

## TEN YEARS OF SUSTAINABLE CONSTRUCTION – PERSPECTIVES FROM A NORTH CONSTRUCTION MANAGER AND A SOUTH ARCHITECT POINT OF VIEW

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### Summary

This paper is about, from a North and South different perspective, how the international focus of sustainable construction issues has changed over the past ten years. The north part is a review from four different international and regional sustainable building conferences between 1998 and 2007, mostly based of the first author's notes from the conferences, especially from the plenary sessions and discussions. The reviewed conferences are GBC98 in Vancouver, Canada 1998, SB02 in Oslo, Norway 2002, SB05 in Tokyo, Japan 2005 and the regional conference SB07 in Malmö, Sweden 2007. The south part is based on literature reviews, research findings and reference buildings from Mozambique and Tanzania reflecting sustainability. The perspectives presented in the paper are those of construction project and environmental manager from northern Europe and from architects in southern Africa with an interest in sustainable construction. The findings of the paper shows that focus of sustainable construction matters has changed from almost solely environmental aspects to a more broad and transparent complexity of sustainability, including ecological-, economic- social- esthetical- and cultural aspects. It also reflects regional and national differences and some shifting views of focus about sustainability in the construction sector during the past ten years.

### 1. Introduction

Sustainable development is a subject that has been of increasing interest by the global community the last two decades. The construction sector has adapted this by introducing the concept of sustainable construction. However, the adaptation depends of the level of the sustainability view, global, national, regional or individual level. It also depends of the cultural and social context of the actual society. For example many of the modern buildings and settlements in developing countries reflect an uncritical reception of modern European buildings form without taking into consideration the special climatic and social conditions of the home country. The aim is to make some reflexions of these differences from a North and South perspective through engineers and architects eyes respectively.

The first section, the North perspective, is about how the international (read North) focus of sustainable construction issues has changed over the last ten years by a review from four different international and regional sustainable building conferences between 1998 and 2007. This section is mostly based of the first author's notes from the conferences, especially from the plenary sessions and discussions, but some contributions are also considered and selected from breakout sessions and from the proceedings. The reviewed conferences are GBC98 in Vancouver, Canada 1998, SB02 in Oslo, Norway 2002, SB05 in Tokyo,

Japan 2005 and the regional conference SB07 in Malmö, Sweden 2007. The reviewing perspective is a engineer by a project and environmental manager.

The architecture in Mozambique and Tanzania, like in many other developing countries, shows little concern for the local environment and climate. The South perspective exams the contribution architects have made towards sustainable architectural practice for the last ten years in Mozambique and Tanzania. Key information is derived from literature review, existing documents, observation, interviews and experience. The section focuses mainly on the analysis of traditional and modern/contemporary architecture in Mozambique and Tanzania with the aim of understanding the attempts that architects have made in the search for sustainable architecture in the tropical countries. This perspective is by architects with southern Africa matter of sustainable construction

## 2. The North Perspective

### 2.1 GBC98, Vancouver, Canada

The aim of the Green Building Challenge Conference in Vancouver, Canada, 1998, was to benchmark Green Buildings with different design and assessment tools of current and next generation. Many design and assessment methods were presented by the participated designers and researchers, e.g. among others: GBC98 Tool (international), Athena (Canada), BEES (USA), HK-BEAM (Hong Kong), C2000 (Canada), BREEAM (UK), EcoQuantuum (The Netherlands), Home Scheme (New Zealand), Ekoprofil (Norway), LEED (USA), Green Building Adviser (USA), CAAD (Germany), Building Stock Model (Germany) etc. The keys of most of these tools were to minimize energy demand during construction and operation, to optimize energy use integrated with renewable energy and to maximize living and working quality for occupants. To ensure the data quality of the inputs was the most frequent issue about to use these tools. Other comments of the tools regarding usefulness was too much information, too much criteria, too many choices and too little time to assess. Two examples of contributions were:

- A test of different assessment tools (Boonstra et al 1998) on the same building showing the output data was too differentiated to be comparable between the methods and an optimization of data not a goal for most tools. Most of the tested tools were developed for specialized consultants and not for actors in the market
- The introducing of the international GBC98 Tool (Cole and Larsson 1998) developed to assess different buildings in different countries with the same tool.

The general conclusions of the assessment methods were about to recognize differences between the tools and the sites of assessments and differences between local and global conditions. But it was important on the other hand to maintain the big picture by the methods

The conference was mainly a presentation of pros and cons of “second generation” tools where the design methods were looking forward and the assessment methods were looking backwards. The main opinion of the future was to develop more LCA-based methods or applications. Absence of methods or tools that covered the construction process was obvious. Most of the methods and the contributions were about Green Buildings and environmental issues, only a very few regarded the whole triple bottom line of sustainability, balancing economy and social development with ecological considerations.

