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ACHIEVING SUSTAINABLE CONSTRUCTION IN THE DEVELOPING COUNTRIES OF SOUTHEAST ASIA

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ABSTRACT. Sustainable construction is a way for the building industry to move towards achieving sustainable development, taking into account environmental, socio-economic and cultural issues. Differing approaches and differing economic markets lead to different priorities. This paper presents the construction scenario of Southeast Asia and the developments in sustainable construction taking place in the region. Barriers to the implementation of sustainable construction are discussed. A list of recommendations was proposed to drive sustainable construction in the region. In conclusion, the status of sustainable construction in Southeast Asia is still in its infancy. The lack of awareness, training and education and ineffective procurement systems are among the major barriers for sustainable construction in the region. In some countries public policies and regulatory frameworks do not encourage the development of the construction sector. Besides the needs for capacities, technologies and tools, total and ardent commitment by all players in the construction sectors including the governments and the public at large are required in order to achieve sustainable construction in South-East Asia.

Keywords: Sustainable construction; South-East Asia; Education; Awareness; Urban development

1. INTRODUCTION

Buildings, infrastructure and the environment are part of our living environment thus affecting our living conditions, social well-being and health. Hence, it is important to explore environmentally and economically sound design and development techniques for buildings and infrastructure for them to be sustainable, healthy and affordable, and also which encourage innovation in construction.

The concept of sustainable development was first proposed by the Brundtland Commission in 1972 as "Meeting the needs of the present without compromising the ability of the future generations to meet their own needs". However, this definition has evolved since then.

During the United Nations Earth Summit held by the United Nations Environment Programme (UNEP) in Rio de Janeiro (1992), sustainable developments was defined as "Improving the quality of human life while living within the carrying capacity of supporting eco systems". This definition has an impact on the economic, social and environmental development and was later formally adopted worldwide.

Sustainable construction was first defined by Kibert (1994). The inclusion of construction in sustainable development was proposed at the last World Summit for Sustainable Development held in Johannesburg in September 2002. All industries, including the construction industry represented by the Confederation of International Contractors'

Associations (CICA), submitted a report on their actions entitled "Construction: Industry as a Partner for Sustainable Development" (CICA, 2002).

The Agenda 21 for Sustainable Construction in Developing Countries was launched as a discussion document during the World Summit on Sustainable Development in Johannesburg in 2002. It defined sustainable development as "the kind of development that need to be pursued in order to achieve the state of sustainability. It is a continuous process of maintaining a dynamic balance between the demands of people for equity, prosperity and quality of life which is ecologically possible". This document is the result of a collaborative process representing an important step in the empowerment of developing countries with an agenda that was prepared entirely by experts from developing countries to answer to the specific needs and challenges of developing countries. It also marks the first milestone in a new partnership between the International Council for Research and Innovation in Building and Construction (CIB) and UNEP-IETC on sustainable construction in developing countries

Although there are various definitions, the aims and goals of sustainable construction remain the same. Sustainable construction is a way for the building industry to move towards achieving sustainable development, taking into account environmental, socio-economic and cultural issues.

The concept of sustainability in building and construction has initially focused on issues of limited resources, especially energy, and on how to reduce impacts on the natural environment with emphasis on technical issues such as materials, building components, construction technologies and energy related design concepts. Recently, an appreciation of the significance of non-technical issues (soft issues) has grown, giving recognition to economic and social sustainability concerns as well as cultural heritage of the built environment as equally important.

Sustainable construction has different approaches and different priorities in various countries resulting from the market economies. Unsurprisingly, there are divergent views and interpretations of the term between the developed and developing countries.

This paper examines sustainability issues affecting construction in the developing countries of Southeast Asia. An overview of existing projects for office building, urban developments and housing are presented in the context of their sustainability features. Barriers to sustainable construction are identified and recommendations for responding to these challenges are indicated for achieving sustainability in the region.

2. ISSUES AND RATIONALE OF SUSTAINABLE CONSTRUCTION

The principal issues affecting the sustainability of construction activities and the built environment were discussed previously in many references (Shafii et. al 2004, Agenda 21 in developing countries, Agenda in sustainable construction in Europe). A summary of the issues and rationales are given in Table 1.

In general sustainable construction will provide improvements on:

- Site assessment , contaminated brown field site use, remediation and development
- Ecological damage and waste minimisation during construction
- Site design to maximise passive solar, hydrological, ecological and other features
- Selection of sustainable and low impact materials
- Integrated design of site, building structure, insulation, lighting, HVAC systems etc. to minimise running costs, heat losses and energy use
- Consideration of the environmental impacts of buildings throughout their life and continued facilities management to minimise them.

