Abstract

In different parts of the world, natives and today’s communities are protecting and trying to save their Identities, sometimes reviving and rescuing old traditions by reproducing ancient architectural methods, using their original elements of design. Although in many conditions it is a very expensive process, which makes producers trying to avoid working with this issue. Therefore it is clear that no-one should underestimate the challenges involved in reviving many of our heritage concepts, and applying them in different types of buildings. But at the same time, to save those cultural heritages, rigorous instructions must be identified leading communities towards valuable movements. With the absent of cultural heritage from the sustainable development debate, despite its crucial importance to societies and its wide acknowledgment at national level, it has been done many studies through the last decades dealing with that issue, but without revealing on its own identity from the humanizations perspective. For that reason innovative Sustainable design will significantly add unique value to the heritage employment.

This paper provides an up-to-date overview of the relationship between protection of the cultural heritage and innovative sustainable technologies, which will describe strategies which can lead to cultural sustainable development as a key factor. Comparing between different sustainable values appeared in new trends, such as figuring out the impact and benefits of newly introduced techniques in the architectural applications, thus will point out how architectural development cooperation can play a crucial role in this process. As a final statement the research will demonstrate what can be achieved with an innovative technology approach that makes the most of the local historic environment, even against the backdrop of the economic aspects.

1. Introduction

The word “heritage” caught worldwide attention particularly in the mid-1980s in association with the UNESCO World Heritage Convention [5].

In developing countries, heritage includes not only the built heritage but also the oral and the living traditions, so that relationships between heritage and local communities include much more than merely built structures and matters of employment and income [20]. Due to their worth. It is necessary concern of heritage revival with different trends. But economic factor has brought social challenges: countries are advancing at different speeds, and people within countries are living with vastly different quality of life. In many countries the gap between the rich and the poor is increasing rather than shrinking with economic growth. Therefore it must be reduce this gap and the innovative sustainable technologies are the best techniques to achieve this.

Therefore, when it comes to “sustainability”, heritage conservation or revival has been ignored. Despite it has a great potential to improve the quality of life, improve our understanding of the past and contribute to any culture. [7], as well as cultural heritage specifically can have the value to the well-being and quality of life to communities and can help prevent cultural globalization sustain cultural diversity and positively affect economic development. Therefore, Heritage revival can play an important role of sustainable development strategies. Also, it can be included in strategies set for using renewable resources and savings of energy [8].

2. The importance of heritage revival

Heritage is almost always related to the concept of territory as both a geographical and cultural entity. It is also related to social and community organizations, which are often formalized today as territorial administrative units. In many traditions, nature, or some of its components, are perceived as having a soul, and this fact must always be taken into consideration. Heritage can be divided into two main categories see Table.1 [6].

Keywords: Innovative studies, Cultural heritage, Heritage revival, Sustainable technologies and historical architectural features

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Table 1. Different Categories of Heritage [Source: UNESCO and ICCROM. 2003]

<table>
<thead>
<tr>
<th>Cultural Heritage</th>
<th>Natural Heritage</th>
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<tbody>
<tr>
<td><strong>Tangible Heritage</strong></td>
<td><strong>Intangible Heritage</strong></td>
</tr>
<tr>
<td>Architectural works</td>
<td>Museum collections</td>
</tr>
<tr>
<td>Monuments</td>
<td>Archaeological sites</td>
</tr>
<tr>
<td>Archaeological sites</td>
<td>Literature, theatre, local, traditions.</td>
</tr>
<tr>
<td>Historic centres</td>
<td>Libraries</td>
</tr>
<tr>
<td>Groups of buildings</td>
<td>Archives Etc.</td>
</tr>
<tr>
<td>Cultural landscapes</td>
<td></td>
</tr>
<tr>
<td>Historical parks &amp; gardens</td>
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<tr>
<td>Botanical gardens</td>
<td></td>
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<tr>
<td>Industrial archaeology Etc.</td>
<td></td>
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</tbody>
</table>

Figure 1. A diagram illustrates the main components of sustainability

http://www.arch.hku.hk/research/BEER/sustain.htm#1.3

by Sam C M Hui. 2002

The study of heritage makes it possible to better understand today’s world and to better prepare for the future. However, for various reasons, the value of this heritage has not always been recognized. For a long time, this heritage was deprecated, and its owners and holders were sometimes even encouraged to forsake it. Moreover, Built heritage faces two risks today emanating from one source—climate change and our efforts to cope with and mitigate its effects [9].

