PROCEEDING

ICO-ApICT 2013

THE 1st INTERNATIONAL CONFERENCE ON APPLIED INFORMATION AND COMMUNICATION TECHNOLOGY

EMPOWERING DEVELOPMENT COUNTRIES
THROUGH **SUSTAINABLE ICT**

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"Empowering development countries through sustainable ICT"

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Preface

Rapid development of ICT has enabled the technology to underpin many aspects of life. Various scientific fields tend to use and apply ICT to make the operation more effective and easier. The use of information technology has penetrated into all areas of life. All levels of society already accustomed to using computers to simplify their lives. Even small children using a computer to learn and play games. All of these things give rise to a variety of side effects such as rapid development can not be anticipated

Various social problems arise in the community, such as the misuse of social networking like as facebook, tweeter used beyond reasonableness, even to support criminality. Certainly, there are still many good result of those technology development.

Products like the most advanced technology has been developed in developed countries, while its people background, culture, education level and economic development are very different compared to the third world countries like Indonesia. It is interesting discussion within the academic corridor since it involves the future of the nation that must be prepared early.

International meetings such as ICo-ApICT are expected to garner a lot of entries so that the application can be better organized and designed to support life in the near future. This seminar is intended to summarize the research idea as well as to promote other forms of real implementation of the use and role of ICT in the field of engineering, economics, politics, law, literature and art.

Dr. Salmon Priaji Martana

ANALYSIS MODEL OF BUILDING LIFE CYCLE TOWARD SUSTAINABLE ARCHITECTURE, ADAPTATION OF LISA (LIFE CYCLE ASSESSMENT IN SUSTAINABLE ARCHITECTURE) INSTRUMENT

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Abstract

Calculation of energy consumption and its environmental impact throughout the life cycle of the building during the architectural design process, has become an essential rather than a necessity. Supporters of different instruments have been invented by some countries, including Australia who have LCA (Life Cycle Assessment) in Sustainable Architecture, or LISA. This paper is the result of the research is a critical examination of the relevant instruments, to identify possible adaptation to the design and implementation in Indonesia. Research continued with designing the building life cycle analysis model as a sustainable approach to architecture design to adapt the principles of LISA. In order to simplify and shorten the process of automatio,n the analysis of related models is carried out

Keywords: LCA, Building life cycle, adaptation, LISA, building automation.

1. Preface

A.1 Background

From cradle to grave is a paradigm associated with sustainable products and is a term that is familiar to the environmentalists. Cradle to grave to this day has underpinned the creation of a variety of instruments to assess the reliability of a product is generally in the context of sustainable development. In other words, a product can be considered sustainable and environmentally friendly if during the production process has been through a process of analysis of product-life-cycle (product life cycle) that its analyzes performed during the design phase that takes into account the use of energy from the beginning until the final design of their role.

Life Cycle Assessment (LCA), an instrument that was born in the 1960s is a concept that demonstrates that the wise way to test the system is to test the performance of industrial product-life-cycle. LCA will assess energy and costs to be incurred and environmental impacts that will occur throughout the production and post-production process, which began the process of extraction of raw materials from the earth, browse through the entire process of production and operation, until the end of the processing of the product in question is recyclable recycled or managed as waste.

Building is the product of the system architecture, which physically is a product of the construction industry so it can not ignore the quality and reliability, given the 50% energy consumption of the built environment associated with the construction industry. Architecture also requires a similar instrument to test the performance of the LCA-building life-cycle. Basically similar principle ever offered by A. Benjamin Handler is a systems approach to the architecture (Handler, 1970) which is intrinsically based paradigm cradle to grave, though at the end of the system is to be equipped with the management and / or processing buildings at the end of its usefulness. Provisions to analyze a building's life cycle in order to test the quality of the architectural design and reliability in the context of sustainable development, has not been enforced in Indonesia. It is estimated that one of them because of the unavailability of tools that simplify and accelerate the process of building life cycle analysis. LCA for the architecture (buildings) have come to the streamlining efforts through the utilization of Information and Communication Technology (ICT). LISA (Life Cycle Analsys in Sustainable Architecture) is the one that was developed in Australia to simplify the process of LCA in green design.

Based on the above conditions, this study aims to conduct critical analyzes to generate concepts for the design of the building life cycle analysis model towards sustainable architecture. LISA, streamlined computer software created for the building during the construction process, is identifying the major environmental issues in the construction process, providing a convenient tool for evaluating the environmental aspects of the building design, as well as enabling the designers to make choices based on life cycle considerations environment. Adaptation to the LISA instrument will only be done on the principle aspect alone, because other element of the instrument is determined by the regional.character.

