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LIFE CYCLE ANALYSIS OF JONGGOL ISLAMIC CITY IN INDONESIA

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ABSTRACT

This paper develops the theory of life cycle analysis for urban areas. It aims to present the development phases of *Jonggol Islamic City* through Life Cycle Analysis. The undertaken research is based upon the model of Lourenço meta - analysis for urban growth areas represented by three curves of planning, action and living. This theory contributes to urban design knowledge development especially in the monitoring phase. This graphical method helps experts and city managers as well as the citizens better identify the trends for urban areas in terms of sustainable development including the three aspects of economic, social, and environment components.

1 INTRODUCTION

Indonesia is a large country by number of people and areas. The problematic issue is low welfare and underdeveloped community standards. Even after more than 60 years of Indonesian Independence Day have past, Indonesia suffers under developed positions in some areas. Education is becoming one of the main targets for development as it can help people gain welfare. Through education people not only will gain knowledge but also wisdom and care for others.

Modern Islamic Education educates young generations through Islamic principles and teaches them life skills to be entrepreneurs and useful people when they live in a community. *Jonggol Islamic City* presents the atmosphere of an Islam community found by Madinatul Quran Islamic School in Bogor, West Java and it was planned as green and zero waste urban area. It is designed to integrate education and tourism, occupying 100 ha of land in the middle of a paddy field and a forest. This city will be completed with education, economic, and health facilities as the main equipments and agro industries, domestic waste refinery and natural preservation as the supporting facilities.

During a period of three years of development (2011-2014), this private city has been simultaneously monitored for planning, action and living activities cycles. Although the study period only encompasses a short time, it will open a discussion of the abnormal conditions of the plan-process of the area. Through LCA assessment, when the cycle

breaks and ruptures emerge in the analysis, there should follow some sound of alarm for City Managers if they want to keep the city developing at a sustainable pace.

2 THEORETICAL FRAMEWORK

2.1 Life Cycle Analysis for Urban Development

Life cycle is a graphical tool that represents phases over a long period of time. It is represented in exponential or logistic s-curves, which are slow at the beginning, undergo acceleration, then slowing down and at the end, saturation. Lourenço (2003) defined the urbanized areas in an analogy with the framework of predictions heuristics of the quasi-model of Holton. She noticed that effectively, Holton broke the attractiveness of mining for gold and the discovery of a new field continuing his analogy with the gold rush. As a result, a utopian model of planning cycles which consists of three curves: planning, action, and living (see Figure 1) was proposed by her as an ideal behaviour of a plan-process. She noticed that the behavior of the knowledge-based graphic could theoretically explain her model as: base curve of planning represented by the curve of participation in the fundamental knowledge, associated actions represented by logistic curve of fundamental research and living curve represented by applied knowledge curve. This model and the likely evolution of the gold rush were associated with an almost metaphoric mathematical model that relies on a graphical representation with an explicit visualization. This same scheme was applied to analyze and forecast the race to urbanization.

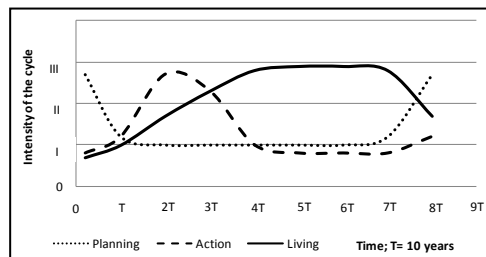


Fig 1. Ideal Behaviour of a Plan-process: Lourenço's Model
Source: Lourenço, 2003

Lourenço's model theoretically considered that during the first ten years there is an intensive planning, which will gradually decrease until reaching a minimum value, after two decades. The intensity level of the actions will increase and present a higher ratio in the second decade, and should reach a peak at the end of this period. Regarding to the intensity of the living, it is considered that the intensity has the same or slower increase ratio than the curve of the actions, requiring forty years to reach its maximum precisely when the measure of the curve reaches its minimum. At the end of the twenty or thirty years, corresponding to sixty or seventy years after the beginning of a planning cycle, the intensity of the living begins to decrease rapidly, while the intensity of planning increases very quickly.