Therefore, the reviving of heritage value not only because of their historical worth but because they offer the important design inspirations and tangible promise for a holistic approach to the crises of built environment, in addition to generate and nourish a sense of community and common social bonds.

3. Innovative sustainable technologies

Modern buildings hence became self-contained units isolated from the immediate environment [13]. Therefore, the trend has been to use sustainability in the application of technology, because it is a process that binds the well-being of people and the ecosystem into a mutually supportive whole [2], [4]. Sustainability is comprised of three dimensions that if achieved, will result in human well-being (see Figure 1). Because the balancing of economic, environmental and social objectives is the need to balance the needs of current and future generations [18], [22].

3.1. The concept of sustainability in the heritage revival

The heritage sites and buildings for centuries survived and developed a sense of symbiotic relationship with their surrounding ecology. Their sense of sustainability emerged from having found resonance with nature, its pace, and cyclical progression [3]. As well as in the words of S. Bianca, “the new patterns of development should be based on an integrated vision of society shared by the community as a whole, and produce creatively a sustained interactive and participatory environment” [3].

Accordingly depending on physical, social and economic contexts, the exact meaning of sustainability of a World Heritage site may vary from one site to another. Where that the sustainability in the context of cultural heritage sites generally means adequate and long-term protection of cultural values of a site by using minimum resources [23]. So it is important to know the key factors...
that can enhance sustainability in order to revive the heritage [19].

3.2. The funding necessary for sustainability

As indicated in this quote “Governments face the complex challenge of finding the right balance between the competing demands on natural and social resources, without sacrificing economic progress” [18]. Furthermore, public funding for cultural heritage sites is very limited. For that reason the sustainability is a more realistic approach to view heritage through inexpensive economic vision [9]. After all, the strategies described below are introduced to facilitate a move towards sustainability in the sense of increasing the benefits and decreasing the costs of heritage revival.

4. Achieving innovative sustainability technologies in heritage revival

One of the ways that used for protecting world heritage site/building which are already existing in heritage regions, but the other way which depends largely on the support of taking the past and extending it into the future, “Old ideas can use new buildings. New ideas must come from old buildings” [10]. Therefor this paper offers the methodology of reviving heritage buildings using innovative sustainable technologies that depends on two strategies as the following (see Figure 2):

First – through reviving the heritage buildings which already exist in heritage region/area.

Second – through the addition of newly sustainable techniques of the architectural applications that reflect the heritage of the country and the character of the society.

Figure 2. Illustrated diagram of the methodology which used in this research

4.1. First strategy

The Reviving of heritage buildings which are already existing in heritage regions can depend on reformulating due to the new energy efficiency requirements put forward. Energy efficiency measures are considered key actions within sustainability work.

For example: “Dick Hellofs & Karl Gillespie’s houses”. In 1984 this building and others in the Union Street were included on the heritage resource inventory as a part of the larger awareness of the importance of Vancouver’s heritage that arose during that era. By 2010 the Union Street Eco-Heritage project proposes to maintain these character defining features and the project will reflect...
today’s aesthetic and social priorities and in turn transmit them to future generations of Strathcona residents [24].

As proposed from the owners, this project serves as a demonstration of how to achieve density, affordability and high performance while still respecting the value of our built heritage.

4.1.1. The project proposed

The Concept: Both the architects, shape architecture, and the owners of this project understand that the built heritage needs to be preserved, but it also need to be creative and realistic. Smart preservation is about preventing razing and rebuilding by evolving buildings rather than demanding the creation of museum pieces. In addition to need to mark the present and preserve the past while still building towards the future (see Figure 3).

Adapting Heritage: Shape architecture proposed a micro-topography of outdoor spaces unique to each unit with porches, decks and patios. Each unit has a private outdoor space, yet these spaces are connected to the streetscape in the same way as the porches of the existing buildings. This will allow the inhabitants to interact with their community, while still feeling like they have their own outdoor space. This outdoor space will be based around a central courtyard, allowing inhabitants to casually interact with each other. New units are added, while respecting the existing pattern, by removing the garage and additions to existing structure and lifting/excavating underneath. Units are inserted underneath, and a new laneway house is built. The new configuration reflects the original pattern, while allowing new, more affordable units on the property and keeping the absolute density as before [24] (see Figure 4).

