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# Proceeding

Bersama Menata Ruang Untuk Semua

## 2nd International Seminar on tropical eco settlements

### Green Infrastructure : a Strategy to Sustain Urban Settlements

Bali - Indonesia, November 03 -05, 2010

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**Research Institute for Human Settlements**
Agency for R&D - Ministry of Public Works
**Indonesia**

# Proceeding

## 2nd. International Seminar on Eco-Tropical Settlements

Green Infrastructure: a Strategy to Sustain Urban Settlements

November 3-5, 2010, Sanur Denpasar Indonesia

**Edited by:**

Dr.-Ing. Andreas Wibowo

**Research Institute for Human Settlements**
**Agency for Research and Development**
**Ministry of Public Works Indonesia**

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# PREFACE

The global climate change and temperature rise become the world's awareness, and are widely recognized to affect the life of living creatures. Experts predict that the problems are getting more serious. The cities' growth and development are basically driven by space needs due to the population growth as well as their activities and interactions. On the other hand, the growth will always be followed by the development of housing and infrastructure. While it will naturally happen, the principal challenge is how to make the development sustain in terms of environmental, social, and economical activities.

Despite having different meanings and definitions to many individuals and organizations, green infrastructure occupies a vital segment in the long-term sustainable development. It refers to a network of multifunctional and physical environments and green spaces, including open spaces, garden, woodlands, green corridors, street trees, water conserving systems, energy conserving systems, and green buildings, thereby covering both natural and engineered or human designed systems. Green infrastructure is recognized as having multiple social, economic, and environmental benefits to communities. As like other types of infrastructure, green infrastructure should be strategically planned and managed to underpin the society.

The 2nd International Seminar held in Sanur, Bali-Indonesia in 3-5 November 2010 with the theme of Green Infrastructure: A Strategy to Sustain Urban Settlements, is part of the International Eco-settlements Seminar Series that was firstly organized in 2006 by the Research Institute for Human Settlements. The seminars provided opportunities to share views and experiences across countries regarding the current issues, best practices and policy implications of green infrastructure and sustainable development.

A total of 65 papers from Malaysia, Netherland, Philippines, Nigeria, Thailand, China, India, United States of America, Singapore, Australia, and Indonesia that discussed 3 major issues on *eco planning and design, green building lifecycle, sustainable settlements and environment* were presented in the parallel sessions on Day One and Day Two. Optional field-trips were held on Day Three to Sarbagita (solid waste treatment), Panglipuran (the traditional housing compound) and Green School (environmentally concept school).

We do hope this proceeding can be contributed as a source of knowledge and experiences on the development of eco-settlements especially for the tropical regions in the terms of green infrastructures.

Denpasar, 12 November 2010

Dr. Anita Firmanti
Director of Research Institute for Human Settlements

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# STRATEGIC ISSUES TOWARDS IMPLEMENTING SUSTAINABLE CONSTRUCTION IN INDONESIA

Reini D. WIRAHADIKUSUMAH[1] and Muhamad ABDUH[2]

**ABSTRACT:** There is a need to introduce more sustainable construction practices, mainly in developing countries. Sustainable construction in the context of developing nations naturally needs different approach from the models used in developed countries. "Agenda 21 for Sustainable Construction in Developing Countries" was put together by CIB and UNEP in 2002. Indonesia has analyzed the possible adoption of this Agenda for national implementation through several focused group discussions among stakeholders with the leadership of the Ministry of Public Works and the academics. Adoption of this agenda requires three enablers: technological, institutional, and value systems. Developing these enablers requires ssimultaneous efforts from all stakeholders. Answering to the challenge, the Ministry of Public Works has taken the lead to formulate the strategic issues towards implementation. The efforts involve identifying existing sustainable construction practices and establishing collaboration among stakeholders. While construction sector in Indonesia is beginning to consider sustainable practices, the broader implementation necessitates the community to "internalize" the concept which can be achieved through public awareness and education. Based on the assessment of the existing conditions, the most realistic strategy is the "defensive" strategy. Besides the strategic actions to answer the issues by various stakeholders, to successfully implement sustainable construction in Indonesia, an R&D agenda is required to bring the enablers into effect in sustaining the actions.

