PERCEPTION OF LOCAL ARCHITECTS ON SUSTAINABLE ARCHITECTURE IN MALAYSIA

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ABSTRACT

Sustainable architecture encompasses the design and management of sustainable human settlements, which leads to the configuration of appropriate human settlements that optimise the utilisation of resources, and management of resource extraction and waste disposal in a manner which does not deplete or degrade the environment. This paper reports on research investigation conducted on the perception of local architects on sustainable architecture in terms of their understanding and attitude towards the concept. Data was collected through a mail survey conducted among a sample group of architectural practices in Malaysia between June – August 2001. The study revealed that a significant percentage of the respondents lack familiarity of the conceptual meaning of sustainable architecture, as well as readiness to embrace the idea. Perceived barriers were issues pertaining to the design process, the people and disciplines involved. This study recognises the importance of incorporating issues of sustainability as integral part of the design and building process. It is concluded that the success of promoting sustainable architecture rest upon collective support and commitment of many disciplines and not only confined to architects.

Keywords: Sustainable Architecture in Malaysia

Introduction

The process of embracing sustainability depends to a large extent on the readiness of the community as a whole. It is inevitable that human's perception of and behaviour towards the environment will affect how well the environment is safeguarded. The choice and behaviour of architects in conducting their practices constitute an essential contribution towards promoting sustainable development.

Definition of Terms

The Concept of Sustainability in Architecture

The word 'sustainable' according to Webster's 10th New collegiate Dictionary means, "of, relating to, or being a method of harvesting or using a resource so that the resource is not depleted or permanently damaged." The concept of sustainability is interdisciplinary in nature, which demands participation from every level of the community, aiming at maintaining a balanced ecological and social systems.

Sustainable development has become a widely discussed topic since the publication of the World Commission on Environment Development (Bruntland) Report, *Our Common Future*, in 1987. The report provides the widely quoted definition of sustainable development: "*to meet the needs of the present without compromising the ability of future generations to meet their own needs".* Sustainable development holds on to the idea that the environmental, economical and social aspects of development are potentially compatible and in fact are complementary objectives. This offers a welcome relief from the paradigm of conflict that had characterised the debate on limits of growth during the 1970s, issued by the Club of Rome in their book *The Limits to Growth (Meadow, 1972).* The book projected that by the

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middle of twentieth century, humanity would reach the material limits of several key resources and exhaust the 'carrying capacity' of the planet. The recent thrust for the concept of sustainability was offered by the Earth Summit which was held at Serrado Mar, near Rio de Janeiro in June 1992. Sponsored by the UN Commission on Environment and Development, this conference was used as a vehicle to explore further the idea of sustainable development. The concept of sustainable development set to imply a wider dimensions to indicate the need for a balanced and sustainable development of the ecological, political, social and economic systems, through policy action.

There are other definitions of what constitutes a sustainable development. Perman et. al. (1996) looked at several definitions by the WCED (1987), UNESCO, Pezzey (1992), Barbier and Markandya (1990),Pearce et. al (1989) before summing up that sustainable development is attainable *'if pollution flows are reduced, recycling is encouraged, and more attention is given to the regulation, management and disposal of waste (Perman, 1996)*, as these measures characterise a move towards sustainability. In other words, a sustainable society is one that persevere to exist while ensuring that there is no irreversible pollution nor reliance on finite resources.

There have been a number of efforts to define sustainable architecture since the introduction of the term 'sustainable development' in the Brundtland Report (WCED, 1987). Design approaches in support of sustainable architecture are 'green architecture' (Vale, 1999), 'environmentally responsive

design' and ecological design' (Yeang 1998; Van der Ryan 1996). Vale (1999) proposes six principles that together could build into a green architecture which are, conserving energy, working with climate, minimising new resources, respect for users, respect for site and holism.

Sustainable architecture echoes the concept of 'sustainable development', targeting on the architectural issues. According to Ray-Jones (2000), the notion implies "a thoughtful and well considered use of energy systems to make buildings that are more conducive to human use and comfort, without generating pollutants or borrowing the earth's resources for the future generations." Sustainable architecture encompasses the design and managing of sustainable human settlements which deal largely with creating appropriate human settlements configurations that optimise (not maximise) the consumption of resources, and managing resource extraction and waste disposal in a manner which does not deplete or degrade the environment.

Energy in Buildings

Building poses global impact in terms of energy and resources. In the UK for instance, the heating, lighting and ventilation of buildings consume about half the total energy consumption of the country (Edwards, 1996). Greenhouse gases are the by-product of this profligate consumption of energy. Energy conservation is an imminent environmental issue that needs to be addressed by various bodies in the construction industry. Another issue connected with the energy use is energy crisis. Malaysia's projection anticipates that the country will be oil importers by the year 2010.

Throughout history, climatic, energy, and resource requirements have been fundamental to the art and craft of architecture. The purpose of design is to preserve and enhance the quality of environments we build. Energy conservation should be a primary consideration in the design of buildings. Recently, energy design has been used as the rationale for aesthetic solutions, putting buildings up in the air and underground. In developed countries such as USA and UK, energy conservation is predicted to provide impetus to a rethinking of

architectural styles and methods as spectacular as that which followed the emergence of industrialisation.