Table 1. Principal issues on sustainable construction

ISSUES	RATIONALE
Environmentally friendly construction materials	As much as 50% of all materials extracted from the earth's crust are transformed into construction materials and products. Including energy in use, when installed in a building, they account for as much as 40% of all energy used. Moreover, these same materials when they enter the waste stream, account for 50% of all waste generated prior to recovery.
Energy efficiency in buildings	The construction, operation and subsequent demolition of built facilities accounts for about 40% of all energy end use and a similar percentage of green house emissions. Moreover, the potential for reducing greenhouse gas emissions in existing and new buildings, is greater than that of any other sector and consequently represents the most significant target for reducing emissions in order to reach the targets laid down in the Kyoto Protocol.
Construction and demolition waste management	Construction and demolition waste constitutes the largest waste stream by weight. Disposing of these waste materials posed increasing difficulties therefore emphasis needs to be placed on waste minimisation and recycling
Water conservation	The operation of building places a strain on raw water reserves while waste water and sewage needs to be treated before being returned to water courses. Ways of conserving water and more efficient and effective means of treating waste water need to be developed taking better account of land use planning for such facilities.
Health in buildings	The quality of the internal environment of buildings is an essential element to the health of its occupants. Problems caused by damp and mould can be avoided through good building practices. Bio-climatic considerations and good ventilation can also reduce or even eliminate the need for air conditioning in summer whilst reducing the amount of energy for heating in winter.
Transportation	Studies have demonstrated that relatively compact towns and cities well served by public transport system are more energy efficient than cities with relatively low urban density (urban sprawl)
Urban sustainability	While construction activities and the operation of built facilities are only on of many aspects linked to urban sustainability, the quality and efficient operation of buildings and infrastructure are of fundamental importance.
Sustainable architecture	There is a lot that can be done to improve the overall performance of buildings by implementing principles and measures in the design process leading to sustainable architecture
Social impacts arising from construction and the built environment	Sustainable construction can improve the living context and relationship between citizens and their environment in rural and urban areas and contribute effectively towards social cohesion and job creation, promotion of cultural tourism and regional economic development.

The economic dimensions of sustainability includes the creation of new markets and opportunities for sale growth; cost reduction through efficiency improvements and reduced energy and raw material inputs and creation of additional added value.

The sustainability criteria for evaluating the impacts of a building project are given by various sources (OECD, WBDG, LEED, BREAM, Shafii et. al., 2004). The standard criteria used are:

- site design and planning,
- energy use
- water management
- materials, resources, and waste
- indoor environmental quality.

Sustainable construction seeks for proper management of all aspects of building design, construction, operations and use which can dramatically reduce the overall cost of a building throughout its life, without necessarily costing more at the design and building stages when

strategically planned. Additionally, sustainable construction improves the performance of building projects at every stage, both in financial and environmental terms.

3. REGIONAL PROFILE OF SOUTHEAST ASIA

South-East Asia comprised of Malaysia, Singapore, Indonesia, Thailand, Vietnam, Laos, Cambodia, Brunei, Burma and Philippines, Fig.1 More than 85% of South-East Asia covers the area between 10 N – 10 S. Nearly half of the total area is in the form of peninsulas and extended subcontinents are part of mainland Asia, and remaining area consist of thousands of islands. Due to the geographical locations there is very little climatic variations amongst the countries.