**KEYWORDS:** sustainable, construction, developing country, strategy, implementation.

## 1. INTRODUCTION

The most commonly referred definition of sustainable develepment was stated in the Brundtland Report (1987): "development that meets the needs of the present without comprimising the ability of future generations to meet their own needs." Several global initiatives that followed this idea include the Agenda 21 formulated at the Rio Summit in 1992 and the Habitat Agenda in 1996. There are also initiatives within the southern and northern regional context.

While these initiatives were the roots of recent movements in the construction sector, the documents were general and did not specifically concern the construction sector. Agenda 21 is basically an action plan for sustainable development for all the stakeholders. Agenda 21 explains several program areas that impact on the construction industry and suggests actions that should be taken to increase sustainability in these areas. For example, in Chapter 4, "Focussing on unsustainable patterns of production and consumption" and "Developing national

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policies and strategies to encourage changes in unsustainable consumption patterns." These actions are very relevant to the need for changing construction industry practices.

The Habitat Agenda, which focuses on settlement and shelter issues, is more closely related to the construction sector. Human settlement and shelter problems include providing proper housing, infrastructures for transportation, communication, water supply and sanitation, energy, commercial and industrial activities. In this context, the construction industry plays a major role to contribute to economic development of the community. In Paragraph 25 of the Agenda, the government is expected to encourage the construction industry to promote "locally available, appropriate, affordable, safe, efficient, and environmentally sound construction methods and technologies in all countries, particularly in the developing countries, at the local, national, regional and sub-regional levels to emphasise optimal use of local human resources and to encourage energy-saving methods that are protective of human health." Several other paragraphs also explain the actions that should be taken by the government and the construction industry for better planning, design, construction, maintenance and rehabilition, including procurement.

The construction industry is one of the priority sectors to contribute in sustainable development because of the characteristics of the construction process which make the industry the point of departure for necessary changes. Construction industry produces the built environment and most of the infrastructure facilities have very long useful lives. Meanwhile, the construction process and the related activities consume the most natural resources and generate significant wastes.

In Indonesia, construction sector contributes about 6% of the GDP and around 5% of national labors depend on this sector. Construction practices with better planning can contribute to the national energy savings. The energy needs of the construction sector is estimated to continue to equal the growth of Indonesia's economy, which is in the region of 6%. As Indonesia's electricity is mostly generated by fuels, the global rising price/demand of fuel has made energy into a commodity that is increasingly expensive. Similarly, the construction process has a significant task in the perspectives of increasing water efficiency and minimizing waste. Thus, there is a real need to make changes in construction practices.

## 2. SUSTAINABLE CONSTRUCTION PRINCIPLES

Engineers have long realized their strategic positions in contributing to the better built environment and sustainable development. CIB (*Conseil International du Bâtiment*), was established in 1953. The objective of this association is to stimulate and facilitate international cooperation and information exchange between governmental research institutes in the building and construction sector, with an emphasis on those institutes engaged in technical fields of research. With a world wide network, in 1994, Task Group 16 - Sustainable Construction - of CIB, defined the goal of sustainable construction as ". . . creating and operating a healthy built environment based on resource efficiency and ecological design." CIB further explained the seven Principles of Sustainable Construction, which would ideally inform decision making during each phase of the design and construction process, continuing throughout the building's entire life cycle. These seven principles are: a). Reduce resource consumption (reduce); b). Reuse resources (reuse); c). Use recyclable resources (recycle); d). Protect nature (nature); e). Eliminate toxics (toxics); f). Apply life-cycle costing (economics); and g). Focus on quality (quality).

The terms green, high performance, and sustainable construction, are often used interchangeably. All these terms address the economic, ecological, and social issues of a building in the context of its community. The terminology defined by CIB is widely used. The seven principles of sustainable construction should apply when evaluating the components and

systems to evaluate a building's energy efficiency consumption are widely used voluntarily in the private sectors.

While the principles of sustainable construction are also applicable to the construction industry in a developing nation, sustaible construction is approached in various ways with different priorities in different countries. The main emphasis in developed countries has been on ecological impact on the envuronment (natural resources). However in countries like Indonesia, the concerns of sustainability are more heavily on the economic and social issues.