The rate of energy consumption in Malaysia is escalating resulting in excessive use of energy sources and environmental strain. Since the 7th Malaysia Plan (1996 to 2000), the Government of Malaysia have been strategising as how to encourage efficient energy use. For the building sector, the Ministry of Energy, Communications and Multimedia is currently in the process of formulating a "Practice Code on Energy Efficiency in Buildings" to ensure that energy consumption levels of air conditioned buildings are designed within certain energy index limit.

Efforts towards energy efficiency in buildings is most crucial in the first three stages of design processes namely, brief formulation, schematic design and design development phases. These phases is referred to by Hershberger (1999) as the architectural programming phase. He states that during this stage "the relevant values of the client, user, architects, and society are identified, importance of project goals are articulated, facts about the project are uncovered, and facility needs are more explicit" (p. 5).

Objectives

- To find out the general attitude and understanding of local architects towards sustainable architecture.
- To identify perceived barriers, likely to impede local architects from incorporating sustainable ideas in their works.

Statement of Problem

This study begins with an argument that architects do not appear to include sustainable design principles and features to an appreciable magnitude into their works. There is a need to explore the reasons for this neglect.

In 1997, Wittmann carried out a similar study investigating the Australian architects' perceptions regarding sustainable architecture. It was concluded that the main barrier to sustainable architecture is of societal significance rather than a problem confined to architects solely. The basic assumption of this study is that Malaysian architects are facing similar problem.

In Hong Kong, Poon (1999) conducted a study on practices in the construction industry, to identify the best practices to derive at changes suggestions on the local construction process in order to achieve sustainable construction. The study revealed that the Hong Kong construction industry is not familiar with the concept of sustainability and sustainable construction. Those claimed that they understand are also unaware of the importance of attaining the equilibrium in social, economic and environmental sustainability.

Professional Architects and Challenges

The architectural profession represents individuals that possess a particular set of technical, managerial and artistic skills. Architects gain financial rewards for their knowledge and skills in the design of built environments. Further to this they also gain respect owing to their role and responsibilities to protect the public interests.

As a professional person, architects have inherent responsibilities towards the society. Practicing architects are expected to deal with numerous multi-faceted issues such as environmental impact, architectural concept, structural solution, building materials,

environmental control, interaction with other professionals, building technology, legal responsibility, health and safety, building regulations, fire, access for the disabled, colour, texture, form, durability, maintenance, flexibility, cost, value for money, proportion, psychology, human sociology, sustainability, etc.(Steele, 1997)

The profession in many countries is currently going through rapid changes and development. The environment in which architects are exercising their professional activities are rapidly changing in various fields. The changes involve the physical and psychological dimensions in the way people conduct their day-to-day activities, and their expectations of their built environment. Further to this architects are expected to keep pace with the rapid advancement of building technologies and sophisticated systems. These changes occur against within immense advancement of information and communications technology which provide architects with a wide range of opportunities and challenges. Symes et al. observed that a significant proportion of the profession felt poorly prepared to cope with the new situations, which in turn jeopardise the quality of designed environment. According to Steele (1997) architects should equip themselves with broad knowledge that not strictly confined to construction, instead they must be familiar with other literature that has direct impact on the architect's world, "to maintain professional responsibility to a wider global constituency that is increasingly demanding." (Steele, pp.56)

Response to Agenda 21

The Rio Earth Summit produced Agenda 21 as the centrepiece of the agreement. The Agenda 21 document extensively details necessary actions needed to be taken up by the governments and international organisations, industrial community and the community as a whole, to procure lasting changes in the modes of human economic development.

Section III of Agenda 21 recognises that Government and international agencies require the full support from the community, through professional bodies representatives and industry organisations in their effort to achieve sustainable development in the development of policy and in achieving the necessary changes. One of the objectives set up in the Agenda 21 is that by 1996, most local authorities in each country should have undertaken a consultative process with their population and achieved a consensus on a 'Local Agenda 21' for the community. Though without any force in international law, the document has prompted several countries to strategise and implement actions to achieve sustainable at national levels. Britain came up with a government white paper, *Sustainable*

Development: the UK strategy while Australia's support is in the form of *Australia's National Strategy for Ecologically Sustainable Development (ESD).*

Section IV of Agenda 21 addresses pertinent issues, which are of interest to architects and urban planners. This section deals with the management of human settlements, referring in detail to the need for adequate environmental infrastructure and changes in the construction industry (Steele, 1997). It identifies environmental issues pertaining to the built environment, examines the present structure of the construction industry, and notes its destructive capacity. The report proposes corrective measures as stipulated in Table 1.

Several members of the American Institute of Architects, together with others representing the International Union of Architect, later produced an addendum to this section of Agenda 21which was published as part of the AIA Environmental Resource Guide. (Steele, 1997) (Refer Table 2)

In 1990 Royal Institute of British Architects issued the RIBA Environmental Statement, a document on the profession's commitment towards sustainable architecture (Edwards, 1996).

Environmental responsibilities for architects at various design stage are outlined within the extended RIBA 'Plan of Work' (RIBA, 1990). (Refer Table 3)

Table 1: Corrective Measure Proposed under Section III of Agenda 21

1. The use of local materials and indigenous building sources.
2. Incentives to promote the continuation of traditional techniques, with regional resources and self-help strategies.
3. Recognition of the toll that natural disasters take on development countries, due to unregulated construction and use of inadequate materials and the need for improvements both in use and manufacture of materials and in construction techniques, as well as training programs.
4. Regulation of energy-efficient design principles.
5. Standards that would discourage construction in ecological inappropriate areas.
6. The use of labour-intensive rather than energy-intensive construction techniques.
7. The restructuring of credits institutions to allow the poor to buy building materials and services.
8. International information exchange on all aspects of construction related to the environment, among architects and contractors, particularly about non-renewable resources.
9. Exploration of methods to encourage and facilitate the recycling and reuse of building materials, especially those requiring intensive energy consumption in their manufacture.
10. Financial penalties to discourage the use of materials that damage the environment.
11. Decentralisation of the construction industry, through the encouragement of smaller firms.
12. The use of "clean technologies".