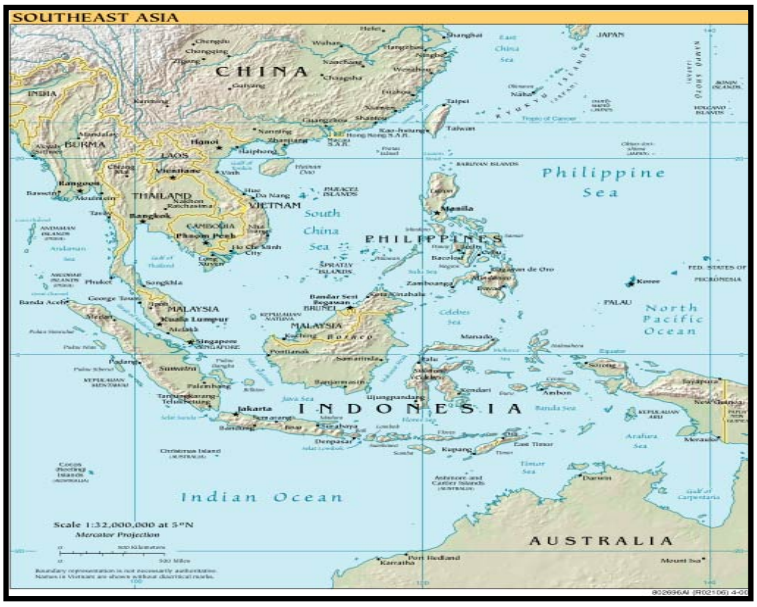

Fig.1 Map of South-East Asia

Rapid industrialization and economic growth have changed virtually every dimension of life in South- East Asia. Yet, by measures of health, education, nutrition, as well as income - the quality of life within the region remains poor for most people. Poverty is a major problem: some 75 per cent of the world's poor live in Asia (GEO 2000, UNEP)

In most countries of Southeast Asia, economic development and industrialization have taken a heavy toll on the environment. Environmental degradation in the region was largely due to poor farming methods and poor land practices. Rapid economic growth began in the early 1980s however the economic currency crisis of 1997-98 had adversely affected the economies of this region. This led to decreased GDP growth rate and increased poverty in the countries affected by the crisis (UN report, 2003). Recent SARS crisis and the tsunami tragedies have further negative impacts on the economies in some countries like Thailand and Indonesia.

Given the geographic, economic and cultural diversity, therefore the countries of Southeast Asia face very different sustainable development challenges. These challenges include disparities in social and economic welfare especially between urban centres and the rural countryside; social and environmental pressures from industrialization and rapid urbanization; and general degradation of the environment.

4. SUSTAINABLE DEVELOPMENT AND CONSTRUCTION IN SOUTH-EAST ASIA

4.1 ASEAN Vision 2020

The long-term sustainable development framework for the sub-region has been fully in place since the 1997 ASEAN Summit that reaffirmed the aims of the association and spelled out its vision for the region by year 2020. Since then, ASEAN Vision 2020 has been defined and translated into concrete goals, targets and activities mainly through the Hanoi Plan of Action.

Besides eradication of poverty, ASEAN Vision 2020 envisaged:

> "a clean and green ASEAN with fully established mechanisms for sustainable development to ensure the protection of the region's environment, the sustainability of its natural resources, and the high quality of life of its peoples."

Construction was included in the goals of ASEAN Vision 2020 with focus on energy security, utilisation of natural resources, management of energy demands all taking into consideration of the environment. Other initiatives include the development of regional water conservation programme and enhancing regional efforts in addressing climate change.

4.2 Construction scenario In Southeast Asia

Sustainability is still a relatively new concept for the construction industry in the developing countries of Southeast Asia. A number of Southeast Asian countries have yet to formulate a sustainable development strategy and action plan; others are still establishing the basic legal framework for the environmental protection and management, and for the environmental impact assessment. Indonesia, Myanmar and the Philippines have prepared their Agenda 21 national sustainable development strategies. Singapore has a Green Plan; Thailand a National Economic and Social Development Plan; Vietnam a National Strategy for Environmental Protection to 2010, and Malaysia a Vision 2020 (Shafii et. al 2005).

In the developing countries of Southeast Asia where societies and governments are faced with extreme survival issues, a management approach to development with little regards for long term impacts on the environment and the society are commonly adopted. Often, sustainability tend to emphasise on the development for eradication of poverty and provisions of basic housing to the lower income community. Hence, in regions marked by poverty and economic problems, it is very difficult to establish environmental sustainability as a national priority. Common issues surrounding construction in the region are discussed in the foregoing paragraphs.

4.2.1 Land degradation

Fragile eco-zones in many countries are being destabilised because of construction activities. Occurrence of floods, land and mud slides caused by construction on delicate hill slopes and wet lands testify to the vulnerability of the environment to interventions of the construction sector. Physical destruction of land are also caused by extraction of sand and gravel for concrete and extraction of clay for the production of bricks.

The rate of deforestation is extensive due to lumbering, land clearing for farming and building construction, which has even penetrated restricted areas like forest reserves on hill sided and highlands. This resulted in increase instability of the natural landscape and increased in erosion.. Rational decision-making and implementation of transparent and

effective strategies are needed to solve the conflicts between land use and the construction sector are urgently required and should be given high priority by decision makers.