A.2. Research Purpose and limitation

"Life Cycle Analysis Model Building Toward Sustainable Architecture in the form of instrument adaptation LCA in Sustainable Architecture (LISA)" will be achieved through the following steps, which is objective as well as the scope of this study:

- Analysis and identification of "Approach Towards System Architecture (System Approach to Architecture)" (Handler, 1970) in order to classify the elements of the system into a universal group and the group will be determined by the character regionalistik Indonesia.
- Analysis and identification of "Architectural Design Criteria in the Context of Sustainable Development" (Abioso, 1999), in order to classify elements into groups of criteria that is universal and that the group will be determined by the character regionalistik Indonesia.
- Analysis and identification of instrument building life cycle "Life Cycle Assessment in Sustainable Architecture (LISA)" (BHP Australia, 2003), in order to classify the elements of the system into a universal group and the group will be determined by the character regionalistik Indonesia.
- Compile the results of the analysis and identification of the above as a basis for the preparation of the building toward the life-cycle model of sustainable architecture that will be tailored to the circumstances and conditions in Indonesia.
- Automation for related models, such as software design, will be done in order to simplify and accelerate the process of building life cycle during the architectural design process

2. Research Method

Research method is divided into 2 parts:

- Qualitative research approach with a method based on substantive theory of testing on Building Lifecycle is done to: Approach to the System Architecture (Handler, 1970), Architectural Design Criteria in the Context of Sustainable Development (Abioso, 1999), and a critical examination of the LISA instrument (BHP Australia, 2003).

- Approach comparative method of qualitative research conducted in preparation of the draft as a basis Model for designing Building Cycle Toward Sustainable Architecture.

C. Analysis

TABLE 1. ANALYSIS SUMMARY ON THE ARCHITECTURE SYSTEM (+) AND LISA

CONCLUSION	ARCHITECTURE SYSTEM (+)	L I S A
Stages of the production process as a manifestation of the implementation paradigm of cradle-to-grave assessment of the product as a control as a sustainable product. This includes taking into consideration the integration of aspects of social, economic, and environmental.	▪ **System Architecture** not only consider the planning and design process, but also consider the processes of construction, operations, human bionomik along with feedback or feedback process in each process, showing concern for the impact it will have and trying to minimize. ▪ **Social Aspects** stronglyconsidered in the process of human bionomik.	1. ***Specification*** detailed background material selection and / or sustainable product standards based material database (LISA feature). 2. ***Construction***,determination of all elements of the system structure and sustainable construction material based on a database which is a feature LISA. 3. ***Fit Out***, determination of all elements fitting out system based on a database of sustainable materials which is a feature LISA. 4. ***Utilisation***determination of all elements of sustainable utilization based on a database material that is a feature of LISA. 5. ***Repair/ Maintenance*** determination of future repairs and maintenance in units of years is determined by material database (LISA feature).

CONCLUSION	ARCHITECTURE SYSTEM (+)	L I S A
Application of evaluation of**energy consumption** over the life cycle plan.	There is no particular calculation, consider the restrictions on inputs Architecture System process. Is under the editorial criteria: **Economic Performance**.	Assessment set out in **theReport of Total Impact**, through the calculation can be done quickly with the form of external graphics. Calculation can be done either on the overall energy consumption partial or all stages of the process.
Implementation assessment of **production costs** throughout the design lifecycle.	There is no particular calculation, consider the restrictions on inputs Architecture System process. Being under the Limitations: **Costs, Limitations** and Cost Criteria: **Cost Effectiveness, Social Cost.**	Assessment stated in **the Report of Bill of Materials** includes transport through the calculations can be performed quickly with output in the form of graphs. Similarly, the use of energy calculations can be performed either on the use of the material as a whole or partially each stage of the process.
Application of environmental impact assessment of others along the life cycle of the building.	There is no particular calculation, consider the restrictions on inputs Architecture System process. Being under the headline goal: **Environment and Characteristics**, Limitations: **Environmental and Physical Environment.**	Integrated into **the Report of Total Impact**.

TABLE 2. ANALYSIS SUMMARY ON THE "CRITERIA FOR ARCHITECTURAL DESIGN IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT"

		GENERAL	REGION'S CHARACTERISTIC
ARCHITECTURE	1. SITE	▪ Allotment site shall be determined based on the integration between the transportationsystem with land use.	Universal and normative. The study does not directly affect the model, as defined in the "design stage".
		▪ Determine the slope carefully in the context of contour and minimize cut and fill volumes.	Regional, is one of the terms that have been applied in Indonesia, including law enforcement, but there is no specific regulation. **Research models** are not directly affected, as specified in the "design stage".
		▪ Taking a careful and rigorous Building Coverage Ratio (BCR) or Build Regional coefficient (KDB) and Floor Area Ratio (FAR) or Building Floor Coefficient (KLB).	Regional, is one of the requirements imposed on Indonesia, including law enforcement, but there is no specific regulation. **Affect the research model**.
		PEDESTRIAN	**REGION'S CHARACTERISTIC**
		▪ Implement the concept of pedestrians (walkers) with a public vehicle use policy.	Universal and normative. **Research models are not affected directly**, as specified in the "programming stage".
		▪ Creating designs are configured by means of multi-purpose pedestrian scale distances.	Universal and normative. **Research models are not affected directly**, as specified in the "programming stage".
		AIR CONDITIONING	**REGION'S CHARACTERISTIC**
		Creates a comfortable thermal conditions on paths pedestrians and outdoor communal spaces by utilizing high-rise buildings as giant sunscreen, applying layers of cooling such as outdoor open spaces, landscaping, pools of water, and so on.	Regional and still is normative. **Research models are not affected directly**. 1. Determined at the design stage; 2. In the design process must consider sunscreen derived from other buildings; 3. Cooler layers determined at the design stage.
		LANDSCAPE	**REGION'S CHARACTERISTIC**
		Designing a landscape by utilizing existing local tree species that can also create shade, buffer, and O2-rich atmosphere.	Regional and still is normative. **Research models are not directly affected**, because it must be determined at the design stage.

