Cases in Taiwan: The Improvement of Existing Buildings toward Eco-city in Subtropical Region

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With the location of subtropical region and Pan-pacific seismic belt, Taiwan intermittently attacks not only the threats of natural disasters but man-made calamities as well. Due to the consequence of excessive urbanization and industrialization, those calamities generate the rapid consumption of energy on the Earth resulting in sharp increase of environmental pollution. In accordance with the geographic position of Taiwan, the climate conditions within Taiwan significantly vary from those of Europe and America including littoral - plain and mountainous areas. This diversity of geographic features demonstrates different landforms between urban and rural regions under the rapid growth of economy. Consequently, the core value of Sustainability in Taiwan is to propose the strategy with localized orientation for the existing buildings occupied 97% of the building ratio. It means that the localized orientation is to integrate different local features of climate - economy and culture into the improvement of existing buildings for the better Eco-efficiency between the Earth and human environment.

This report will take the related cases of improving existing buildings as the examples for sharing the experiences of promoting Eco-city in Taiwan, such as the ancient street conservation - the reuse of historic buildings - seashores improvement and pilot programs of sustainable campus, to restate the evolution of Eco-urbanity corresponding with the successful effort on playing a role of international division of collaborations in the region of the tropics and subtropics to further exchange the experiences with the world.

1. International Tendency
With the excessive consumption of earth resources and the globalization of dramatically climatic fluctuation, sustainable development becomes a vital issue among a large number of nations. This world tendency can be verified by a diversity of international conference in relation to sustainability including International Green Building Conferences (GB98', GB2000), Health Building Conferences (HB97', HB2000, HB2003...), and Sustainable Building Conferences (SB2000, SB2002, SB2005... etc.) etc. The issues of sustainable development, therefore, take a critical change from passive actions as “environmental protection” and “energy saving” to active responses as “Sustainability” and “Efficiency”. In this sense, facing the climatic changes of global environment, 2007 APEC drawing up three concrete implementing measures to resist the effect of the global warming, as the following:
1. To promote Global Energy saving up to 25% by 2030
2. To promote Global planting Area up to 20,000 hectare by 2020
3. To setup the Networks of Energy Technology for Pacific Region

In the line with the cognitions, the International Organization for Standardization issued ISO 21930 and ISO15686 (Draft, in 2006), which provide clear definitions and solutions to the enhancement of environmental performance and the prolongation of life cycle of sustainable buildings, and among other things, while discussing the concept of Integrated Performance of Building (IBP), that the purpose of sustainable buildings is to satisfy the needs of the building users in aspects of environmental performance, social performance, economic performance, technical performance and functionality; this statement has revealed the core value of sustainable building.

2. Challenges from the subtropical region

2.1 Geographical Conditions of Taiwan

Due to the geographic position of Taiwan, the climate conditions within Taiwan significantly vary from those of Europe and America. This diverse subtropical climate conditions caused some of the challenges facing the sustainability in Taiwan. One of the greatest challenges is epidemic diseases associated with the high temperature and high humidity of climatic conditions, for instance, dengue fever, SARS and Avian influenza. Taiwan generally has a high-temperature and high-humidity climatic feature. That is because the Tropic of Cancer of 23.5 degrees in north latitude of Taiwan passes through it. This causes the co-existence of continental, littoral and mountainous climate in Taiwan. As the result, it is essential for the sustainability and health of urban development to provide a strategic approach accommodating all changes that can be utilized not only for Taiwan, but also for all nations in the subtropical region.

2.2 Residential Environment

In addition to variations of climate, Taiwan in the 21st century has also to face many current problems arising from industrial transformation, population concentration, development toward high density and high-rise of urban buildings. The air conditioning system and the artificial lighting which are heavily depended on to maintain the indoor environmental quality, for example, not only consume a large number of energy resources, but also considerably reduce health quality, presenting increasingly serious energy consumption, environmental pollution and other problems. Furthermore, the existing buildings in Taiwan amount for 97% of the total buildings, with only 3% of new buildings. Thus, existing buildings become the core of the urban revitalization. That means in the course of developing strategies to promote sustainable building environment in Taiwan’s subtropical climate, while we give the highest priority to the climate, economical and human culture characteristics of each city as well as the economical and energy-saving benefits of buildings, we should incorporate the health factor into them.