Source: Steele, 1987

Table 2: Addendum in Response to Proposals in Section III of Agenda 21

1. An extension of the view of the built environment beyond shelter, to include "energy harvesting, waste management and reuse, food production and distribution, water harvesting and handling, as well as facilities for recreation, health, education, commerce, etc."
2. Reduction of construction processes that damage the environment in favour of those that restore it.
3. The strict implementation of reuse and recycling of building materials.
4. Encouraging the creation of self-reliant communities to reduce transportation, energy, material use.
5. A return to well-established methods of design that conserve energy and natural resources.
6. A further examination and exploration of the potential of self-help in the "making, remaking, and use" of sustainable settlements.
7. The encouragement of community participation in the design and construction process, an idea that was first popularised in the early 1970s in the United States by Charles Moore.
8. Urban energy and harvesting, forestry, food production and hydrology, and wildlife management supported by the involvement of UN agencies.

Source: Steele, 1987

Table 3: New and Expanded RIBA 'Plan of Work'

A. Inception	• Brief client on new environmental duties • Place environmental duty of care within brief • Advise on environmental consequences of site choice
B. Feasibility	• Test the feasibility on environment-friendly design • Advise on appointment of 'green' consultant. • Investigate environmental consequences/opportunities of site
C. Outline proposal	• Develop green strategies in design • Obtain approval for unusual energy use or environmental aspects of design
D. Schematic design	• Finalised environmental parameters within design • Check the green approach to design and construction against cost and legislative controls
E. Detail design	• Obtain final approvals for environmental design stately • Check the benignity of materials to be specified • Undertake broad appraisal of life-cycle assessment of components
F. Production Information	• Ensure that design, details and spec. are in line with current environmental duties in building
G. Bills of Quantities	• Check that BQ allow contractors to realise their environmental duties in building
H. Tender	• Obtain Environmental Policy statement from tenderers • Advise tenderers of environmental duties
I. Project Planning	• Advise appointed contractor of environmental duties and standards
J. Operation on Site	• Monitor site operations to ensure good environmental duties and standards
K. Completion	• Ensure building is environmentally sound • Check environmental controls are working and understood • Compile environmental statement for building
L. Feedback	• Monitor environmental initiatives in journals • Prepare a user manual for all subsequent owners

Source: Edwards, 1996

Malaysian Architectural Profession and Building Industry

Architectural profession in Malaysia has been through many phases of development. The rapid economic and social growth has increased the demand for architectural services.

The establishment of the Board of Architects and the Institute of Architects in 1967 marked a new era in the architectural profession in Malaysia. PAM plays a major role in promoting the profession and to uphold the society's respect towards the profession.

Malaysia's economical growth provides opportunities and challenges for practitioners to demonstrate their competency. However, Murray (1984) warned the possibility of Malaysia facing similar problem faced by the Great Britain in the 1950s and 1960s, when "too much was built too quickly with too little concern for quality". (Saruwono, 1998)

Architects are important team players in the building industry. The challenge for the industry is to play an integral part in providing a better quality of life through its activities whilst minimising impact on the environment. The building industry is diverse and its scope ranges from producing major infrastructure works such as bridges over canals to minor interior works.

Planning and Building Control

The administration of the states in Malaysia is divided into multiple local areas, either defined geographically, economically or politically within their respective boundaries of administration. The overall general policy in respect of planning and development of Local Authorities are under the responsibility of the State Authority, who is the Ruler in Council, Governer in-Council of a State. In terms of planning control, the Town and Country Planning Act 1976 empowers every Local Authority 'to regulate, control, and plan the development and use of all lands and buildings within its area'. This Act provides the legal framework and uniform procedure for the preparation of development plans and planning control as well as a wide range environmental policies such as urban renewal, environmental development and management, and conservation.

The power of local authorities are further extended to include approving of building plans under the Uniform Building by-Laws (UBBL). Under Section 34A of the Environmental Quality (Prescribed Activities)(EIA)(amendment) Order 1996, any project proposals which falls within the prescribed activities require the preparation of Environmental Impact Assessment for approval by the Department of Environment.

Research Methodology

A total of 400 architectural practices were chosen as sample group from 997 registered practices in Malaysia. The practices were randomly selected from the Malaysia Sourcebook for Architects and Designers 2000-2001. Questionnaire was used as the instrument for data collection. Questionnaires were sent by mail, addressed to the Principals.

Questionnaire was chosen because it provides participants a degree of freedom to think and express their opinion. In addition, others who have carried out similar studies have suggested that it is particularly difficult to arrange an interview with the principals of architecture practices. (Saruwono, 1998)

Questions in the questionnaire are derived from previous works of similar nature by Wittman, 1998; Poon, 1999 and books by Steele, 1997; Vale, 1996; and Edwards, 1996.