### 2.2 SB02, Oslo, Norway

The introducing theme of SB02 in Oslo, Norway, was about the -02 World Summit and issues of economic growth, natural resources, environmental impacts, social and cultural development. It was about the challenge of sustainability with prioritized key issues as:

1. Objectives of sustainable development – find reordering of global priorities
2. Sustainability – realize the closed system of earth, the spaceship view
3. Eco-efficiency – Factor 4 is a minimum, Factor 10 is a vision
4. Ratification of the Kyoto Protocol

The knowledge has to shift from a deductive view to a holistic view. The technologic knowledge is dominated over the socio-related. It has to be an integrated design process. The Building Industry is rather proactive than active and the feedback from the performance stage is very low. The solution has to be in small steps with ISO 14001 significant environmental aspects. It is important with affordable living in a market driven environment.

Presentations were made of assessment and design tools that were developed by Europe and North America countries. Some of them were already evaluated and commercial available as national applications as LEED in USA and BREEM in UK. The methods were environmental oriented with most focus on energy

savings. It occurred frequently a lot of confusing interpretation of the terms sustainable construction, sustainable building, environmental sustainable building and green building. One effort of explaining the differences between these terms was by CIB's Agenda 21 of Sustainable Construction. New parts of the world were introduced by the Developing Countries Agenda 21 (du Plessis 2002) with South Africa and Brazil in the frontline. There was also a couple of construction process oriented contributions from Australia, Finland and South Africa. Discussions of indicators of sustainable construction was made e.g. by the CRISP project (Häkkinen et al 2002)

This conference focused mainly on environmental issues as material productivity, CO2 emissions and assessment tools and methods. But some awareness of the rest of the triple bottom line of sustainability was addressed. Two agendas of sustainability in the constructions sector were presented, one general by CIB and one concerning the developing countries. The latter stated a definition of sustainable construction including the triple bottom line and the necessity of a holistic view. New countries as Brazil and South Africa contributed with thoughts about more socio-economics and management focus. Still, the mainstream research community was focused on solely environmental issues.

### 2.3 SB05, Tokyo, Japan

The latest world conference about sustainable buildings, SB05, was held in Tokyo, Japan, 2005. The introducing theme was about the importance of reducing CO2 emissions, to reduce environmental loads, about eco-efficiency through Factor 4 and Factor 10. Some new approaches were made as Life Cycle Value and Management of Environmental Ethics i.e. sharing common vision and ideas. New issues about ethics, the global aspect and city development were discussed. The conclusion was that sustainability in construction in general was initiated and has become to gain acceptance but it is still a very long way to go. Concerning the broad spectra of sustainability in different economies and regions of the world follows a few examples of contributed presentations and papers:

- Procurement procedures were discussed by Brophy and Lewis (2005) as barriers to sustainable development and sustainable construction. They found the building projects within their study were procured, the scope of sustainability was lacking. The design teams in the study indicated that client commitment, design team commitment, motivation and expertise as the features that most contributed to the achievement of the project targets
- Sustainable – affordable habitat for the rural poor in developing economies by Nair et al, 2005, is depending on socio-cultural, economic, technologic and environmental factors including strategies and policies
- Sustainable construction contains environmental, economic and social values (Yin and Cheng 2005) where local dimensions are significant. Sustainable construction is a long term objective. It should be in account of an early stage of a facility development. This with a management approach and with a focus on procurement methods.

This conference contained more practical issues as procurement procedures, valuating of assessment methods and social housing issues regarding all triple bottom line values. More of management approach was assigned. Again, the mainstream contributions were focused on environmental issues as energy savings and material productivity.

### 2.4 SB07, Malmö, Sweden

Before the next world conference in Melbourne, Australia, SB08, there were some regional conferences during 2007. One was held in Malmö Sweden as SB07 Malmö or Sustainable City Development -07. The key issue was to demonstrate good examples of sustainable buildings and sustainable development of a city. The concept of Passive Houses and the importance of local sustainable development were highlighted plus the UK housing agenda – the Green Paper. Some lessons were learned, as S-house in Austria – a factor 10 example, but sustainability in the real mainstream project is still invisible. An ethical commitment is essential. From a plenary discussion of how to make sustainability more attractive there were some summarised keywords as liveability, make it easy, initiative, motivate, transparent, local context, lifecycle value and participation.

Following conclusions was made:

- Sustainability not enough – it is necessary to regenerate.
- Reduce consumption – changes in values and lifestyle is also necessary
- A holistic triple bottom view.