For this model to reflect the practice, due to the result of complexities and uncertainties of the real world, is more problematic. Commonly, the planning cycles are interrupted; interpenetrate, unable to reach the normal transformation, sequential execution cycles (actions) and, subsequently experiences (living). The parameterization of the "S-curves"

could be translated by mathematical expressions for the cases analyzed as a function of the domain of static analysis and evidence available. The intensity of planning can be measured, as an example, by the number of plans produced, by the funds spent on the procurement plans and resulting projects, consulting, planning, among other postings of possible technical and human resources spent in this sector. The curve of action may be established in the same way as above, by number or financial resources allocated and actions taken to develop over time. The curve of living was established as an analogous logistic curve, for example, the evolution of the urban area or the population growth. With the application of this model, almost becomes possible to present a master plan-process in a way that can be graphically parameterized in a long time span, as a function of the variables available.

2.2 Green Urban Design and Zero Waste Concepts

Compact and walkable are the most sustainable system in the urban or rural area. It combines human scale urbanism as a mix of uses and services with the ability to walk and bike inside the area as part of daily life. Urban design principles and practices have opportunity to bring together the ideas and plans in order to create enjoyable places while greatly reducing energy use. Cars and motorcycles are the most pollutant vehicles which supposed to be considered at the initial design phase. Designing away the need for cars is the most important step in creating sustainable places (Urban Design, 2014). By creating car-free zone, architects and urban planners can protect the area from uncontrolled energy consumptions, impact of global warming emissions, and lowering of quality of life. Green urban design is formulated by Kyushu University as Sustainable Habitat System in a mathematic model. It is a simple model of $T=W-D$ (Kawase, 2007). The result of this green urban design theory is *Throughput* which theoretically should be reached at maximum results. To reach this condition, the *Welfare* value should be at a maximal condition which is influenced by *safety, relief, health, and comfort*. Those are supposed to be the efficient factors. If sense factor is included, this factor should be at the sufficient stage. The impact of the urban design should be at the minimum level especially to environmental damage which is influenced by *Life Cycle Energy, Life Cycle CO₂, and Life Cycle Cost*.

The concept of Zero Waste can be resumed as an integrated waste management concept. It is including the reduction of waste volume from the sources to the approach. The reduction can be done through technology, environmental treatment, economic values, and active roles. The principle of waste management is minimizing the production of waste from the whole production of people activities. It needs very careful examination in order to determine the most possible implementation of 3R in the each step of the activity. In sum, waste management should be well-planned, well-executed, well-controlled, and well-evaluated in order to be well-implemented by the community. Generally, the principle of zero waste is the concept of 3R, those are: reduce: minimizing the goods or materials that used, more material is used, more waste is generated; reuse: extending the use of good before it becomes junk; recycle: using waste as new sources of another benefit products.

The application of the concept of zero waste in the 3R General Guidelines Settlements and Regions are divided into two methods, those are: (1) handling of waste should no longer be based solely on the collection activity of transport and garbage disposal and (2) handling of household waste and the region area is expected to implement the minimization efforts by reducing, reusing and recycling waste generated. There are some

cities who has implemented zero waste concepts in their solid waste management city, those are: San Fransisco, Stockholm, and Adelaide. According to research which is conducted by Zaman and Lehman (2013), San Fransisco becomes closest to achieving zero waste than the other two cities due to its emphasis on reusing solid waste. San Fansisco has struggled to involve all of the citizens in order to separate the trash and recycle all of possible trash which still can be source for other goods.

2.3 Sustainable Urban Development

Sustainable urban development has been written about so many times since the Brundtland Report (1987). It consists of three dimensions: economic, social, and environmental. It has significant influence on planning and policy at the local level. Afterwards, the communities have adopted sustainability as a goal in comprehensive plans and other planning activities.

Nowadays, sustainable planning and management has diverse definitions ranging from “deep green” ecological fundamentalism to: energy conservation issues, serious principles of social equity (inter, intra-generational, and gender), environmental economics, and economic sustainability. Kammeier (2003) proposed the resume of sustainable development coped with big events management as a pragmatic manner as seriously “green” to some extent, socially equitable (at present and with regard to the near future), and economically prudent. The emphasis is on economic value added, employment effect and ‘city image’.