ARCHITECTURE	2. THE BUILDING	**GENERAL**	**REGION'S CHARACTERISTIC**
		▪ Using a design that does not harm implementers and users. ▪ Implement architectural expression results interconnection factors of socio-cultural, environmental, ecological, and technical issues. ▪ Using design elements are symbolic as well as functional. ▪ Using a broad style, can adapt to the local environment and aims to minimize the building facade changes and maintenance funds.	Universal and regional as well as still are normative. **Research models are not directly affected**, determined at the design stage before using this model. In the section dealing with the facade of the building can be emphasized in the **Research Model**.

		▪ Implement the concept of multi-purpose space, and can be styled himself for disposition for multifunctional or flexible concept.	
		SOLAR ORIENTATION	**REGION'S CHARACTERISTIC**
		▪ Consider the solar orientation are strictly based on location footprint, using appropriate materials and can be different in each direction as well as the facade of a variety of shapes and configurations right building.	Regional, **affecting Model Research**, relating to building orientation and material selection. Except for the configuration of the building that had been set at Design Stage.
		FORM AND CONFIGURATION SPACE	**REGION'S CHARACTERISTIC**
		▪ Implement forms and configurations forming outside space and a buffer for facilities of social interaction, for high-storey buildings can be communal spaces. ▪ Implement forms responsive to the environment: aerodynamics, concourse, atrium, courtyard as a climate regulator, outer space and set back supported vegetation and landscaping. ▪ Implement forms and configurations that modify the climate and air movement to create a comfortable thermal conditions. ▪ Implement single loaded corridor to optimize the use of cross ventilation.	Universal and regional as well as still are normative. **Research models are not directly affected**, because it must be determined at the design stage before using this research model.
		FASADE	**REGION'S CHARACTERISTIC**
		Applying facade designs that can direct the wind, use of skin building temperature control, sunscreen carefully calculated specifically toward the west-east, as well as retaining rainwater.	Universal and regional as well as still are normative. **Research models are not directly affected**, because it must be determined at the design stage before using this research model.
		SCTRUCTURE SYSTEM	**REGION'S CHARACTERISTIC**
		Implementing structural system whose elements act as architectural elements, can modify the climate, set air circulation, and disturb the environment as little as possible implementation.	Universal and regional, and partially still is normative. **Research models are not directly affected**, because it must be determined at the design stage before using this research model.

MATERIAL AND CONSTRUCTION	REGION'S CHARACTERISTIC
▪ Using construction easily disassembled without damaging the main structure and transportation do not damage the environment. ▪ Using leather construction and building materials energy efficient, can regulate the heat and extreme climates.	Universal and regional, and partially still is normative. **Research models are not directly affected**, because it must be determined at the design stage before using this research model.
BUILDING AUTOMATION	
▪ Implement building automation systems such as Building Environment System (BES). ▪ Implement assisted natural ventilation system with sensor control equipment. ▪ Apply sunscreen to the facade on the hottest side that is activated by the sensor.	Universal and regional, and partially still is normative. **Research models are not directly affected**, because it must be determined at the design stage before using this research model.
LANDSCAPE	
Using vegetation and landscaping for space cooling. Symbiotic mutualism with mechanical systems to the environment balanced. Application of the roof, walls, and plaza to cool city structures.	Universal and regional, and partially still is normative. **Research models are not directly affected**, because it must be determined at the design stage before using this research model.
STRATEGY	**REGION'S CHARACTERISTIC**
▪ Implement the strategy of self-help in housing provision, with in-service training by leading architects design needs, including affordable operating costs.	Universal, a strategy must be set at the localgovernment level. **Research models are not directly affected**, because it must be determined at the design stage of a local government regulations must be adopted, before using this **Research Model**.
▪ Implement the system of self-build housing procurement with participation of users, the method allows variations in the expression construct instructive, size, shape, fenestration, color as well as the development of the communal areas.	
▪ Implement the concept of self-sufficient communities, prepare the site that accommodates the needs of the community in accordance growth.	
▪ Utilizing the results of research and development programs of designs that are environmentally sound.	
▪ Apply the principles of rehabilitation and reuse of buildings, reduce operating costs, rent and maintenance in order to obtain funds still minimizing energy consumption.	
POLICY	**REGION'S CHARACTERISTIC**
▪ Identifying back natural disasters that have occurred related to the construction and use of limited material unregulated, improvements in the manufacture and use of materials, construction techniques, as well as training programs.	Universal, a policy which should dipranatakan advance at local government level. **Research models are not directly affected**, because it must be determined at the design stage of a local government regulations must be adopted, before using this **Research Model**.
▪ Restructuring credit institutions so that people are not able to obtain material and reasonable service.	Universal, a strategy must be set at the localgovernment level. **Research models are not directly affected**, because it must be determined at the design stage of a local government regulations must be adopted, before using this **Research Model**.
▪ Implement conservation policy as the basis for the concept of building rehabilitation and reuse of the building.	