Some good practice of green buildings in Scandinavia was demonstrated as progress in sustainability, but the arguments of sustainability contained only environmental issues. Mainstream project is still in the very beginning to adapt a sustainability view.

## 3 The South Perspective

The history shows that even the greatest monuments and largest civil and religious buildings, the ancient builders designed in harmony with nature (Barr-Kumar 2003). Buildings were designed and oriented to take

advantages of prevailing winds, to block excessive solar radiation for the case of tropics and in other climates to face the warming rays of the sun. Tanzania and Mozambique, like many other developing countries, has abundant natural resources like water, sun, and natural building materials. However, the development of Dar es Salaam and Maputo, the major urban centers in these two countries, does not utilize these abundant resources. The emerging architectural development of these countries has to consider more appropriate architecture techniques in order to contribute to the sustainable use of the available natural resources. This can be achieved by considering micro climate, culture, and the economy of the country and the specific geographical area within the country which the building will be located (Yimprayoon 2005). However, the level of environmental sustainability awareness in the construction industry in Tanzania and Mozambique is very low and government environmental policies are yet to be implemented. Awareness about the use of climatic principles of architecture (Tombazis 2005) and their utility in achieving sustainable architecture has to be increased.

### 3.1 The Colonial Heritage: a Paradigm of Environmentally Sustainable Architecture

Before the German colonial period in Tanzania most buildings were of typical Swahili–Islamic style that featured simple regular plans utilizing mangrove poles for construction. Swahili–Islamic architecture was characterized by the use of an interior courtyard and a deep covered front veranda. Materials used were wooden sticks, mangrove poles, coral hardcore, and clay soil. The German regime adapted traditional construction techniques in an innovative and sophisticated way giving the colonial architecture of Tanzania a unique character and quality.

The “old Boma” built during the German colonial period is an example of architectural environmental sustainability. The Germans used thick coral hardcore, poles and limestone walls of about 600mm to protect interiors from heat gain and also act as noise barrier. The materials and construction technology used were locally available. Windows were mainly placed on the north and south side to allow cross ventilation since air conditioning was not available. The courtyard design was also adopted from traditional Swahili architecture of Dar es Salaam. The use of a courtyard was important to facilitate air flow through a chimney effect. White colour was an essential part of colonial buildings and was used mainly to reflect solar heat.

The German colonialists learned and adopted local building techniques to suit their own purposes. From the pre-colonial and colonial architecture there are clearly lessons to be learned in order to achieve sustainable architecture for Tanzania. The optimal cross ventilation of spaces, shading against sunshine by walls and other shading devices are things that can still be employed in today’s architecture (La Roche 2005). Pre-colonial and early colonial architecture is highly instructive.

### 3.2 Last Ten Years Development

Since the colonial era Tanzania has invested funds to improve its infrastructure, particularly in the area of transportation, urban planning and public buildings (Lauber, 2005). However, most buildings in Dar es Salaam and Maputo in Mozambique show a minimum concern for the micro–climate, economy, and social cultural conditions of the country. In general, in these last ten years we have seen a gradual disappearance of traditional architectural forms as a result of importing the European, American and Asian technology without taking into consideration the special climatic and social condition of the home country. Some cities of these countries such as; Maputo, Beira, Nampula and Nacala in Mozambique; Dar es Salaam, Mwanza, Arusha in Tanzania, did start to construct some buildings using glass materials. These buildings have many air-conditioners which expend a lot of energy for cooling. The extra energy so used would be better used somewhere else.

Some examples:

- The Kilimanjaro (Kempinski) Hotel, facing Dar es Salaam’s harbor, was renovated in 2005. The hotel has a perfect orientation for sun protection; east–west, with the long façade facing north–south. During renovation operable windows on the south and north façade were replaced by fixed glass panels, which necessitates the use of an air conditioning system all the time. This increases energy expenditure for maintaining a comfortable temperature in the building, and prevents any use of the cool breezes from the ocean and the south–east monsoon winds.
- A few blocks southwest from the Kilimanjaro Hotel is the PPF (Parastatal Pension Fund) tower in downtown Dar es Salaam. It was designed in 1996 and features glass facades that are completely exposed towards the east and west ensuring the PPF tower heats up all day because it must absorb the maximum daily dose of the intense equatorial sun. This leads to a high level of energy consumption for cooling the building.

During the same period, a number of recently built houses, residential and institutional, present different design solutions corresponding to specific local conditions. This is evidence of climatically appropriate architecture. These buildings are well-oriented with optimal natural cross-ventilation of spaces and protection against direct sunshine offered by walls; benefits easy to achieve using local material. Some of these buildings can be seen in Maputo and Dar es Salaam, e.g.:

- A new Central Library at Eduardo Mondlane University, Maputo. The building incorporates the most important aspects of sustainability. The design has been conducted in a very participative way and focus

was placed on the need to find innovative architectural and engineering solutions. Local conditions were regarded important and such effort was made to take them into account.