4.2.2 Depletion of non-renewable Resources

The construction industry is a major consumer of natural non-renewable resources such as metals, fossil fuel and non-renewable energy resources. Construction sector activities and the manufacturing processes of basic building materials such as cement, steel, aluminium, glass, bricks and lime are highly energy dependent where fossil fuel is a major non-renewable resource require to generate huge amount of energy. The world-wide recognition of the limited supply of fuels and the high degree of dependency on energy by the construction industry has lead to regional efforts in search of alternative energy sources and renewable sources. Malaysia, Thailand, Vietnam are known to have invested in the search of alternative energy resources for construction (UNESCAP). Consequently, as fossil fuel become more and more precious fuel wastage are prevented, and the overall energy efficiency become the overriding criterion in the design and operation of buildings. Energy efficiency is seen as the most attractive factor why stakeholders invested in sustainable building and construction.

4.2.3 Use of Brown Sites for Construction

In some countries in Southeast Asia, in order to relieve the pressure on undeveloped land, the use of previously built-on and contaminated sites is always encouraged and has become common practice for developments. The contamination left a significant toxic legacy in the soil, eco-system and food chains thus becoming potential threats to human health. The need for decontamination of these sites in line with statutory regulations is vital to ensure that any health risks are either removed or reduced to within acceptable limits.

4.2.4 Construction Practices and Procurement

Due to the fragmented nature of the construction industry, a number of countries experience difficulties in the execution of construction projects; this being due to factors such as inadequate capacity for the planning and design of projects hence the difficulty of obtaining tenders, inefficiency in planning, design and construction, and difficulties of obtaining materials. Project delays are common and represent a physical constraint on development.

In many cases where construction projects are implemented, the cost is often higher than anticipated. Factors such as poor estimates, variations by the client, inappropriate technology and design, inappropriate tendering and contractual procedures, inefficient on site supervision and construction management contributed to these effects.

Also, in several countries the import content of construction activity is high. For example, machineries, energy and raw materials. This may comprise up to 60 percent of materials and a significant percentage of professional, managerial and supervisory skills. The increasing dependence on imports has imposed a severe strain on the balance of payments and fuelled inflation.

4.2.5 Skilled Labour

The construction sector requires a higher percentage of skilled labour than manufacturing. In most developing countries of South-East Asia, there is a severe shortage of all kinds of skilled labour for the construction industry. A large percentage of the skills required are not available locally. Additionally, apprenticeships and vocational training schemes appear to be inadequate in both quantitative and qualitative terms. As a consequence, the local training contracting industry is not sufficiently developed. The degree of local participation in contracting varies, but it is common for local contractors to operate only on small residential

projects while the larger industrial and commercial projects are awarded to foreign-based construction firms.

4.2.6 Building Materials Shortage

The local production of building materials in countries of South-East Asia mostly are not sufficient to meet the demand for the construction sectors. In many countries that produce cement, there are severe bottlenecks in the supply of this materials cause by demand fluctuations and lack of capital for the build-up of supplies, or inputs. In cement producing countries, cement is often regarded as a local product even when 60 % of the production cost is due to imported energy.

Infact, the biggest factor influencing climate change is concrete and steel. Cement production is the biggest contributor to greenhouse gas emissions. Although cement makes up only 12-14 % of the final concrete mix, further embodied energy comes from the transportation and production of aggregates and in the case of reinforced concrete the manufacturing of steel

Shortage of other locally produced building materials, such as aggregates, bricks and tiles are also experienced. In some countries where there is a monopoly in supply, shortages have been deliberately created in order to force up the price. The scarcity of building materials has also affected development plans in other sectors, including agriculture, health and education. The steep rise of land and building materials has effectively removed decent housing from the reach of low and medium income groups in most countries in the region.

4.2.7 Construction Design Systems and Technologies

Most developing countries had systems or frameworks inherited from their various colonial administrators and they found that some of these systems are inappropriate for their own current needs (Latham Review, 1994). Conventional designs of these types suffer from various limitations for example, lack of thermal comfort and poor ventilation. Thus attention is now more focus to include building features appropriate to tropical and local conditions. Locally produced systems and technologies have now been given more consideration in search of sustainable solutions.

The importance for improvements in air quality and day lighting for buildings have been given more recognition for healthier and happier occupants in workplaces and residential buildings. The SARS crises in South-East Asia have great impacts on design for indoor air quality especially for public buildings and hospitals, which may greatly influence health. Many building design professionals are now beginning to get involve in “sustainable design” in response to expressed interest or requirements from their clients.

4.2.8 Health and Safety in construction

Occurrences of fatalities from construction injuries are far more common in developing countries like South-East Asia than in the developed world and has remain high over the years; pesticide poisonings remain common; and provisions of clean water and air are major challenges as these regions industrialised and the population concentrates in urban centres.