Balancing between high performance & character: Table 2 shows the methods has been used passive design techniques as an innovative sustainable technologies to get the certificates of The Union Street ECO heritage project (see Figure 5).
Table 2. A time line illustrates historical sequences for the Strathcona neighbourhood

<table>
<thead>
<tr>
<th>Using Passive design techniques in the Union Street ECOheritage project*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energuide rating</strong></td>
</tr>
<tr>
<td>For homes shows a standard measure of its energy performance. It shows the owner (and future buyers) exactly how energy efficient your home is. The rating is calculated based on standard operation assumptions so the energy performance is compared of one house against another.</td>
</tr>
<tr>
<td>passive design meets privacy requirements</td>
</tr>
<tr>
<td>The large, south-facing windows of the new units behind the heritage structures will look at the north side of the laneway housing, where passive design dictates few windows. Similarly, the south-facing windows on the laneway house will be looking on to the laneway and impressive southern views of the city, rather than into their neighbour’s windows.</td>
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Figure 5. Using passive design techniques as an innovative sustainable technologies [Vancouver,2012]

The Project Cost: The total amount of energy consumed in a year will not exceed the amount of energy produced by the project, these technologies and design strategies can come with an ‘innovators’ premium; in terms of initial construction premiums, the projected costs are not more than 10-12% above ‘normal’ costs for a similar type of project. However, higher capital costs will mean that the project’s operational costs — the annual cost to live in the project — will be much reduced. Additionally, the owners have identified a potential demand in the market for energy efficient housing.

Another example: “Stephanie Maingot & John Flipse’s house”.

Like many homes in 1636 Charles street Vancouver, it started out as an upper-class residence, then in 1951 this home was converted into a duplex, a common trend in many large single –family dwelling of the time; often a necessary adaptation to the increased demand for housing and higher cost of living in Vancouver post-world war II [24] (see Figure 6).
As shown in Figure 7, zoning allows heating and cooling loads to be customized using individualized digital thermostats for each room or areas. Because water carries heat much more efficiently than air, smaller zones are made possible than with an air-based system. When combined with a digital thermostat, heat can be directed exactly where it is needed, saving on heating costs and energy use. As well as the owners replaced two inefficient hot water tanks and two old furnaces with one high grade boiler system. The introduction of
this efficient energy system has halved their heating bill making the mostly uninsulated home cosy even in the coldest months of the winter [24].

4.2. Second strategy

Heritage can be revived through re-using the Heritage elements of architecture in new buildings according to new technological applications, especially there are several architectural heritage elements that are reflecting different images of sustainability, [16]. In that way the technical image forefronts measurable environmental facts of resource consumption along with economics, operating costs, efficiency in material use and systems Through design’s elements [20]. Therefore the most important vocabularies / elements of architectural heritage [17] which propose for building designs through civilizations and reflect different innovative technical images of sustainability appear commonly in Arab world such as the courtyard, he wind towers, roofs (domes and vaults), Mashrabia and Taktaboush.

Now the focus will be on the one type of these vocabularies to highlight their distinctive characteristics in addition to how to use them in new buildings with new trends which depends on the innovative sustainable technologies. So the case studies were chosen to be inspirational and demonstrate how practical and approachable sustainable development can be.

4.2.1. The court yard

**History:** the courtyard commonly used in old Egyptian, Greek-Roman-Coptic and Islamic Architecture, which served for several purposes. Although there were socio-cultural differences in each region, the design of different buildings retained a common architectural language that responded to both the common hot arid zones climate and the common religious needs such as providing privacy repressing social and cultural images [16] (see Figure 8).

**New technological applications of sustaining heritage in new buildings:** For example the New Parliamentary Building, 2000 (London, England), features a ventilation system that is historically referential and provides an environmentally sensitive form of air-conditioning. A series of towers, which recall the site’s Gothic architecture, draw air from ventilation ducts - pulling cooler air through vents on lower floors and releasing hotter air at the top [28] (see Figure 9).

Another example in “Bamboo Lakou project” for John Naylor, who won Foster + Partners prize 2013. This project merges a sustainable bamboo-growing infrastructure with the development of the vernacular "Lakou" communal courtyard typology. Initially the ‘Lakou’ courtyard house forms the fundamental urban block and this itself is broken into four stages: Occupational Strategy, Material Strategy, Structural Strategy and Construction and Assembly Strategy. therefore The courtyard offers air, light, and seclusion as well as it provides the desired privacy and peace, making the environment an oasis of tranquillity, at the same time as if creates a strong sense of territory. It is also a place for contemplation. Humans are not only rational beings, they are also contemplative [25] (See Figure 10).

The concept and realization of the new courtyard is powerful and successful. It not only achieves high density, but also has the capacity for communal facility provision and good privacy and security control. The courtyard creates a comfortable outdoor environment, which is essential for the 21st century modern living [25].