		▪ Conducting international exchange of information between architects and contractors on construction aspects related to natural resources are not renewable.	
		▪ Impose sanctions for the use of environmentally damaging materials.	
		▪ Implement decentralized systems construction industry, construction companies improve and develop small, labor-intensive system instead of solid energy.	
	3. PERAN ARSITEK	**RESOURCES**	**REGION'S CHARACTERISTIC**
		▪ Following the paradigm of design-oriented design and energy-saving concept.	Universal and some regional. All items is the responsibility of the architect to hold them both before and in the design process.**Research models are not directly affected**, because it must be determined on stage before and in the process of designing before using this **Research Model**.
		▪ Harnessing the potential of nature, studying and considering the characteristics of the sun, wind, rain, and in collaboration with the climate.	
		▪ Treating land as a commodity that can not be bought and sold freely, but as a more philosophical substance.	
		▪ Consider traditional knowledge and indigenous people as a storehouse of traditional knowledge accumulation, are able to recognize the creative energy and potential.	
		▪ Helps eliminate patterns of formal development environments that are too far away to intervene and destroy cultures proved capable of managing the environment.	
		▪ Increase knowledge of green index specifically related to resources, and help change consumption patterns that lead to environmental degradation.	
		MATERIAL	**REGION'S CHARACTERISTIC**
		▪ Using the results of research on the material which is the main resource.	Universal and normative. This will affect the material selection process. **Affect the research model.**
		▪ Have knowledge of materials and energy-efficient construction techniques, the use of local materials, sustainable natural, historical, cultural, traditional and renewable methods for contemporary practice, reuse, and recycling.	
		▪ Be aware of the use of energy-intensive materials such as steel, glass, and concrete are polluting and increasing the supply of short-term supply. Perform a life-cycle approach to the use of building materials and equipment as well as life cycle costing in the process of changing natural resources into material.	
		▪ Taking cradle-to-grave cost and energy required during the production of material that is often used, as well as the environmental impacts would occur.	

		USER	
		▪ Developing new customers can help themselves to build as needed based on the concept of instructive and helped determine the design so that the user is able to pay operating costs. ▪ Putting the interests of the user responds to the climate in any design process.	Universal and some regional. All items is the responsibility of the architect to hold them both before and in the design process.**Research models are not directly affected**, because it must be determined on stage before and in the process of designing before using this **Research Model**.
		Develop new patterns of internal life usersstorey high building.	It is the policy in the field of education for the community and self help design policies related to human bionomik.
		▪ Finding patterns of new spatial configuration to a better built environment.	
		DEVELOPMENT	
		▪ Using relevant literature is more demanding professional responsibilities in the face of global clients with all the demands of the ever increasing and diverse.	Universal and normative. **Research models are not directly affected**, but will determine the policy of sustainable architectural design process.
		▪ Using the model as a reference for future generations in the face of which will come with a variety of problems, which are expected to change social patterns to a better direction.	Universal and normative. **Research models are not directly affected**, but a paradigm concept and related models.
		▪ Implement the concept of sustainability as a concept that is reliable and does not regard it as a fashionable concept rather than jargon.	Universal and normative. **Research models are not directly affected**. This does not directly affect the research model, but a model of the relevant concepts and paradigms.
		▪ Use preservative-free material that can endanger human life.	Regional. **Affect the research model**. This will be incorporated into the material library as material selection options.

	4. PENGGUNAAN MATERIAL	▪ Using recycled materials, local natural, renewable, healthy environment with high vigilance on availability.	Universal and normative. **Research models are not directly affected**, but a paradigm concept and related models.
		▪ Make use of the material in an honest suitable for power and maintenance characteristics.	
		▪ Using the material products of fossil fuel as possible (non energy-intensive) and the results of energy-intensive industries with air usage instructions wary purpose of energy saving issues.	
		▪ Using a cladding material and responsive to sunlight and heat can adjust as needed.	Regional. **Affect the research model**. This will be incorporated into the material library as material selection options.
		▪ Using materials with different colors for different functions, terms of lighting and ease of use.	Universal and normative. **Research models are not directly affected**, as determined at the design stage.