## 3. AGENDAS ON SUSTAINABLE CONSTRUCTION

The advances on formally addressing environmental issues in built environment as shown in several developed countries, have not been present in other regions. Sustainable construction in the context of developing nations naturally needs different approach from the models used in developed countries. The problems and their scale, the development priorities, the capacity of the local industry and governments, as well as the skills levels found in developing countries are often very different from those found in developed countries. There are also certain cultural and worldview differences between the developed and developing world countries that impact on the understanding and implementation of sustainable development and construction.

Du Plessis [5] suggests that developing countries use a new development model that places more moderate demands on the earth's resources and encourages more equitable distribution. While CIB published "Agenda 21 for Sustainable Construction" in 1999, another agenda specifically developed by and from the experts of CIB in developing nations was later issued in 2002. "Agenda 21 for Sustainable Construction in Developing Countries" was put together by CIB and UNEP-IETP which includes R&D agenda and strategy for action for the developing world in partnership with the developed world.

The latter agenda was compiled in the context within which built environment practitioners, researchers and educators have to work in developing countries. There are numerous barriers for sustainable construction, but also some opportunities. The international community agreed that a number of enablers are required. Enablers can be technological, institutional, or they can come from the value systems.

"Technological" enablers are required since development is supported by technology. The socio-economic goals of development cannot be met without the use of technology. However, the technology used must also support the environmental and socio-economic principles of sustainable development. Technology enablers can be divided into "hardware", "software" and know-how. For technology enablers to be successful, processes for technology transfer and management are required, as well as access to those technologies. This requires the presence of functioning "institutional" enablers. Furthermore, specific "value system" enablers are necessary to bring about the successful uptake of technologies that are conducive to sustainable development. The enablers are interdependent and multi-dimensional.

Developing the necessary enablers requires an approach that operates simultaneously at various scales, as well as different time horizons. There are enablers that have to be immediately developed to provide a sound basis from which to work. Concurrently with these immediate enablers a set of medium term and long-term enablers also have to be developed. The immediate enablers relate to the creation of an enabling environment and the collection and sharing of information for benchmarking and assessment. The medium term enablers relate to the mitigation of impact and actual implementation of sustainable construction, while the long-term enablers relate to the creation of a totally new and more sustainable built environment paradigm.

## 4. CHALLENGES FOR IMPLEMENTATION IN INDONESIA

A formal initiative to implement the sustainable construction in Indonesia has been started by benchmarking activity, which was conducted by the Ministry of Public Works in 2009, to three developed countries and one developing country, i.e., UK, USA, Japan, and Malaysia. United Kingdom and United States of America were chosen to represent the developed countries in Europe and America continentals. Japan was picked to represent a developed country in Asia region, while Malaysia was to represent a developing country. The benchmarking activity was intended to compare baseline conditions, progress of development, and. achievements of each country in implementing sustainable construction, and then to formulate the challenges for Indonesians.

All of the benchmark developed countries were to embark on successful implementation of the sustainability issues in construction industry as a result of their value systems and cultures that are very conducive. Moreover, the developed countries have been implemented the agendas of implementation properly for many years, and the achievements of the implementation were continuously monitored by an authoritative institution. Strong commitments from all stakeholders in construction sector to the agenda of implementation become one of their success factors besides the availability of effective indicators and assessment program. On the other hand, in Malaysia, as a representative of developing country, the initiative was still at the emerging stage, and therefore, further nation-wide agendas need to be established. However, they were already aware of the needs to create and participate in a network of developing countries in answering the challenges faced by the construction industry in sustainability issues.

Moreover, the results of benchmark activity that could portray several challenges for Indonesia in establishing agendas of implementation in sustainable construction are as follows:

a. **The availability of reliable data related to sustainability issues that could be used as baseline for improvement**. In Indonesia, the availability of such data is limited due to weak practices of collecting transaction data in construction sector. There should be a sustainable practice of reporting construction performance data, including the sustainability issues, by construction companies regularly to an authoritative institution, such as the Construction Service Development Board (LPJK).
b. **The availability of information on research activities and products related to sustainability issues**. While research activities have been sporadically conducted by many research institution and universities, there is no adequate available information that could map all research activities and their products related to sustainability issues in construction. The information should be accessible for the reference by the construction stakeholder or public that would initiate any sustainable construction movements.
c. **Participations from all stakeholders to conduct initiatives in sustainable construction**. Even though there is low level of awareness and understanding on the sustainability issues in construction, some construction stakeholders, in small number, have initiated the internalization program of sustainability issues in their business processes as part of their efforts to gain competitive advantages.
d. **Strong commitments from all stakeholders to the implementation agenda**. Two agendas have been developed in Indonesia associated with the planning for sustainable development. Yet, commitments to implement the agendas by relevant stakeholders, as well as construction stakeholders, were not presented due to unavailability of binding consensus among them.
e. **Coordination of stakeholders for orchestrated efforts towards effective sustainable construction agenda**. In Indonesia, there is no strong and respectable institution that could gather all stakeholders into a coordination forum that would plan, execute, monitor, and evaluate all initiatives of sustainable construction. Learning from the implementation of