3 RESEARCH METHODOLOGY

The model consists of three curves: planning, action and living. To estimate the intensity of each phase, there are some factors influence, those are: (1) the intensity of planning is indicated by the presentation of urban strategy, planning frameworks, directives, planning proposals, new bodies, and urban development visions which have relation with the projects, (2) the intensity of action is indicated by the number infrastructures construction, public participation, and amount of investment, (3) the intensity of living is indicated by the number of people living and visiting, and the economic and social activities. Figure 3 shows the flow work of this methodology which is revisited from Lourenço (2003a) and Alvares (2008). The factors will be checked whether present or not present in order to determine the intensity of each phase (low, medium, high). The graphic portrayed is a quasi-dynamic model for urban area planning process.

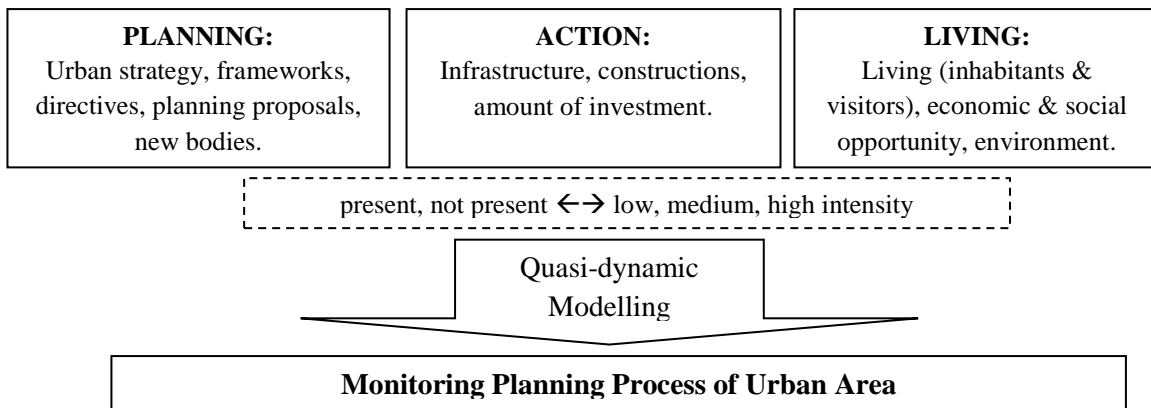


Fig 3. The flow work of the model
Source: cited and revised from Astuti (2013)

The justification of the intensity of the cycle for each phase is done according to the representation of the factors which appear in the urban plan-process that can be examined through the plan-process history of the study case. For example, for the planning phase, when the city puts forward a vision and mission, the planning proposals, and urban strategy, the intensity of the planning phase is justified in the high intensity. When the city has a new urban image that is mostly based on the planning proposals of the action plan, the intensity of the action phase is justified in the high intensity. Afterwards, in the living phase, if the data on visitors shows that not much people come to enjoy the new urban image, the intensity of the living phase is justified in the medium intensity. Through this graphical monitoring, the city managers can do an assessment to find out the problems in the living cycle and try to solve them as quick as they can to avoid dry run of the investment and infrastructure building. The analysis process for Jonggol City is described in Figure 4 .

Year	Planning	Present/not	Action	Present/not	Living	Present/not
1975						
1980						
1990	Vision & Mission	√				
1995	Urban strategy	√				
	Framework	√				
2000			Constructions	√		
2005			Investments	√		
			New urban image	√	Number of visitors	-
2010					Economic opportunity	-
2015						