	5. KONSUMSI ENERGI	**POLICY**	**REGION'S CHARACTERISTIC**
		▪ Designing the energy needs of the target can be predicted.	Universal and normative. **Research models are not directly affected**. This will affect the whole concept of the items that will assess the design and design elements.
		▪ Implement the concept of low-energy designs, shapes and unconventional materials, natural lighting automatically, wind power generators and solar energy technology is simple.	
		▪ Manage the use of electrical energy by zone: heating, cooling, lighting, ventilation, and others. ▪ Minimizing the use of fossil fuels.	

	NATURAL RESOURCES	REGION'S CHARACTERISTIC
6. PENGGUNAAN SUMBERDAYA LAIN	▪ Make use of soil and groundwater: a planned, systematic, optimal, net-to-gross and minimize ecosystem destruction.	Universal and normative. **Research models are not directly affected**. This is determined at the design stage.
	▪ Using sunlight for most of the lighting as well as for solar heating.	Regional. **Research models are not directly affected**. It will be linked to the opening direction of the building and electrical energy resource system in the design stage.
	▪ Using wind for natural ventilation and generators.	Regional. **Research models are not directly affected**. It will be connected to the ventilation system is applied.
	▪ Using water and rain water as a medium of internal and external air conditioning.	Regional. **Research models are not directly affected**. It will be linked with natural air conditioning system.
	▪ Using vegetation and landscape: internal or external air conditioning, O2-rich atmosphere.	This will be incorporated into the library vegetation as a recommended option. **Affect the research model.**
	▪ Using natural materials of wood and stone as the main material optimally.	Regional, it will be incorporated into the material library as a recommended option. **Affecting the Research Model**
	ARTIFICIAL RESOURCES	**REGION'S CHARACTERISTIC**
	▪ Reuse / reuse of the building and / or materials as a new resource.	Universal, it will be incorporated into the material library as a recommended option. **Affect the research model.**
	▪ Minimizing energy-intensive fabrication material unless operationally efficient.	

D. RESULTS - MODEL OF BUILDING LIFE CYCLE TOWARDS SUSTAINABLE ARCHITECTURE

Table 3 show the concept of Life Cycle Analysis Model Building Toward Sustainable Architecture with case studies multi-story Building, which can be used inductively to other cases.

All the results in **Table 3** still requires supporting data such as Material Database. Such data is not yet available in Indonesia, however, for materials that are universal data may be used. Each item has a size specification, quantity, and unit can be multiplied to produce a bill of materials. Then each item on the bill of materials multiplied by their respective attribute values to produce the amount of energy that will be involved in a project. The multiplication results can be checked on the reports that can be designed according to the need, in this case is a material impact on energy use.

Table 3. Life Cycle Analysis Model Building Toward Sustainable Architecture

PREPARATION				
PREPARATION	**TYPE**	**DESCRIPTION**	**SIZE**	**UNIT**
	▪ LAND CLEANING	Consider projects that involve the use of energy tools.	a	m^2
	▪ MOBILIZATION / DEMOBILIZATION TOOLS	Transport	b	Km
	▪ LAND PREPARATION	Consider projects that involve the use of energy tools.	c	m^3

THE DESIGN PROCESS				
	TYPE	**DESCRIPTION**	**SIZE**	**UNIT**
	▪ DIMENSION OF THE BUILDING	Building's hight	x	m^2
		Building's width	y	m^2
		Floor to floor	z	m^2
THE DESIGN SPECIFICATION	▪ EXTERNAL WALL SYSTEM	*Precast*	a	m^2
		In Situ	b	m^3
	▪ INTERNAL WALL SYSTEM (PARTITION)	*Precast*	a	m^2
		In Situ	b	m^3
	▪ DOOR AND WINDOW AREA	Aperture area	c	m^2
	▪ DOOR AND WINDOW HEIGHT	High Treshold	d	m
	▪ NUMBER OF FLOOR	-	e	floor
	▪ CEILING HEIGHT	Height from floor	f	m
	▪ NUMBER OF ELEVATOR	-	g	*cars*

THE CONTRUCTION PROCESS				
	TYPE	**ELEMENT**	**SIZE**	**UNIT**
STRUCTURE AND CONTRUCTION SPECIFICATION	SRTUCTURE		g	g
	▪ FOUNDATION STRUCTURE SYSTEM (FOOT)	Concrete Foundation	a	m^3
		Concrete Beam	b	m^3
		Concrete Plate	c	m^3
	▪ BUILDING STRUCTURE SYSTEM (BODY)	Concrete Coloumn	d	m^3
		Concrete Beam	e	m^3
		Concrete Plate	f	m^3
		Sliding Wall	g	m^3
	▪ ROOF STRUCTURE SYSTEM (HEAD)	Concrete Beam	h	m^3
		Concrete Plate	i	
	WALL			
	▪ EXTERNAL WALL SYSTEM	Concrete Wall	j	m^3
		Cladding	k	m^2
	▪ INTERNAL WALL SYSTEM (PARTITION)	*Light Weight Concrete Wall*	m	m^2
	APERTURE	d		
	▪ DOOR AND WINDOW	External – Aluminium Frame + Glass	n	$m + m^2$
		Internal – Aluminium Frame + Glass	o	$m + m^2$
	▪ DOOR AND WINDOW HEIGHT (THRESHOLD)	External	p	m^2
		Internal	q	m^2