Many countries in South-East Asia have enacted regulations and established government agencies aimed at improving workplace safety and preventing occupational diseases and injuries, however fatalities are still high. Resources focused on these goals are increasing significantly, but still fall far short of needs. The countries lack expertise in all components of occupational health including medicine, nursing, industrial hygiene, and toxicology may be one cause that contribute to the high statistics.

5. CASE EXAMPLES OF SUSTAINABLE CONSTRUCTION IN THE REGION

Construction in South-East Asia is developing rapidly as a result of improvements in its economic growth. There is a rising number of construction projects addressing sustainability in their implementations. The case examples presented below provide an insight into the many approaches which have been taken to put the theory of sustainable construction into practice. It is hoped that these examples will help shape and define our own vision of sustainable construction and encourage the wider application of sustainable construction practices.

5.1 Office and Commercial Buildings

Designing with climates results in the reduction of overall energy consumption of the building by the use of passive structural devices, instead of mechanical equipment, which require much energy (Yeang 1996). Cost savings in the operational costs means less use of electrical energy resources, usually derived from burning of non-renewable fossil fuels. The lowering of energy consumption would further reduce the overall emission of waste heat thereby lowering the overall heat-island effect on the locality.

In addition to passive design strategies for sustainability, proactive strategies focusing on high technology solutions as solutions to energy conservation and environmental problems are now becoming common. Advanced technology in the design and production of photovoltaic and other areas such as sources of electric energy like wind-powered generators, evaporative cooling systems have encouraged the development of sustainable buildings, as illustrated in the case examples discussed below.

Telekom Tower was constructed in 1996 and completed in 1998 (Fig. 2). It is 75 storeys high and stands at 310 metres. It is located in the suburb of Kerinchi and Kuala Lumpur's 3rd tallest and the world's 20th. Telekom Tower was designed by Hijjas Kasturi who also designed Menara Maybank, one of the tallest building in Kuala Lumpur. Its curvy shape is a major breakthrough of tall building architecture. The Tower has slabs at every 5 floors which accommodate gardens like a mini park.

Fig. 2. Telekom Tower, Kuala Lumpur, Malaysia.

Beyond its functional attributes, Telekom Tower is more than just an intelligent building. It offers residents a work environment that enhances their well-being in an intelligent, efficient building with state-of-the-art facilities.

In addition to sophisticated telecommunications systems, the latest integrated building and office automation and control systems, the 55-storey tall Telekom Tower provides occupants with ready retreats from the hectic work environment. The Sky gardens help 'green' the Tower thus making the architecture environmentally sensitive. Varying in size and landscaping at different levels, these Sky gardens not only provide natural shade on the eastern and western facades but also serve as spaces for relaxation and informal meetings.

Offices are designed within a central core and make the best use of natural lighting while keeping out heat. The narrow eastern and western frontages minimise solar penetration, reducing air conditioning loads while allowing for high amount of indirect lighting.

Modular under-floor air conditioning system ensures comfort and fresh air for all. Other facilities include:

- Telelifts (Document Conveyor System) minimise delivery time by catering to the movement of documents and parcels within the building.

- Integrated Building Management System (IBMS) provides a productive, cost-effective environment by optimising security, systems, services and management and their inter-relationship.

Another fine example of energy efficient building is the Security Commission Building in Malaysia also designed by Hijjas Kasturi (Fig.3) . It was the winner of the Asean Energy awards 2001, Hanoi, Vietnam (www.aseanenergy.org). The building concept based on a premier intelligent office was developed as an energy efficient and a flexible office workspace environment. The basic characteristics of this intelligent building is to create a holistic design incorporating:

- An effective building shell
- Environmentally responsiveness
- Energy efficient of design both in passive and active concepts
- A flexible work space
- Provide a healthy working environment
- Environmentally friendly with,
- Minimum cost of operation

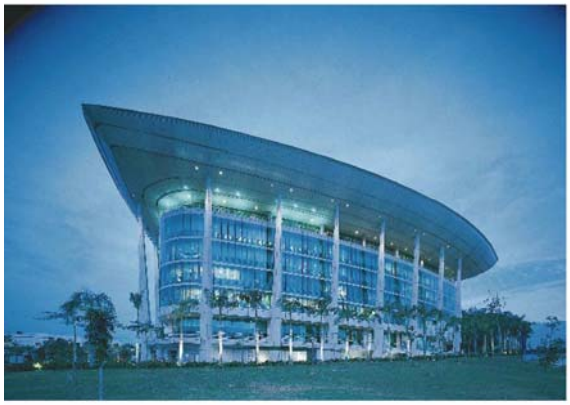

Fig 3. Securities Commision Building, Malaysia

Passive design concepts involve factors like the orientation and building design. The design was optimised to fit the existing valley topography, minimising earth removal for construction of basement car parks and facilities that do not require natural daylight hence, the auditorium, lecture theatre and squash court were placed in the basement. A 12 meter

wide moat runs around the building to bring natural daylight into the spaces below ground that require natural daylight.