Analysis And Findings

From the 400 questionnaires that were sent out, 42 responded. This represents 4.2% of the 997 registered architectural practices in Malaysia. This chapter analyses results of the survey findings. The aim of the analysis was to determine what was the architects overall understanding and attitude on sustainable architecture. Their acceptance on energy efficient and environmental approaches in design were analysed to provide an overview of their commitment level to sustainable design approach.

Profile of Respondents

Information on the company profile gathered comprised of the company size, and the respondents' highest academic achievement, age and gender. Every group was well represented, with majority of respondents from company of less than 10 people (47.62%), mostly with Bachelor Degree qualifications obtained from foreign universities (57.14%). Most were from the age bracket of 31 – 45 years (64.29%). 88.1% of the respondents were male.

Table 4: Summary of Respondents' Profile

Company Size

	Frequency	**Percent**
<10	20	47.62
11 – 20	9	21.43
21 – 50	8	19.05
>50	5	11.90
Total	**42**	**100.00**

Respondents Academic Achievement

	Frequency	**Percent**
Foreign Dip.	1	2.38
Foreign Bach.	24	57.14
Foreign Masters/PhD	9	21.43
Local Bach.	8	19.05
Total	**42**	**100.00**

Age

	Frequency	**Percent**
26 - 31	2	4.76
31 - 45	27	64.29
46 - 50	6	14.29
>51	7	16.67
Total	**42**	**100.00**

gender

	Frequency	**Percent**
female	5	11,90
male	37	88,10
Total	**42**	**100,00**

General Attitude and Understanding of Sustainable Architecture

Content analysis was carried out on the results of two open ended questions, seeking for respondents' definition of what makes 'good architecture' and their interpretation of the term 'sustainable architecture'. The objective was to study what they consider to be the primary factors that made up good architecture. It also served to find out whether they were familiar with the term, which would reflect their knowledge and attitude towards the subject.

Good Architecture Criteria

The respondents felt that good architecture primarily depends on the architects themselves. Others identified to have some influence on producing good architecture were the clients and others in the building team, namely other consultants and contractors.

There were five architects' attributes identified as primary criteria for producing good architecture;

1. practical & cost effective judgement, (a1)
2. design skills and creativity, (a2)
3. values and morality, (a3)
4. environmental and contextual responsiveness, (a4)
5. good management skills (a5)

As shown in Figure 1, majority emphasised on the first and second attribute, where respectively 57.14% and 54.76% of the respondents mentioned them in their answers.

38.09% mentioned both the practical judgement (a1) and design skills (a2) in their answers. Insignificant percentage (9.5%) identified all (a1,a2,a3,a4,a5) or at least the first four (a1,a2,a3,a4) as important attributes. 28.5% identified *environmental and contextual responsiveness* as one of the primary criteria.

Cross tabulation performed on *environmental and contextual responsiveness* attribute (a4) against respondents' profile showed that those from smaller practices (< 10) and within the age group of 46-50 years appeared to place higher emphasis on the importance of environmental concerns. Those with foreign academic background seemed to stress on environmental concern more than the local graduates.

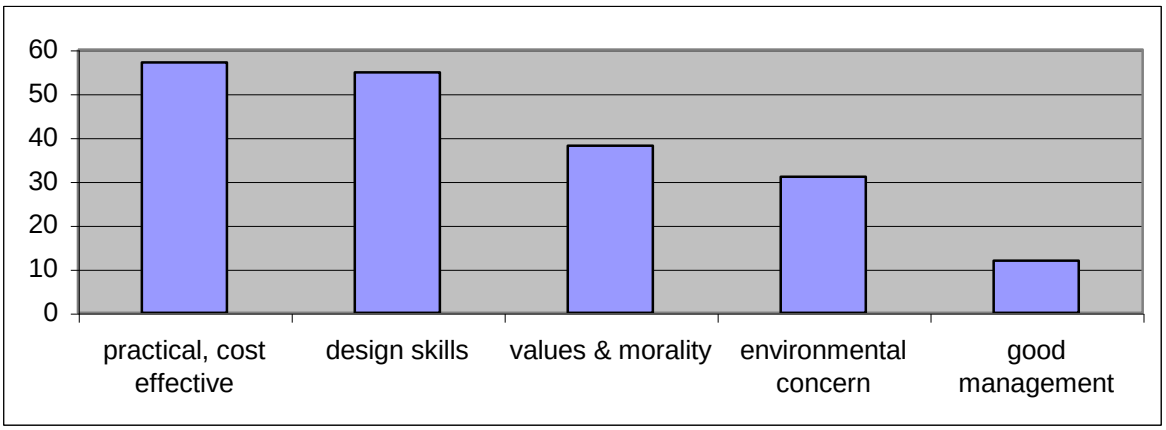

Figure 1: Architects Attributes to Produce Good Architecture (according to each attribute)