FITTING OUT PROCESS				
	TYPE	**ELEMENT**	**SIZE**	**UNIT**
	▪ *AIR CONDITIONING*		a	unit
	▪ VENTILATION		b	piece
	▪ FINISHING	Ceiling	c	m^2
		Wall	d	m^2
		Floor	e	m^2

FITTING OUT PROCESS				
FIT OUT SPECIFICATION	▪ INSTALATION	Electricity	f	according to specifications
		Lift	g	buah
		Sanitation	h	according to specifications
	▪ STAIRS	Concrete Staris	i	m^3
		Stainless Steel Balustrade	j	m^2
		Balustrade Glass	k	m^2

OPERATIONAL PROCESS				
OPERATIONAL PROCESS	**TYPE**	**NEEDS/MAINTENANCE**	**NUMBER**	**UNIT**
	UTILISATION			
	▪ Lighting	Electricity	a	year
	▪ Water Heater	Electricity	b	year
	▪ other Electrical equipment	Electricity	c	year
	REPAIR AND MAINTENANCE			
	▪ *Air Conditioning*	Repairing Plastic	d	year
		Repairing Metal	e	year
	▪ Ventilation	Repairing	f	year
	▪ Finishing	Painting the Ceiling	g	year
		Repairing Ceiling	h	year
		Painting the Wall	i	year
		Repairing Wall	j	year
		Repairing the*Cladding*	k	year
		Painting the Ceiling	l	year
		Repairing the Ceiling	m	year
	▪ Instalation	Electricity	n	year
		Lift	o	year
		Sanitation	p	year
	▪ Structure	Roof Structure	q	year
	Wall	External – Mortar	r	year
		External – Plaster	s	year
		External – Paint	t	year
		Internal – Mortar	u	year
		Internal – Plaster	v	year
		Internal – Paint	w	year
	▪ Door and Window	External – Repairing the Door and Window	x	year
		Internal – Repairing the Door and Window	y	year

Table 4 –MaterialDatabase

MATERIAL	ATTRIBUTE	VALUE	RECYCLING CREDIT	UNIT (ENERGY)
Aluminium	GGE	14	13,662	T equiv CO_2/t
	Energy Sources	200	194,600	Gj/t
Brick	GGE	0,49	0	T equiv CO_2/t
	Energy Sources	5,8	0	Gj/t
Concrete	GGE	0,21	0	T equiv CO_2/t
	Energy Sources	1,4	0	Gj/t
Wood	GGE	1,6	0	T equiv CO_2/t
	Energy Sources	13	0	Gj/t
Ceramics, dst.	GGE	1,5	0	T equiv CO_2/t
	Energy Sources	20	0	Gj/t