- The offices of The World Bank and Swedish Embassy are other examples of sustainable architecture in Maputo.
- The American Embassy in Dar es Salaam where it is good relationship between natural and artificial situation. It is possible to see the application of Sustainable Construction knowledge.

Both countries have other public and private buildings where this knowledge has been applied.

### 3.3 Influence from the North

Instead of applying and modifying proven design and construction techniques developed in Southern Africa to meet Southern African conditions, the building industry has become fixated on importing the latest technological developments and new construction techniques from the North with little reflection on their suitability for local conditions. This new phase of building design completely ignores traditional and early colonial architecture. In many ways the building industry reflects larger patterns of economic, political, and social interaction between Southern Africa and the North, where Northern ideas and practices serve as the benchmark to be adopted. In the building industry this has meant the disappearance of efforts to achieve sustainable architecture and its replacement with buildings that use high rates of energy in their daily operation and imported materials for their construction.

### 3.4 Awareness of Sustainable Architecture

The construction industry by large should be responsible for converting the natural environment into a built environment without destroying its natural state. However, in Tanzania and Mozambique, awareness of environmentally sustainable architecture is very low. In order to make an impact, the basic principles of sustainable architecture will have to be known to all members of the building team - including the client, architect, consultants, contractors, building product manufacturers, and building users. There is a need to change the way in Southern Africa to build and use the buildings from an architecture based on low quality replication of Northern designs to more innovative use of traditional low technology. It is a matter of low energy use designs to achieve greater long term sustainability of the region's natural resources, the economic viability of the client's building and to ensure greater comfort to the buildings users.

### 3.5 Lack of Architectural Research and Communication

Research in the field of architecture provides an opportunity to link new knowledge with design. It is therefore a fundamental aspect of the architectural profession (Emmitt 1996). It provides scientific knowledge, useful for resolving architectural problems. However, the research element in Tanzanian and Mozambican architecture is not given the importance it deserves in order to promote a positive development of the profession towards sustainable development.

## 4 Conclusions

Many developing countries in the Southern hemisphere do not apply the knowledge of Sustainable Construction due to many reasons. As a result of this situation, many of the modern buildings and settlements in these countries, in the last ten years, reflect an uncritical reception of modern European buildings forms without taking into consideration the special climatic and social conditions of the home country. The examples from the pre-colonial and early colonial era when mechanical air conditioning did not exist and the use of local materials showing the structures that made use of materials, cross ventilation, colours, and orientation toward/away from the sun that kept occupants comfortable with minimal energy inputs, even under the intense equatorial sun. In comparing this earlier period to modern day architecture in Southern Africa we can see that the principals that underpinned the early sustainable architecture have been forgotten. However, this knowledge has gradually started to be applied and it is making it possible to see some buildings on the basis of this knowledge. The principal of making buildings to fit their environment, climate and culture, rather than aping the architectural styles of developed countries is the key for making sustainable architecture to be achieved in Tanzania and Mozambique.

The economic development that occurs in the North and the South perspective, especially in non-developed countries, in the last decade, is made up of great utilization of the production of energy from the fossil resources. The finite nature of this natural resource, and the environmental impact of its production and consumption, makes these countries to rethink their development plans. New strategies must be found to maintain the current standards of life in developed societies and to help aspiring new developed countries to reach higher standard of life. This has to be developed without compromising the new technology, not only for the benefit of the environment, but also in level of economic and social development.

With a look backwards from the Rio summit in the beginning of the nineties, there has been a long time for the construction sector in the industrial countries to adapt the whole concept of sustainability including the triple bottom line. The research community of sustainable building has moved its focus slowly from solely environmental issues and assessment methods through questions as energy savings and material productivity to a holistic view of sustainable buildings including the triple bottoms. What about the mainstream project and its involved stakeholders as clients, project management team and end users? Where are the process thinking and management aspects of sustainability? The objective is to reach a resource productive factor of Factor 10 or Factor 20 in one generation but the first generation is soon at halftime and we have barely just started. It is time to prioritize the objectives to make it easy to get information how to do and make rules or opportunities to promote the mainstream construction project towards sustainability. It is obvious that a general global agenda of sustainable construction has to be complemented with specific conditions of the actual site, of the specific project or facility, of the ability or knowledge of the design and management team and of course regional and local conditions of the triple bottom lines of sustainability. It is a matter of fact a question of knowledge transfers from bottom-up and top-down perspectives locally adapted, despite if the site is located in a Northern Arctic mountain area or in a Southern tropical urban area.

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