√ : present, - : not present

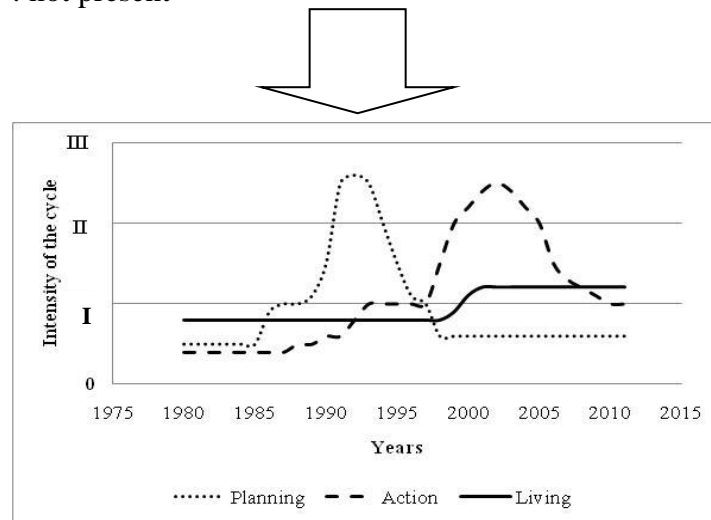


Fig 4. LCA graph for Jonggol City

The justification process of the intensity of the cycle might present the most relevant difficulties in doing the analysis. The subjectivity when justifying the intensity of the cycle should be minimized by the evaluator trying to fairly apprehend the big picture to get the assessment results clearly similar to the field condition. The objectivity of the analysis can be achieved if the complete and historic data can be collected and verified. It should be done carefully in order to help researchers and city managers understand the behaviour of the city plan-process during the specific period to be assessed.

4 JONGGOL ISLAMIC CITY

Jonggol Islamic City is located in the Cibodas Village, Jonggol District, Bogor Regency West Java. It is 60 km southeast from Jakarta, Indonesian Capital City. It is a strategic area which nowadays becomes a fast developing residential area.

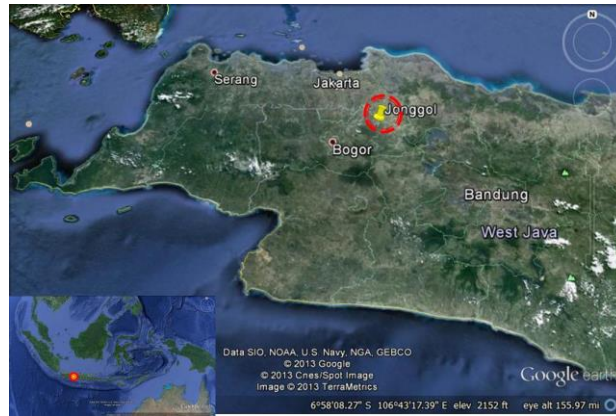


Fig 5. Location of Jonggol

4.1 Master Plan of Jonggol Islamic City

The area of 100 ha is divided into three zones of Madina, Sunda, and Mecca. Madina zone represents the modernity of Islamic education due to the exclusive facilities and infrastructure. It is important to attract moslem rich families to send their children to study in this school. Sunda zone represents the traditional Islamic education due to the facilities and infrastructures. The sundanese village atmosphere will be performed in this zone. This traditional atmosphere is brought to deal with low income families who want to send their children to study Islam. Sunda and Medina are created to be connected through cross subsidize where the rich can help the poor. Mecca zone is a green hilly area. It has a beautiful view and is a prospective area to be a Muslim academic resort. People from Jakarta can come to Jonggol Islamic City to take a short course of Quran for about three weeks. Those zones will be completed with several facilities such as dormitory, market, and hospital.