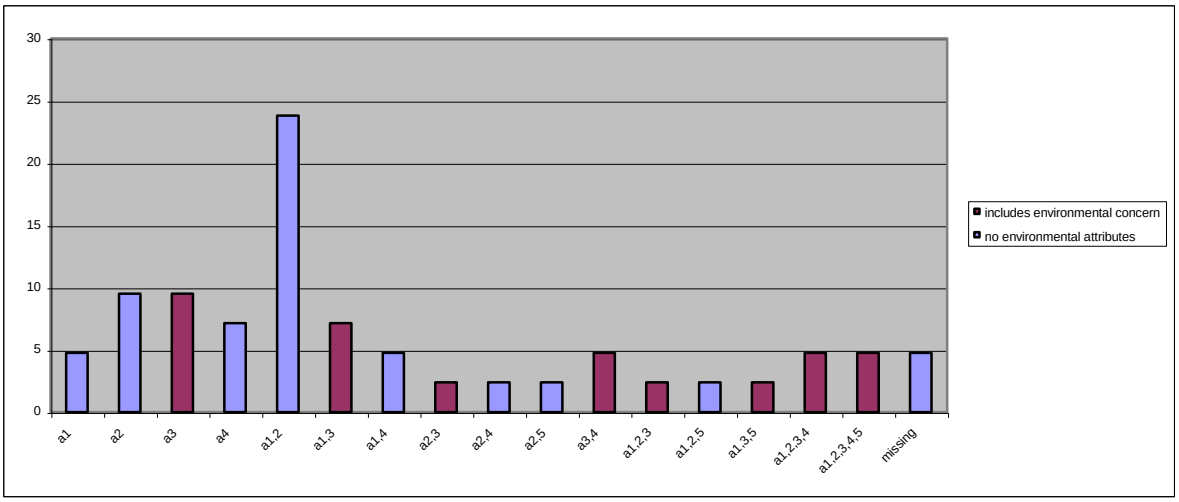

Figure 2: Architects Attributes to Produce Good Architecture (according to combinations of components identified)

Interpretation of Sustainable Architecture

The answers were analysed and categorised as follows;

1. familiar (Y1)
   - able to provide acceptable definition of the term;
   - relate sustainable architecture with environment as primary factor and connect with other domains as well, such as social, economical and cultural;
   - emphasis on the importance of balance and harmony in architecture.
2. partially familiar (Y2)
   - relate the term with environmental dimension; however
   - express the meaning with doubt.
3. literal interpretation (P)
   - relate with literal definition of the term;
   - although no mention of the word 'environment', other terms used such as "ageless", "evergreen", and "quality design" may imply association to nature and environment.
4. unfamiliar (N)
   - unfamiliar with the term;
   - either admitted that they are not familiar with the term, or provide wrong definition.

As indicated in Figure 3, 40.48% were able to provide a clear conceptual definition of the term. They were able to relate sustainable architecture with environment as primary factor. They were also aware that sustainable architecture also encompasses other aspects such as social, economical and cultural. Group y2 (16.6%), although were able to relate the term with environmental dimension, did not include the social and economical aspects in their definition. It can be concluded that a significant percentage of the respondents were not familiar with the conceptual meaning of the term (42.85%).

Cross tabulation results showed that comparatively respondents from smaller practices (<10) provided more accurate definition of sustainable architecture. Age wise, those within the lowest (26-31 years) and highest age group (>51 years) provided better explanation on the meaning of sustainable architecture. Male appeared to have better understanding of the term.

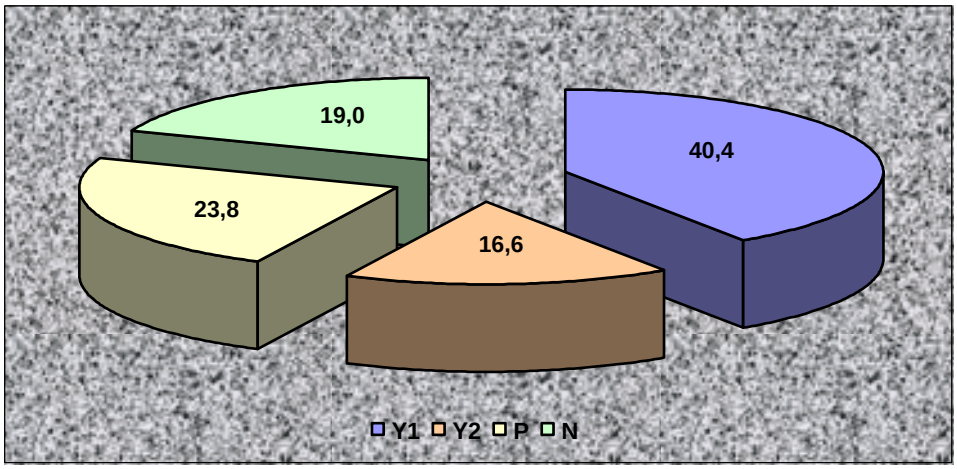

Figure 3: Understanding of the Conceptual Meaning of Sustainable Architecture

Key Players in Promoting Sustainable Architecture

85.71 % felt the need for more support towards sustainable architecture. Respondents identified the following as potential key players in promoting sustainable architecture;

- professional bodies
- authorities
- developers.
- building associations, and
- universities

The professional bodies were most frequently cited (43.9%) as the organisation that should take the lead in the effort. Also high in the vote was the authorities (34.8%).