two Indonesian previously established agendas on sustainable development, the existence of such institution is significant to facilitate the coordination forum.

Furthermore, based on the comparison to other developing countries' sustainability conditions, other efforts, in the form of desk study and several focused group discussions, conducted by the Ministry of Public Works in analyzing the opportunities of implementation in Indonesia, suggested the implementation should focus on the following issues:

a. The earlier developments in Indonesia have been accentuated to address economic and social issues. Higher priorities have been set on those issues, while for addressing the environmental issues, the government adopted the 'weak-sustainability' approach by sanctioning the environmental impact analysis to prevent environmental disturbance of the development. In 2009, the government had issued more strong regulation on environmental preservation and management (UU No. 32 Tahun 2009) to be implemented by all local governments and parties to assure that any developments are based on the sustainable development principles and used an integrated 'strong-sustainability' approach, i.e., the balance between economic, social, and environmental aspects. Yet, the effectiveness of this regulation is still waited to be seen in the future.
b. The most important challenge in Indonesia, as well as in other developing countries, is public awareness. The improvement of public awareness in sustainable construction becomes the primary driver that could also make answering other challenges easier.
c. Other technical challenges that should also be addressed are:

1) **Design Process**. Construction design, both product design and process design, should be environmental friendly and involved as many parties as possible in earlier stages.
2) **Construction Environment Quality**. Construction field is considered to be unique compare to manufacturing production location. Hence, temporary organization with unique working environment makes the management of the environment quality is not stable and rather difficult.
3) **Re-engineering of Development Process**. Innovations to the development processes, such as re-engineering, are encouraged to provide more eco-efficient processes through the life cycle of the development.
4) **Human Resources**. Construction process needs to be performed by adequate and multi-skilled human resources. The needed human resources should be capable to adopt new technology and material that satisfies the criteria of sustainability.
5) **Education**. To implement the sustainable construction, the education is aimed to improve the awareness and understanding of all of construction stakeholders and to provide professional human resources in construction.
6) **Standards and Codes**. It is a real and immediate need to have a proper standard and codes that will guide the practitioners in construction to implement the sustainability issues. The standards and codes should be developed based on the local wisdom that utilizes local resources.
7) **Research**. Research and development are considered the main gate to innovations. Supports from all of stakeholders to embrace the research and development related to sustainability issues in construction should be addressed firmly.
8) **Construction Products**. Products related to components of a construction should also be produced by ecological way. The embodied energy to produce the products should be minimized. During the assembly on construction site, the operation should also minimize the use of energy as well as the consumption of the natural resources.

## 5. STRATEGIC ISSUES FOR IMPLEMENTATION OF SUSTAINABLE CONSTRUCTION AGENDA

CIB [4] suggested the use of four possible strategies for change towards sustainable development that were listed in a UK Report's "The Greening of Industry for a Sustainable Future," published by the Advisory Council for Research on Nature and the Environment and the Greening of Industry Network in 1997. The strategies were proposed to provide a framework for analyzing the opportunities which could be taken by construction industry of any countries. The strategies are: the "defensive" strategy: complying with regulation; the "offensive" strategy: beyond compliance; the "eco-efficiency" strategy: win-win solution for reducing environmental impacts and cost; and the "sustainability" strategy: the ideal strategy and holistic approach.