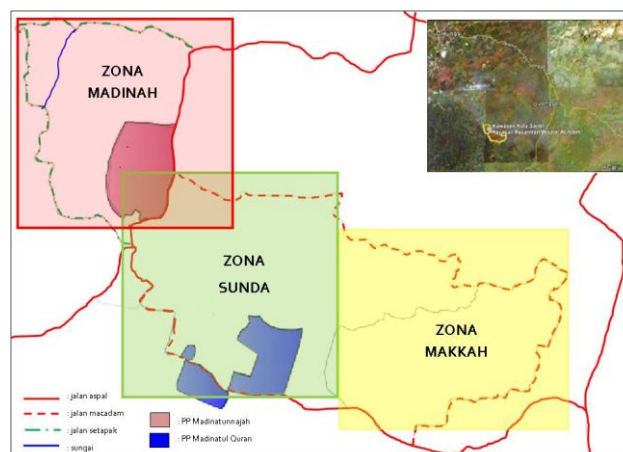


Fig 6. Zoning of Jonggol Islamic City

The design concept is based on zero waste. It is an ethic concept to reduce the volume of waste production and see the waste as a resource. Through this concept, the waste will be processed in situ and open an opportunity to get more advantages from it. Besides, the dominant agricultural area of this case study, opens an opportunity to be self-sufficient for food and energy. The green area which can be conserved as natural asset can be designed as a car free zone area. Those design concepts support the vision of the city as a modern

Islamic City completed by education, economic and health centre facilities, agro industry areas and environment conservation. The plan process of the Jonggol Islamic City is designed for 15 years. This lengthy time is to accomplish the planning and implementation of the infrastructures and core buildings, in order for full living standards of the people who will live there.

4.2 Medina Zone Development

Medina zone has 15 ha area to be developed. It is designed to be a modern Islamic education centre for high-middle class family who are interested to send their children to a boarding school. This zone is designed to support the education activity of 10.000 students.



Fig 7. Site Plan of Medina Zone

This area consists of a big mosque, classrooms, boarding houses, big hall, gymnasium, market, and a parking area. Green is the main concept for Medina Zone. It is represented by the big mosque as a prototype of Nabawi Mosque in Medina City with the dominant colour of green for the dome and the minarets. The boarding houses and the classrooms will be painted with green too. On those designs, big windows and high ceiling will be adopted in order to get a smooth air circulation. It is important to create a friendly climate atmosphere since this area starts to be urbanized. In addition, to access from one building to other buildings, pedestrian paths will be built. On the edge of the pedestrian paths, several shade trees will be planted in order to protect pedestrians from the sunshine.



Fig 8. View of the Mosque, boarding houses, and the connector paths in Medina Zone

The planning process has been started since 2012 with the concepts of Modern Islamic Education Center in this Zone. The location of this zone as the front of the area should be

the landmark of the Islamic City. It is continued in 2013 with the architectural design and landscape especially for the mosque and the boarding houses.

By the end of 2013, the soil work has been started in order to prepare the land field. It was paddy field with all of green landscape before the work started and nowadays, this paddy field was removed and became prepared land in order to receive several infrastructures.



Fig 9 Paddy field before the soil work started (left) and prepared land (right)

4.2 Sunda Zone Development

Sunda Zone is the most developed area for today. There are junior high school Islamic boarding houses and Islamic academy for teachers. Those two schools have been opened since 2013 and have 100 students.

The Junior high school has a mosque, sport yard, boarding houses, class rooms and a canteen. Those facilities support the daily living for 50 students who stay in the school every day and have to do several activities. In between of their schedule, the students can participate in entrepreneur activities like planting and farming.



Fig 10. Classroom, boarding houses, mosque, and open canteen

The academy for Islamic teachers provides education from foreign teachers such as from Madina, Saudi Arabia. It has permanent students who will stay in this school for one year and temporary students who participate in the short course program. Students also can do several activities such as farming and studying mechanic.



Fig 11. Mosque, houses, and students boarding houses for Islamic Teacher Academy

This area has accomplished the planning, action, and living phases of the model in a short time. Planning started in 2012, building started in the beginning of 2013, and living occurred in the middle of 2013. The investment came from private funds of the community and the cash-flow from the students' tuition fee. The living involved permanent as well as temporary students and villagers around the area who should get more advantage from this city's activities.

4.3 Mecca Zone Development

Mecca zone is planned to be a higher education centre through franchise pattern such as Computer and Information Technology education. This zone is also planned as an Islamic education resort for short courses of Quran and Hajj practices. To support this planning, some infrastructures will be built such as condominium, classroom, mosque, and hospitals.



Fig 12. Hilly landscape in Mecca Zone and Quran Academy Building Design

Detail design of this area has not yet been created. The Manager is still focusing in those two zones. At present, a Quran Academy from India and a franchise Islamic education have showed interested to build one academy in Indonesia. This academy will teach muslim to read and memorize Quran as well as a short course for about three weeks which can be taken by visitors.