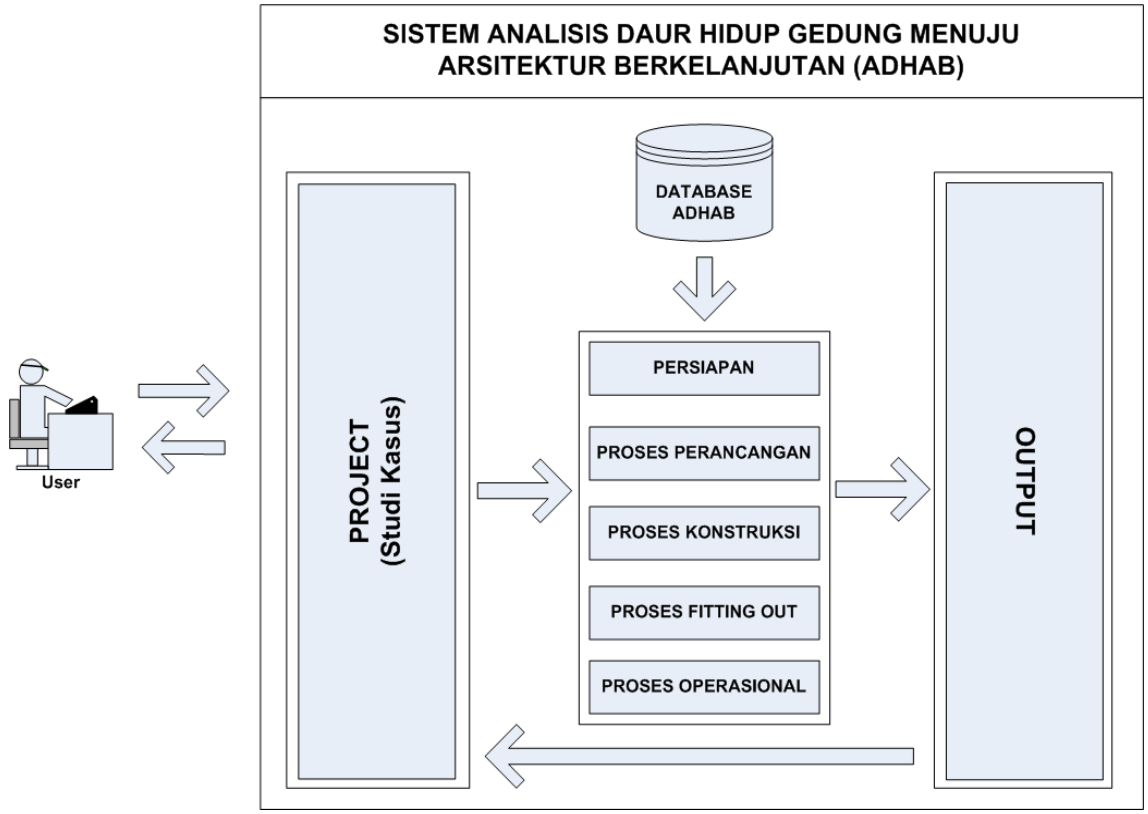

Figure1. – Architecture design ofthe application

C.1 Development of Building Life Cycle Analysis Toward Sustainable Architecture Aplication

The application development starts from the representation of the data derived from the data required in the process of building life cycle analysis. The data analysis of the study include: Data Preparation; Designing Data; Construction Data; Fitting Out Data, and Data Operations and additional data Material Database.

D. THE COMPUTER ARCHITECTURE OF BUILDING LIFE CYCLE ANALYSIS TOWARD SUSTAINABLE ARCHITECTURE

This application is used by the user to perform the life cycle analysis of buildings along the "design process". Although the analysis is not only in the construction phase, but primarily in the construction phase because the energy consumed as well as negative impacts on the environment are mostly located in this stage. These applications use the database that has been entered by the first operator as the basic data used in the analysis process. Operation of the application process begins after the design of a building complete with specifications, then the application will pull through processing and the building life cycle analysis will produce output in the form of the amount of energy consumed by the building, from the design stage of the process until the final stages of building management in its usefulness.

D.1 Desain

Archietcture Design of Building Life Cycle Analysis toward Sustainable Architecture can be seen on Figure 1.

D.2 Database of Building Life Cycle Analysis toward Sustainable Architecture

The first part includes the paper title, authors' name,abstract, and keywords. All fonts must be in Times NewRoman.

The main title (on the first page) should begin about 3.5 cm from the top edge of the page and should be centered (14-point and boldface). Leave two blank lines after the title.
Referring to the data analysis of the study consists of data preparation, specification data, construction data, fitting out the data, operational data and material data, the database design can be seen in Figure 2

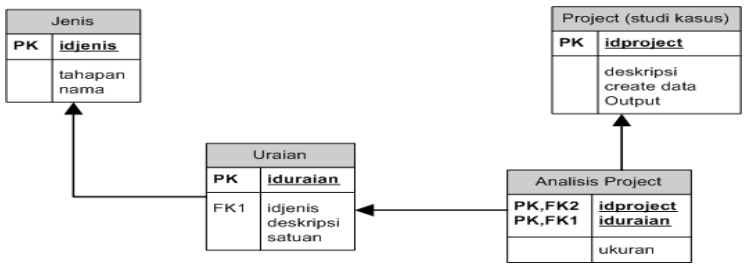

Figure2. – Database design of the analysis of Building Life Cycle toward Sustainable Architecture