Based on previous analysis on the existing conditions and practices of the Indonesian construction industry, and referring to the CIB's proposed strategies for change, the "defensive" strategy is considered to be the most appropriate strategy for Indonesia. The defensive strategy is very typical response from the majority of construction practitioners who are driven mostly by regulations to improve their quality of products. The majority of the Indonesian construction industry's stakeholders still have low level of environmental awareness and understanding, even though there would be some notable exceptions. In their view, the cost of addressing the sustainability issues to their products is considered as the cost of compliance with the regulations and minimum standards. Therefore, the cost of non-compliance becomes the primary motivator for any improvements. The construction industry's stakeholder will continue to follow this situation until the market changes its demand for sustainability issues. In this defensive strategy, any government-led initiatives, by incentives or regulations, should be put first and have significant portion and priority in the implementation.

For the last two years, the Ministry of Public Works has worked on formulating the strategic issues towards implementation of sustainable construction in Indonesia. The defensive strategy was then definitely utilized in the case of Indonesia, since the market's demand on sustainability issue is still considered low and the construction industry always await regulations from the government to step forward on any important issues. In this situation, it is very important that the Ministry of Public Works have an agenda of the implementation that could be well accepted and effectively supported by all stakeholders. Moreover, several strategic issues for implementation of sustainable construction in Indonesia have been identified as follows:

a. **Adoption of Agenda 21 for Sustainable Construction in Developing Countries.** It is strongly recommended that the Ministry of Public Works adopt the already available international agenda in sustainable construction to be implemented in Indonesia, i.e., the Agenda 21 for Sustainability Construction in Developing Countries [5]. This is due to the fact that there are a lot of similar existing sustainability conditions in Indonesia that also characterized the developing countries, despite the fact that some conditions in Indonesia are better. Research and development agenda, as well as the strategy for actions recommended in the Agenda 21 for Sustainability Construction in Developing Countries are also relevant. It means that Indonesia will have a research and development agenda to fulfill three enablers and strategies for actions for each sector of stakeholders as mentioned in the adopted agenda.
b. **Immediate Action.** The Ministry of Public Works should prepare a strategy to gather all willing stakeholders and to embrace them to have the same commitment and spirit stepping forward together to implement the associated agenda and actions in practice. A nation-wide consensus among the stakeholders is needed in developing and implementing the agenda and actions.

c. **Performance Indicators.** The adopted agenda is only a framework of planning and developing more implementable actions to be identified by each relevant stakeholder. Therefore, more detail actions need to be developed and should be set as part of the consensus among stakeholders. Furthermore, in order to assure the high level of implementation of the adopted and developed agenda and actions, several performance indicators are needed to be identified to measure the achievement of the implementation and set as continuous monitoring and evaluation program. It is also suggested that these performance indicators are not only set to measure the achievement of R&D agenda and strategies for actions, but also to measure the achievement of sustainable construction in Indonesia in comparison to the ideal.

## 6. CONCLUSION

Different stakeholders in Indonesia have established the starting point to embrace sustainable construction principles. While the barriers for effective implementation are complex, a strategy has been adopted within parts of the government and the academics. The draft of this national strategy will be disseminated through the assistance of various groups: the wider sectors within the government, the academics, and the professionals. National consensus requires persistent efforts by these concerned groups. The next step is to identify and develop performance indicators for the purpose of monitoring and evaluation of our progress. Without monitoring and evaluation, sustained and concerted actions will not be feasible. The construction sector will continue in their efforts contributing towards sustainable development, including developing a national research agenda in three aspects (technological, institutional, and value system) enabling the implementation of sustainable construction.

## 7. REFERENCES

1. Kantor Menteri Negara Lingkungan Hidup, *Agenda 21 Indonesia: Strategi Nasional untuk Pembangunan Berkelanjutan*, Pelangi Grafika, 1997.
2. Kementrian Lingkungan Hidup, UU No. 32 Tahun 2009 tentang Perlindungan dan Pengelolaan Lingkungan Hidup, 2010.
3. Kibert, Charles J., *Sustainable Construction – Green Building Design and Delivery*, John Wiley & Sons, Inc., New Jersey, 2008.
4. The International Council for Research and Innovation in Building and Construction (CIB),, *Agenda 21 on Sustainable Construction*. CIB Report Publication 237, 1999.
5. Du Plessis, *Agenda 21 for Sustainable Construction in Developing Countries*, International Council for Research and Innovation in Building and Construction (CIB) and United Nations Environment Program International Environmental Technology Centre (UNEP-IETC), 2002.