3. The localized orientation of policies and techniques—In-site Upgrading

Facing the challenges mentioned above and the crisis of global environment, Taiwan drawing up “Taiwan’s Agenda 21: Strategic Guidelines for Sustainable Development”. It comprehensively considers the development of Taiwan’s environment with a sustainable society to provide a basic strategy and an action plan consisted of some related regulations and measures in response to the demands of
better living in the 21st century.

In terms of better living, on the other hand, the techniques of urban planning and design can apply for the concept of organic circulation as an approach means that architects or planners can orientate horizontal thinking models to vertical ones in whatever building interior, its body and surroundings. This is because the vertical models adopt more organic circulating systems including solar energy, airflow and water recycling to facilitate achieving the spirit of sustainability. Either the policies or the techniques are aimed at "eco-symbiosis" and taken into account the features of urban habitants to Taiwan's subtropical climate and environment.

3.1 Human Health

1. Enhancement of Indoor Environment Quality

that there are many office buildings in which the formaldehyde concentration exceeds 0.08 ppm recommended by the World Health Organization and whose users suffer a risk of cancer 100–1000 times higher than the risk acceptable to the common people. This indicates that the indoor air quality in Taiwan is being influenced by building materials and never stops affecting the health and work efficiency of the users. Therefore, the Taiwan Architecture and Building Research Institute officially launched the “Green Building Evaluation and Labelling System” in 2004, which includes four categories: healthy (the use of natural building materials with low volatile organic matters can avoid damages to human bodies caused by chemically synthetic materials), Ecological (to reduce the ecological load and energy consumption of chemically synthetic materials), Recycled (to reduce the energy and resource consumption required for material production) and High Performance (the evaluation and control of fundamental functions and special functions of materials can ensure the quality of building materials at use stage).

Moreover, based on the life cycle of buildings, technologies have been developed for healthy buildings as follows:

(A) Building Preventive Medicine: (At the planning and design stage of new buildings)

To gain a clear understanding of the influences of indoor and outdoor environments of new buildings and of the benefits of improvement, the measured values can be simulated and explained using the digital design technology, and presented visually using a digital 3D module, as the sources of reference for physical environment design in aspects of indoor sound, light, heat, air and the like, and to help the designer optimize the combined effect of sight, hearing, smell, taste and touch senses, eventually to produce a healthy indoor environment to the users.

(B) Building Diagnosis Medicine: (At the use and renovation stage of existing buildings)

The procedure goes as follows: find out problems by users, give a presumptive diagnosis, and perform a detailed diagnosis using precision instruments, and, if necessary, carry out a joint inspection and discussion by the air condition specialist, the investor and the architect. At last, a right solution comes into being using intelligent low-tech design methods (e.g. Hybrid Ventilation, Passive Cooling and etc.) and “fool” hi-tech systems (e.g. real-time detection system, monitoring system, and etc.) to maintain the best service functions of buildings during the life cycle.

2. Enhancement of Building Performance
The Ministry of the Interior has introduced a plan titled as “Green Building Promoting Movement for private existing buildings” and a policy regarding Diagnosis and Improvement of Indoor Environment Quality to strengthen the reflection on human health and improve existing private and public buildings. The former is aimed at increasing the energy saving performance, at reducing SO2 emission, wastes and environmental pollution and impacts of buildings, at strengthening the ecological preservation, at ensuring the indoor environment quality and at creating a comfortable and healthy residential environment. The latter focuses on the diagnosis of the health of building environment, includes measuring the comfort and health of indoor environment, relative to the environmental health benchmark of indoor space, through the physiological health survey and psychological comfort evaluation of the residents, and by the quantitative analysis on the environment quality using instruments.