Active design features include a low level displacement air-conditioning for atrium with hot air allowed to stratify the remaining unoccupied 6 floors above for thermostatic venting. This produces energy saving of 40 % compared to traditional air-conditioning.

Similar to Telekom Tower, the use of under-floor air conditioning (U/A) system in the Securities Commission building ensures thermal comfort and good ventilation.

An example of a low energy office (LEO) building built by the Government of Malaysia is the new Ministry of Energy, Water and Communications (MEWC) headquarters (Fig. 4) . The building design and energy systems were optimised for minimum energy consumption using a computerised design tool. A saving of 50 % was targeted on the energy consumption compared to the performance of traditional office buildings in Malaysia. An additional construction cost of less than 10 % is anticipated thus giving a payback period of the extra investment of less than 10 years.

Fig. 4. Low Energy Office, Putrajaya (artist impression)

Another energy efficient building is Kuala Lumpur International Airport (KLIA) (Fig. 5). This airport is designed to be an environmentally friendly airport with its central theme of an “airport in the forest” and a “forest in the airport” The central hub of the satellite building offers travellers a landscaped garden, including forest trees and sculptured waterfall for enjoyment and relaxation. The landscape circular hub of the satellite building features a forest in the airport.

Fig. 5 Rain forest arboretum at Kuala Lumpur International Airport

Other examples of other energy efficiency building in South-East Asia include the Urban Development Authority of Singapore, Singapore Immigration and Registration Building,

Temasek Tower (Singapore), Plaza Bank International Indonesia Tower II, Hanoi Daewoo Hotel Building (Vietnam) and Hotel Le Royal Building (Cambodia).

The concern for energy saving is also reflected in the increasing number of retrofitted buildings in the region where major changes and improvements made to improve energy efficiency. Examples include The Sultanah Zanariah Library at Universiti Teknologi Malaysia, Hyatt Regency Hotel, Singapore and several others major buildings in the region.

New buildings under construction include the Zero Energy Office owned by Malaysia Energy Centre (PTM ZEO Building) (Kristenssen, 2005) and the new headquarter for the Energy Commission of Malaysia.

5.2 Urban Development

The administrative centre Putrajaya in Malaysia, (Fig 6) is an example of a mammoth urban development project. Putrajaya.has incorporated the latest technologies to position Malaysia to face the future while at the same time it encourages values that would help in achieving sustainable development in every aspect – environment, economic and social. The essence of Malaysia can be seen in the grandest buildings to the simplest street furniture. In Putrajaya, a national heritage is being created for the future generation.

Fig 6.. City of Putrajaya

The planning of Putrajaya was based on the Total Planning Doctrine, which among others recognises the important relationship between man and his surrounding environment (Issace, 2005). Land use planning has particularly given emphasis to the following aspects of the environment:

- The preservation of trees, natural topography and environmentally sensitive areas such as hill land, natural water courses, flora and fauna.
- Influencing the micro climatic condition by the creation of the lake system.
- Maintenance of the lake and river water quality by control of point source pollution and erosion management.
- Creation of the constructed wetland to further facilitate water quality control
- Creation of green lungs to act as buffer zones against potential sources of environmental problems such as vehicle emissions.
- Introduction of an integrated public transport system network
- In terms of land use planning, land area designated as parks and open spaces cover some 37 % of Putrajaya land area.

Sustainable building construction has saved the Putrajaya government in operating costs. It has educated the people that with appropriate use of natural resources and with proper management of the buildings, it will contribute to saving scarce resources, reducing energy consumption and improving environmental quality.

6. HOUSING DEVELOPMENT

In general housing conditions in the poorest countries of South-East Asia are often characterised by substandard housing with poor infrastructure and services. Slumps and squatter settlements have proliferated in many of the large cities. Clearly the emphasis of housing needs between countries in South-East Asia differ considerably and so are the technologies and methods adapted in the construction.