![Figure 8: The courtyards in the Arab world](https://www.cdf.gov.eg/art2.htm)
4.2.2. The wind towers

**History:** A wind catcher is an architectural device used for many centuries to create natural ventilation in buildings. The function of this tower is to catch cooler breeze that prevail at a higher level above the ground and to direct it into the interior of the buildings. Without the construction of such tall towers there would be no possibility to take advantage of the prevailing winds and breezes either from the shimal or from the on- and off-shore breezes associated with developments located by the sea. The wind towers in many countries around the Arabian Gulf, were constructed on a square plan and contained a cruciform device on the internal diagonals which allowed air to funnel down into a space at the bottom of the tower. This took place both through the direct impact of breezes striking the exposed face of the diagonals, as well as through the principle of convection on the other three faces when the structure was warmed by the sun and ambient air. The internal partition allows the low pressure on the lee side of the tower to suck air from inside the building [26], Figure 11.

**New technological applications of sustaining heritage in new buildings:** For example: Iranian wind towers in Yazd, which have been recognized in varied forms and plans where the wind tower is used to convey the wind current to interior spaces of building in order to provide living comfort for occupiers. In Iranian Architecture a wind tower is a combination of inlet & outlet openings (see Figure 12) [12].

Second example is “Princess Nora Bint Abdulrahman University” in Riyadh, Saudi Arabia; the design of this university is rigorously arranged to form a series of courtyards at multiple scales. The courtyards are intended as usable outdoor space, even in a climate as fierce as Riyadh. At the largest scale, Each of the 4 quadrants which shape a grand public gathering space contains a large courtyard, serving as the primary shared space between two schools. This courtyard is cooled with large passive wind towers that catch the breeze and

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Figure 9. The New Parliamentary Building, 2000 (London, England) [28]

Figure 10. “Bamboo Lakou project” for John Naylor [Dezeen, 2013]
bring flowing air down to the level where people will evaporation provided by plants and fountains increase the amount of time the courtyard is comfortable by 30% during the spring and fall. The arid conditions and intense heat of the region promoted innovative sustainable concepts including wind towers that naturally cool outdoor courtyards. The campus is remarkable not only for its size and speed of design, but is exemplary in that all major buildings are pursuing LEED certification [1], Figure 13.
Third example is Masdar city that is envisioned as the world’s first carbon-neutral city development, which is engineered to be a cold island in the middle of the surrounding desert climate focuses on the science and engineering of advanced alternative energy, environmental technologies and sustainability through a variety of innovative sustainable technologies like using well-positioned wind towers [14], Figure 14.

5. Concluding remarks

The revival of heritage buildings has a contribution to make to achievement of environmental balance in human affairs. There are many overlaps between heritage conservation and sustainable development where sustainability can serve as a tool to achieve heritage conservation and at the same time heritage conservation can serve as a tool to achieve sustainability. Therefore, the overall conclusions drawn from the following:

1. Emphasize that there is a risk of losing historic and architectural values due to energy measures being carried out;
2. Acknowledge that the heritage trail is one tactic that has the ability to relate different developmental aspects within a comprehensive understanding;
3. Agree that a new strategic agenda is needed for sustainable development of the heritage sector with renewed focus on proactive work.
4. Highlight on the proposed methodology in this paper where it can be picked as one of the introduced strategies (the Reviving of heritage buildings which are already existing in heritage regions or Heritage Can be revived through re-using the Heritage elements of architecture in new buildings) to lead to use innovative sustainable technologies to revive heritage where it will not always be easy to implement, and progress will not always be dramatic, but at the same time it will be a successful way to connect the past with the present and the future in the framework respecting the environmentally sustainable.

6. Recommendations

For sustaining heritage environments and to achieve the goal of creating a balance between heritage revival, innovative sustainable technologies and efficiency of economy it must be do the following:

1. The need to identify the appropriate methodology for each community or region to revive the heritage depending on the type of heritage, how to revive it and what are the available sustainable technologies to take into account the least possible cost;
2. Need to focus on using innovative sustainable technologies to revive heritage. Otherwise, historical and heritage sites will either disappear because of the uncoordinated efforts and the contradictory approaches to conservation, or will turn into an open air museum, perhaps physically pleasant, but socially lifeless;
3. The need to develop a future plan that is intended to revive the heritage through using innovative sustainable technologies;
4. The conviction that every community is different from the others in the way of reviving the heritage Using what suits from the techniques of innovative sustainable technologies.

References


Websites


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