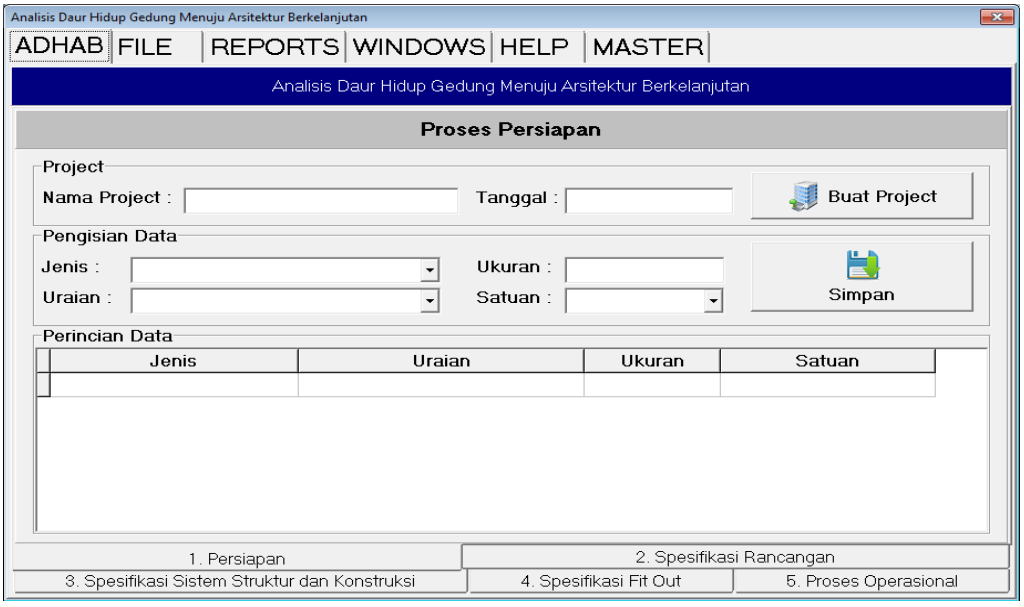

Figure3. – Interface design of preparation process

D.3 The Interface of Analysis Model of Building Life Cycle toward Sustainable Architecture.

Figure 3. The following is the interface design process is started on the application ADHAB models that represent specification design interfaces, Structure and Construction Specifications, Specifications Fitting Out, Operational Processes, all of which are sub from the frontpage.

E. CONCLUTION AND RECOMENDATION

E.1 CONCLUTION

a. System Approach to Architecture (Handler, 1970) which in this context is analogous to a Life Cycle Assessment (LCA) instrument for architectural design is still conceptual, so most of the elements that must be met are universal and normative. However, some elements of which are influenced by regional characteristics Indonesia still technically be translated so that it can be applied in the research model.
b. Although Handler's system remains to be added at the end of its usefulness building management in order to accommodate the paradigm of cradle-to-grave LCA as an instrument of the building, however, the concept has contributed greatly to the design of similar models. Because existing LCA is still common, which is for the general design and if directly related to the life cycle of buildings is often just as legitimation tool for material selection.
c. Although the criteria have been divided into six groups that are within range of the conceptual level to the technical (1. Tread; 2. Building 3. Role of Architects; 4. Use of materials; 5. Consumption of Energy; 6. Usage of Natural Resources), but thus still difficult to translate conceptual things become more technical in particular that can benefit the design of Model Research.
d. A more detailed classification and analysis even deeper research needs to be done to the things that are in the conceptual subgroups, so the paradigm cradle-to-grave can be implemented optimally though still not able to reach 100%. Most of the criteria set out in the regulations in Indonesia, but some are still part of the general provisions concerning building permits, has not become part of the synergy with other parts packed in a holistic legislation on sustainable architecture.
e. The things that can not be adapted to the model research: LCI (Life Cycle Information) for each material circulating in the Indonesian market, due to the unavailability of attributes for each material. However, for the same materials, the data attributes can be used.
f. decommissioning Calculation and transport material, because it is not a standard per area and charge both types of activities, as well as for the transport of material often has been included into the price. Besides determining the vendor was often based on material availability and prices, although relatively more distant location.
g. Especially for LCI, should be done to similar information in Indonesia. However, this must be underpinned by government policy on the provision of sustainable architecture that will be adopted, in particular measuring instrument "building life cycle".
h. Provide convenience to take into account the energy consumption during the life cycle of buildings, especially at the stage (stage) the construction process and the counting process is done once the design has been completed and the building design specifications has published.
i. Applications can only take into account the amount of energy consumed by some process of building life-cycle process and materials used during the life cycle of a building design architecture, database of attributes for the energy contained by all the components involved in good order. Besides those things that can only be taken into account in the field can not be analyzed the amount of its energy consumption..
j. Potential of ICT was found to be further explored in the architecture as well as its association with the energy savings. For example: age of the building is determined in advance, will be a measure of energy consumption of the counting process.

E.2 RECOMENDATION

a. There should be a database of instruments related to sustainable architecture such as LCA or similar instruments, so the results of this research can be continued to a higher level.
b. Developed countries -the United Kingdom, England for instance- has imposed a condition that any building design that will be built in addition to obtaining building permits, must obtain the permission of the relevant design that has been tested as building energy-saving principle into account, as well as has been known to estimate its energy consumption throughout the building life cycle.
c. Such provisions should be implemented in Indonesia, step by step, because in addition to supply of fossil fuel energy resources dwindling, Indonesia was until now has not promotes alternative energy resource intensively. It needs a good will of the government institutions in the form of the application and enforcement of legal

sanctions to take into account energy consumption, especially along the life cycle of the building. The institutions that govern the planning and architectural design should only be done by a professional architect, who has been through the education profession.

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With ICT, those fields can optimize their work and even get new opportunities in the developing the endeavor to reach beyond current possibilities. This is possible due to the effective and efficient manner of the ICT. With this technology, distance, time, will be no longer a boundary to support further areas of optimized scientific resources.

This seminar is intended to summarize the research idea as well as to promote other forms of real implementation of the use and role of ICT in the field of engineering, economics, politics, law, literature and art.

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