The national housing policy in Malaysia and other countries in Southeast Asia focus on the low income groups, to ensure that they have access to adequate and affordable shelter and related facilities. The policy is emphasised through housing strategies and programmes outlined in the country's development plan.

Traditional houses in the region designed and built by ordinary villagers themselves is a near-perfect solution to climatic control with multifunctional use of space and flexibility in design thus a sustainable design option Fig. 7. On the other hand modern terraced housing developed to solve the problem of accommodating urban population due to migration from rural to cities gives little respect to "ground connection" to the rain forest landscape and giving negative impacts to the environment.

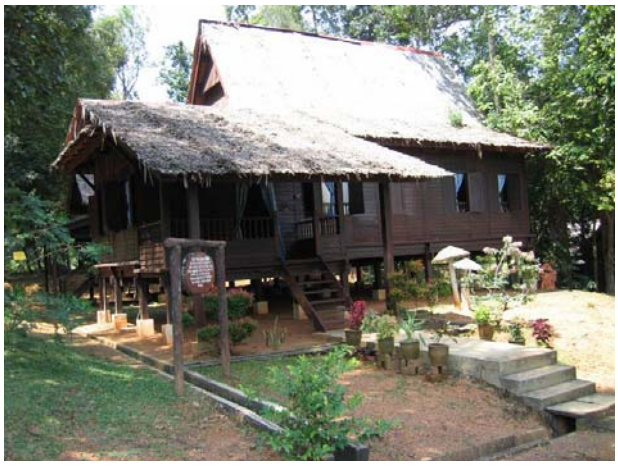

Fig. 7 A Traditional Malay house

The main issues in housing development in the region are the lack of suitable designs and technologies that makes hot houses during the day and stuffy cells at night. Conventional designs are inherited from past colonial designs, which are not suitable for tropical climates.

In addition, the motivation for improving low-income housing in majority of the countries relates to overcrowding, insecurity, vulnerability to disasters, poor sites, poor ventilation and design, land and housing that are not affordable compared to income levels and strained physical infrastructure and social services.

In summary, there is an urgent need to promote a wider notion of sustainability in housing in order to improve the environmental performance as well as creating a greater impact of sustainability upon the lives of the community. With the recent tsunami disasters, South-East Asian countries especially Indonesia and Thailand is further burdened with the challenges for providing houses for the tsunami victims.

7. BARRIERS TO SUSTAINABLE CONSTRUCTION IN SOUTHEAST ASIA

Most countries in South-East Asia are facing with the growing environmental problems that have been the natural consequence of economic development. Malaysia is one of the few countries in the world that has actively attempt to balance environmental conservation with economic development..

In general, the process of driving sustainability in construction in the region is slow. Studies (Shafii et al 2005) showed that the following points contributed to barriers in sustainable construction.

(a) Lack of Awareness on sustainable building

Sustainability is still a relatively new concept for the construction industry in the developing countries of South-East Asia. Generally, there is an increase in awareness on sustainable building and construction in the region however it is not across the whole spectrum of the construction sector.

(b) Lack of Training and Education in Sustainable Design and Construction

Many important stakeholders are not even aware of the concept of sustainable building and so are naturally resistant to change. Hence the greatest barrier is the lack of understanding of the need for sustainable design.

(c) The higher cost of sustainable building Option

Many stakeholders are in the opinion that the construction industries won't go green unless it saves them money somehow. Majority of the clients have not been interested in any sustainable features except for energy efficiency aspects, which is believed to lead to an immediate paybacks.

(d) Procurement issues

Undue emphasis on lowest price rather than best value impacts negatively on industry performance in terms of time, cost and quality. It affects the sustainability of enterprises and their ability to develop and retain a skilled workforce, and to actively promote safety, health and the environment.

(e) Regulatory barriers

Public policies and regulatory frameworks do not encourage the development of the construction sector.

(f)Lack of Professional capabilities/Designers

SBC requires another area of sub-specialisation for architects and engineers. Sustainability takes too much time to learn and design. Clearly the architecture and design curriculum in existing schools and construction education is not sufficient to prepare future architects and engineers to understand such roles and responsibilities.

(g)Disincentive Factors over Local Material Production

One of the disincentive factors to SBC is the involvement of the government in the supply of building materials. In order to meet the demand for building materials, many governments in SEA have played an active role in the supply of basic building material such as cement.

(h) Lack of demonstration examples

More demonstration examples are needed to convince stakeholders to adopt sustainable building and construction options.