For the new buildings, Taiwan has carried out a Green Building Labelling System to promote the design ideas of comfort, nature and harmony, and environment protection, which includes nine indexes classified into four categories: Ecology (including biodiversity, greenery and soil water content indexes), Energy Saving (daily energy saving Index), Waste Reduction (including CO2 and waste reduction indexes) and Health (including indoor environment index, water resource index and sewage and garbage improvement index).

3.2 Sustainable Earth

1. Implementation of Eco-Communities

The Sustainable Campus Promotion Program launched by the Ministry of Education is to successfully create a progressive, safe, healthy and personalized learning environment. With the combination of hardware – spatial buildings (environmental education) and software – school life and teaching materials (personal education), sustainable campus bring concepts of sustainability and environmental protection into the education system. The Sustainable Campus Promotion Program places emphasis on (1) the ecological campus environment, and (2) sustainable building technologies; these two factors have become the highest guidelines to the space and building design of campuses. This program includes four themes: recirculation of resource flow and energy source flow; ecology recycle; base sustainable corresponding; and healthy buildings, letting schools seek the values of campuses and communities from the point of view of regional characteristics. Taking public spaces of campuses as demonstration and through the participation of residents, this program can result in an identity among adjacent communities.

2. Sustainable Urban Regeneration (SUR)

The most essential condition for SUR is to ensure the human health which has direct bearing on the existence and survival of human being because only with human health there can be sustainable healthy buildings (or schools), and then sustainable communities and Eco-cities, and eventually the sustainable Earth. In response to the subject regarding the ratio of new buildings to existing buildings in Taiwan (3% : 97 %), with the aim to benefit all the human beings, a coping strategies of SUR has been developed, in which in-site upgrading is conducted through small-scale change, adjustment and management to existing buildings, in short, with in same way to sing old songs in new way. The activities include preserving and utilizing historic buildings, the conversion of existing buildings and even the hybrid applications. In 2008, for Taiwan, what shall be done most for the sustainable development is to
implement the Green Building Promotion Program of Ecological Cities which will indicate the actual achievements of Taiwan in sustainable development.

4. Physical and psychological Harmony • Carbon Balance

The tide of international sustainable development, health and comfort, Taiwan is in-site upgrading its existing buildings through existing buildings improvement and indoor environment quality diagnosis. This method not only pays respect to the health requirement of users, but also can provide the masses with the feeling of happiness. This is the “Physical and psychological Harmony” has been pursuing for recent years. On the other hand, from the concepts of sustainable campus and Eco-community, to develop local characteristics and community cohesion consciousness, and further develop sustainable environment such as Sustainable Urban Regeneration, is the so-called “Carbon Balance” (reduce pollution by CO2 emission, wastes and environmental loads). Eventually, with the healthy quality, energy-saving, resource-saving and local culture characteristics should be taken into consideration approaching to the next step of sustainability for living environment that will be to construct the actions for Eco-urbanity.

5. The new value of the Earth sustainability and human health

From the viewpoint of building functions, creating a healthy and comfortable setting is of the most importance for human being. Since a human body with six senses, including the sense of vision, acoustics, smell, taste, touch and psychology, is a never powered-off senior during human lifetime, a slight variation can be felt by a human body. Consequently, earth sustainability have to be based on human-centric concerns of healthy environment that is comprised a wide range of building complexes in the varied scales- buildings, communities and an urban.

A terminology originally cited from U.S.A. regarding the relationship between the earth-centric and human-centric concerns called LOHAS, lifestyle of health and sustainability, is to explore a way of sustainable living for the better off future between the earth and human being. Similarly, the four dimensions in mathematic quadrant, which take the horizontal and vertical axes as the aspects of sustainability and health respectively, can also illustrate that the new value will be located at the first dimension because of the habitant lifestyle simultaneously contributes both the earth sustainability and human health.

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