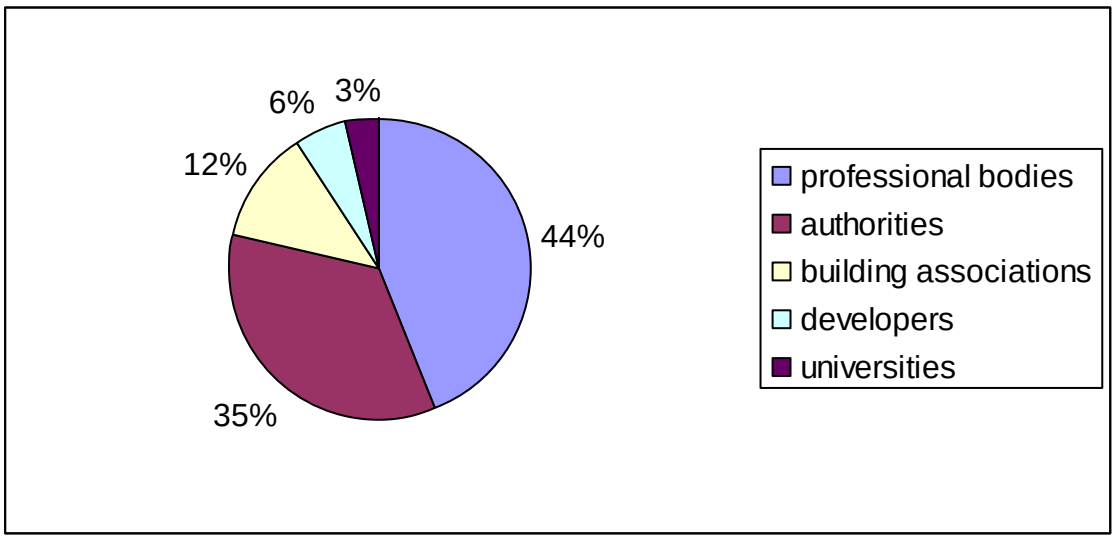

Figure 4: Key Players in Promoting Sustainable Architecture

Barriers to Sustainable Architecture

Asked if there was any reason for not or not being able to apply sustainable architecture, most believe there were. The resistance identified to be from within (internal resistance) and

outside (external resistance) themselves. These resistance were seen almost equally strong, 61.9% and 57.1% respectively. Internal resistance was primarily (50%) due to the lack of knowledge, awareness and concerns over the matter, and secondarily (11.9%) due to respondents' opinion that such support is not important, pursued by specialised group of architects.

External resistance were in the form of the clients' lack of commitment on the subject. Their lack of knowledge and understanding of the importance of sustainable architecture was identified as the primary reason for this attitude.

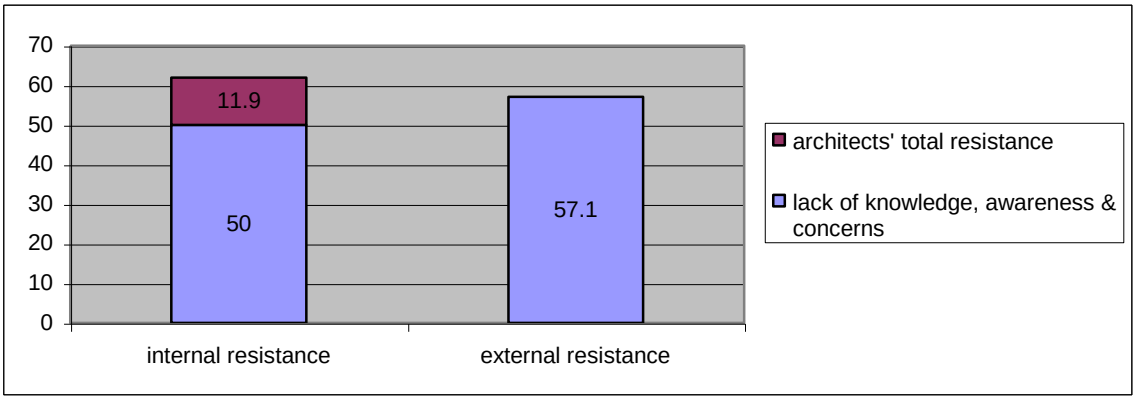

Figure 5: Barriers to Sustainable Architecture

Sustainable Architecture as Primary Agenda

Respondents were asked if they thought sustainable architecture was/would be a primary agenda presently/in future. 57.1% of the respondents thought that it would be a primary agenda within immediate future (less then 5 years). The remaining 42.9% appeared to be more sceptical, and predicted that it would not be a primary agenda in the near future or never would.