8. RECOMMENDATIONS

The challenges of the construction sector is not only to find the balance between environmental, economic and social solutions but also an attempt to favour decision without regrets in the life cycle or construction phase of the built facilities.

The industry will have to adapt to these new and emerging construction markets which have environmental and social dimensions. As highlighted in sustainable construction for Europe (2001), construction businesses will be expected to integrate and consider the issues valued by others at national, regional and community level where the driving forces constituted a mixture of political, social and market forces thereby requiring products responding to genuine need and concerns. Achieving sustainability means require the involvement by government and all construction stakeholders as actions for sustainability involve both policy and financial support.

In responding to these challenges and, for the construction industry in the region to move towards sustainability, the following recommendations have been proposed.

(a) Education and training should incorporate sustainable development concepts and made it well known and accepted by all people. Education is seen as an important tool in promoting sustainable development and improving the capacity of the people to address environment and development issue. This will increase the level of awareness both among the actors in the entire construction process, as well as the general public.
(b) Initiatives involving planning and construction should be through adapted regulations, standards or fiscal measures and incentives.
(c) Building owners and clients should play important roles in disseminating sustainable construction .
(d) Understanding sustainable construction through common definitions and language to address the issues.
(e) Designers adopting an integrated approach to design (integrated design approach).
(f) Improvement of the building construction process as opposed to the traditional methods.
(g) Building users should consider the environmental issues as one aspect of productivity.
(h) Manufacturers of building materials/ products taking life cycle considerations as the basis of product development.
(i) Building maintenance organisations should consider environmental consciousness as a factor of competitiveness.
(j) The development of tools to help in decision making.

Some of the recommendations indicated above were general points discussed in other previous references. In summary, the recommendations made above indicate the need of capacities, technologies, tools and broad involvement of construction stakeholders in order to achieve sustainability in construction.

9. CONCLUSIONS

Countries of South-East Asia face very different sustainable development challenges, but at the same time confront common challenges typical of industrialising and urbanising economies. These and other challenges make the pursuit of sustainable development and construction in South-East Asia particularly challenging. The lack of awareness, training and education and ineffective procurement systems are among the major barriers for sustainable construction in the region. In some countries public policies and regulatory frameworks do not encourage the development of the construction sector. Besides the needs for capacities, technologies and tools, total and ardent commitment by all players in the construction sectors

including the governments and the public at large are required in order to achieve sustainable construction in South-East Asia.

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References

Agenda 21 for Sustainable Construction in Developing Countries) - A Discussion Document, CIB & UNEP-IETC Publication, CSIR Building and construction Technology, South Africa, 2002

Agenda for Sustainable Construction in Europe, A Report by the Working Group for Sustainable Construction, Brussels, 2001

BREEAM(UK), Building Research Establishment Environmental Assessment Method, www.breeam.org

CICA, Industry as a partner for sustainable development, Confederation of Internatinal Contractors' Associations (CICA) 2002

GEO 2000, Global Environmental Outlook: State of the environment , Asia & the Pacific – Social and Economic Background, UNEP

Issace, J. Sustainable Development Planning and Construction in Putrajaya, Putrajaya , Sustainable Building and Construction in South-East Asia, Proceedings of The Conference on Sustainable Building South-East Asia, 11-13 April 2005, Malaysia

Ken Yeang, , The Skyscraper Bioclimatically Considered, Academy Editions, London, 1996

Kibert (1994), First International Conference on Sustainable Construction, Tampa, Florida, 1994

Kristensen, P.E., , Khalid, R., Tang, C.K , The PTM ZEO Building , Proceedings of the Conference on Sustainable Building South-East Asia, Kuala Lumpur, Malaysia, April 2005, pp 167

LEED (USA), Leadership in Energy and Environmental Design, www.usgbc.org

OECD, Environmentally Sustainable Buildings: Challenges and Policies, Paris, Organisation for Economic Co-operation & Development, www.oecd.org

Shafii, F. , Othman, M.Z., Design Challenges of Tall Buildings and Implications on Construction Education, Proceedings of The CTBUH Seoul, Korea: Tall Buildings in Historical Cities, October 2004, 808-815

Shafii, F., Othman, M.Z., Sustainable Building and Construction in South-East Asia, Proceedings of The Conference on Sustainable Building South-East Asia, 11-13 April 2005, Malaysia

UNEP 2003, Sustainable Development Priorities in South-East Asia, United Nations Environment Programme, Regional Resource Centre for Asia and the Pacific (UNEO RRCAP), Nov. 2003.

WBDG, Whole Building Design Guide, www.wbdg.org/design/designobjectives.php