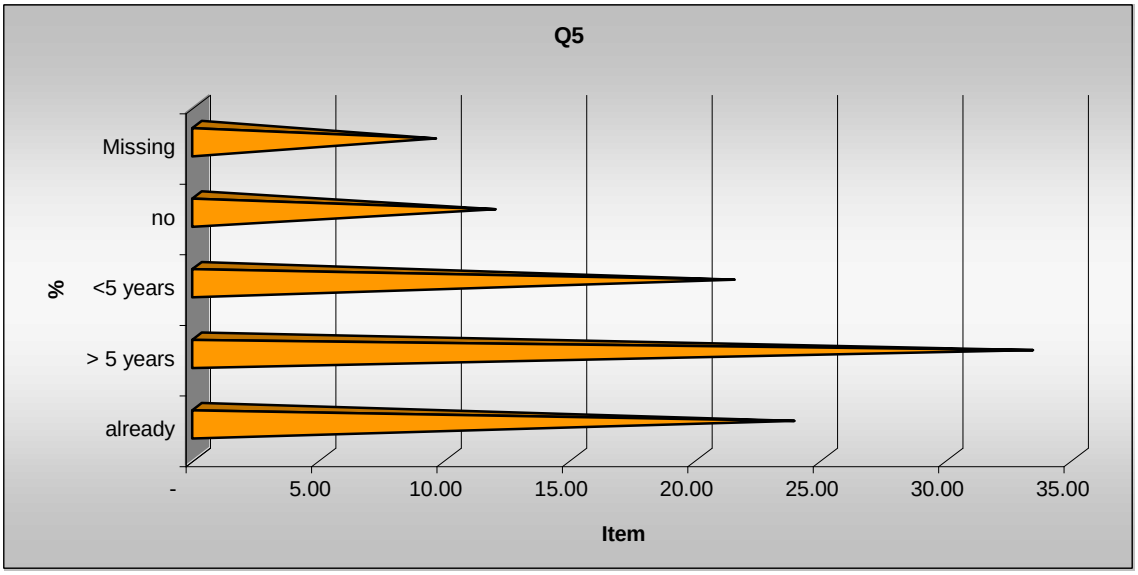

Figure 6: Predicted Timeframe of Sustainable Architecture as a Primary Agenda

Response on Energy Efficient Design Approach

Energy efficiency is a salient component of sustainable architecture design approach. One open ended question was included to understand what was the respondent's primary design concern. This provided an insight to their attitude and overall support on environmental design considerations.

Primary Design Concerns

Primary design concerns cited by the respondents were analysed and classified as follows;

1. Function Driven (economical, user satisfaction and social concerns)
2. Aesthetic Values and Innovation Driven (emphasis on cultural issues, ideas, innovations and forms)
3. Environmental Driven (spatial quality, contextual and environmental impact)

Functional issues were most often (54.28%) cited as the primary design concern. Environmental factors were cited as frequent as Aesthetical Values, at 22.86%. Crosstabulation on the Age and Size of Practices revealed that larger practices (>21) and older respondents (>46 years) were more inclined to accept environmental considerations as Primary Design Concerns.

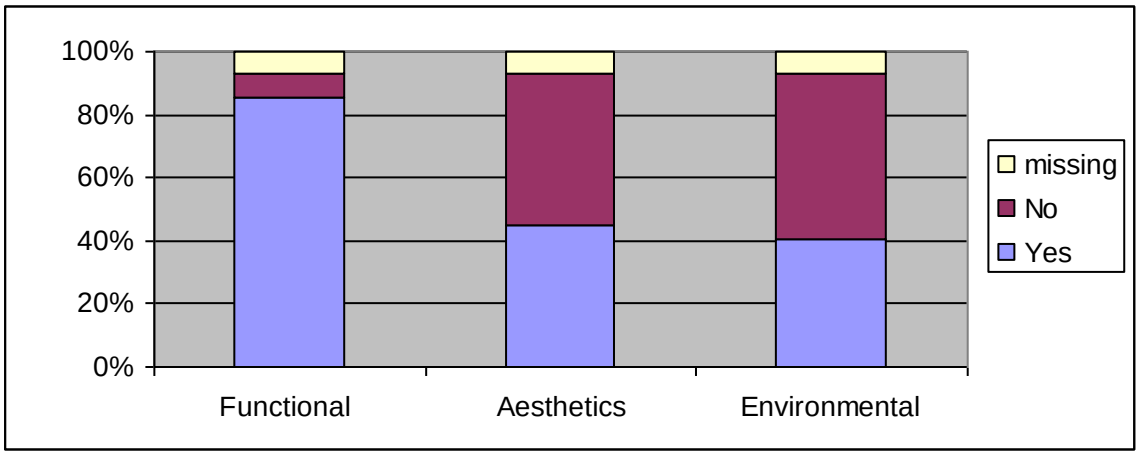

Figure 7: Primary Design Concerns (according to each design emphasis)

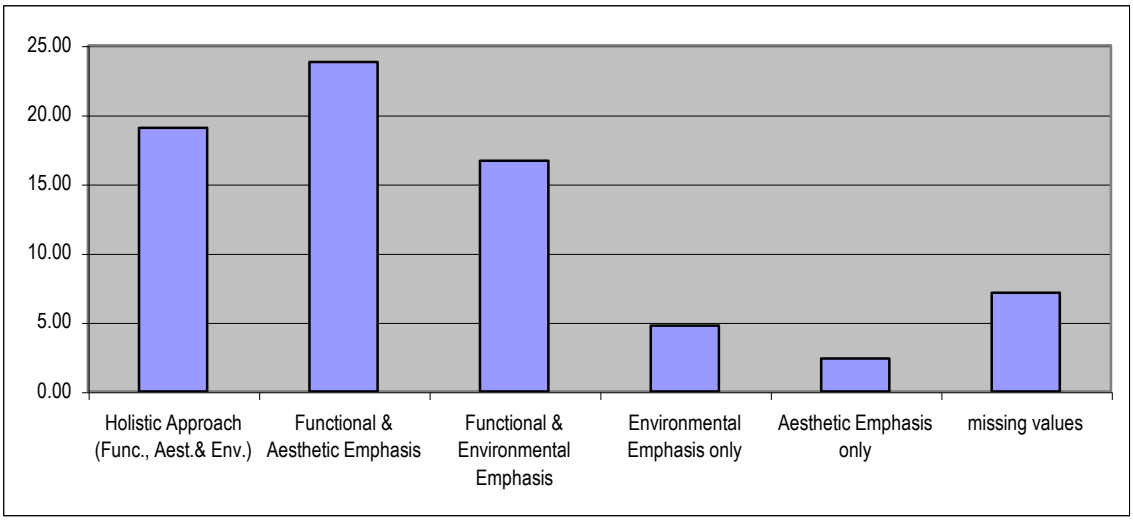

Figure 8: Primary Design Concerns (according to combinations of design emphasis)

Crosstabulation was performed between Environmental Design Concerns and Respondents' Understanding of Sustainable Architecture to see the relationship. Results showed that those who provided better definition of sustainable architecture (y1) and those who equated the term with 'ageless' and 'quality design' (p) were more likely to accept environmental approach as a Primary Design Concerns, where respectively 56.3% and 55.6% of the respondents within the group, identified Environmental Concerns as one of the most essential design aspect. Those who were unable to provide a correct definition of sustainable architecture in previous question (n), did not identify environmental issues as primary design concerns (85.7% of the group population).

'Energy Efficient' Design Approach

78.57% of the respondents agreed that energy efficient design approach is an integral component of architecture and a rather significant percentage (21.43%) thought otherwise.

Respondents were asked to rank their design focuses using Likert Scale, with scale 1 as most important, and scale 5 as least important.

For environmental aspect, majority (30.95%) ranked it at the scale of 2. For conceptual aspect, majority (57.14%) ranked it at the scale of 1.

Table 5: Energy Efficient Approach as Integral Component

Energy Efficient

	Frequency	**Percent**
Integral component	33	78.57
Not integral component	9	21.43
Total	**42**	**100.00**

Table 6: Need for Energy Efficiency Guidelines in Malaysia

Energy Efficiency Guidelines

	Frequency	**Percent**
Yes	17	40.48
No	25	59.52
Total	**42**	**100.00**

Discussions

Previous studies conducted among Australian architects revealed that one major reason for architects' lack of readiness to incorporate energy efficient/ecological architecture features to a significant extent in their works may be due to the architects' own lack of commitment towards energy efficient/ecological architecture. The study also concluded that the main barrier to sustainable architecture is of societal significance rather than a problem confined to architects only.

The research revealed that a significant percentage of Malaysian architects were not familiar with the conceptual term of sustainable architecture. When asked to define sustainable architecture, those from smaller practices (<10) were able to provide better meaning of the term where 55% of the group managed to associate the term with environmental, social / cultural and economical dimensions.

Principals of smaller practices (<10) appeared to place higher emphasis on the importance of environmental consideration. Older and more experienced practitioners (>46 years) were more likely to associate environmental responsiveness with good architecture. There seems to be similar judgement between female and male respondents.

Those who provided more accurate definition of sustainable architecture (y1), and those who associated the term with 'ageless' and 'quality design' (p) appeared to be more ready to accept environmental approach as a Primary Design Concerns.

The study discovered that perceived barriers to sustainable architecture are the architects themselves and their clients. Some (11.9%) felt that sustainable architecture is a 'choice' and preference, 'pursued by specialised group of architects'. Often enough clients and architects treat sustainable architecture as a secondary issue. Although majority (78.57%) agreed that environmental consideration as an integral aspect of design, a significant percentage (21.43%) disagreed. Reasons frequently given for low commitment level were lack of knowledge, awareness and concerns over the subject matter.

Limitations

The research did not explore on the nature and size of projects that the practices were involved with. This would have provided additional information on whether this has any influence on the architects' approach and general perception.

Conclusion & Recommendations

In 1995, Symes et al. reported that seeking energy efficiency, have been an important concern for most design firms in UK. The present study conducted among Malaysian architects seems to indicate that there are significant percentage of architects who do not feel the strong need for such approach.

The overall results from the present study seems to provide similar outcome of previous studies performed on Australian architects in 1997, and Poon's studies on building practitioners in Hong Kong (1999). This study shows that the success of promoting sustainable architecture does not rely on architects solely. Strong support for sustainable architecture must be collective in nature, requiring commitment from various sectors and organisations. This research recognises the importance of embedding issues of sustainability as integral part of the design and building process.

Commitment of Architects and their Professional Bodies

Generally it seems that local architects do not feel strongly the pressure of the present wave of environmental concerns which pose challenges to all professional bodies to prepare themselves for the challenging needs and additional responsibilities. Architects need to put in more effort to curtail undesirable practices which support destruction of the environment. They need to work on regaining their honour as the expert advisors to clients, rather than get dictated by them. Professional organisations namely, the Malaysian Board of Architects (LAM) and the Malaysian Institute of Architects (PAM) are in the best position to take the lead towards this goal.

The professional bodies need to offer continuous professional development (CPD) programme to inculcate architects and other building members on means and methods of achieving sustainable architecture. This could be effectively conducted through collaboration efforts such as presentations of seminars, talks and experience sharing by experts and specialists comprising consultants (architects, engineers, environmental engineers, etc.), suppliers, manufacturers and other relevant bodies.

Strengthening the Regulatory Framework

The Uniform Building By-Laws (UBBL) 1984 is out dated and is currently being revised. This revision process need to be expedite and clauses on the protection of the environment in terms of material selections, building orientation to reduce heat gain, incorporation of passive design means, sustainable development criteria etc. need to be stipulated and regulated accordingly. Clients' overzealous desire to accumulate high profit margin with minimal attention on environmental impact needs to be curtailed through effective means such as regulatory control. Introduction of the proposed Code of Practice for Energy Efficiency in Buildings is timely and appropriate.

It is recommended that further studies be conducted on the application of sustainable architecture in Malaysia, to be appreciated by architects and the society as a whole.

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