Mecca zone complex is planned to support the activity of 500 students. It consists of four main class rooms with a capacity for 50 students, one class with a capacity for 100 students, mosque with capacity for 500 people, accommodation capacity for 600 people, canteen capacity for 500 people, office and a large kitchen. The building design from The Quran Academy can be seen on the Figure 13.

5 Green and Zero Waste Application

The green and zero waste concepts have been considered by the Area Manager at the beginning of the planning phase. Car-free area, eco-friendly buildings, independent food supplied, water conservation, renewable energy application, and waste management system, are some concepts which are intended to be implemented as the soul for *Jonggol Islamic City*.

The concept of car-free zone has been implemented in the planning of medina zone and will be the most accessible way to access an entire zone. The cars can only be used by the teachers, the employers and visitors for their first visit. The students can access the area on foot or take soft-modes such as bicycle. Eco-friendly buildings have been implemented in the performance of some existing buildings. The idea of open building and rooms with wide windows is an effort to create a friendly environment. Local materials such as

bamboo and coconut woods are used as the main materials to build some of the buildings. Farming activity has been proposed as an effort to gain self- sufficiency in food.



Fig 13. Pedestrian path, bamboo for the schools buildings, farming activity, spring water conservation

Water conservation is planned to create a big pond in the lowest area of Sunda Zone. It can be integrated with fishery activity. Waterfront area also to be developed as a green and fresh area. Finally, the water energy might become a renewable energy source which can be implemented in Jonggol Islamic City. Those still remain planning proposals not yet implemented until today. However, the Area Manager has conserved the spring water which can be used for daily activities. Waste management system through zero waste concepts of reduce, reuse and recycle will be adapted in order to solve waste problems. It is in the planning phase and has not been implemented yet. Though this concept, the waste can be used for organic fertilizer to support farming activity.

6 LCA Model for *Jonggol Islamic City*

The behaviour of *Jonggol Islamic City* will be examined through Lourenço’s model. The plan-process of each zone and the green concepts implementation will be done during period of 2011 until beginning of 2014. The conditions is broken down in chronological stages and categorized through the zone development.

Table 1 The Resume Data of *Jonggol Islamic City* Plan-Process

Year	Conditions	Planning	Action	Living
2011	Planning concepts of Jonggol Islamic City	Vision & Mission		
	Consolidation for the land availability		The land benefaction process from land owner to Area Manager	
2012	Start DED Planning for Sunda Zone		Infrastructure Planning	
2013	Build infrastructure in Sunda Zone		Infrastructure building	
	Start living for first year students in Sunda Zone			40 Junior High School Students
	Held social events for the villagers		Mosque launching	200 villagers 50 volunteers
	Master plan consolidation for Medina Zone	The zoning and land use concepts		
	DED for Medina Zone		Infrastructure planning	
	Land work in Medina Zone		Land preparation	
	Master plan consolidation for Mecca Zone	The zoning and land use concepts		

Year	Conditions	Planning	Action	Living
	Master Plan for Green Concepts	Green Concepts Planning		
	Build infrastructure for green implementation		Water tank to spring water conservation	Using spring water for daily needs
			Farming activity	Plantation & livestock
	Fund raising through private property business to build facilities in Sunda Zone	Zoning for property land	Selling activity	60% already sold out
	Build more infrastructure for the second year students		More houses and classroom	
2014	Changing plan for Mecca Zone	Quran Academy	Quran Academy DED	
	Preparing start living for the second year students in Sunda Zone			

Blue: all zone, red: Medina Zone, green: Sunda Zone, yellow: Mecca Zone

From the data above, the condition of *Jonggol Islamic City* can be drawn on the bi-dimensional graphic of Lourenço's model. The behaviour can be compared to the Lourenço's ideal behaviour model. It can be justified whether the cycle mirror the ideal model or not. If the cycle trend is going up it means the cycle is in the high intensity and if it the curve goes down it means ruptures or decreasing symptoms that are supposed to create city awareness.

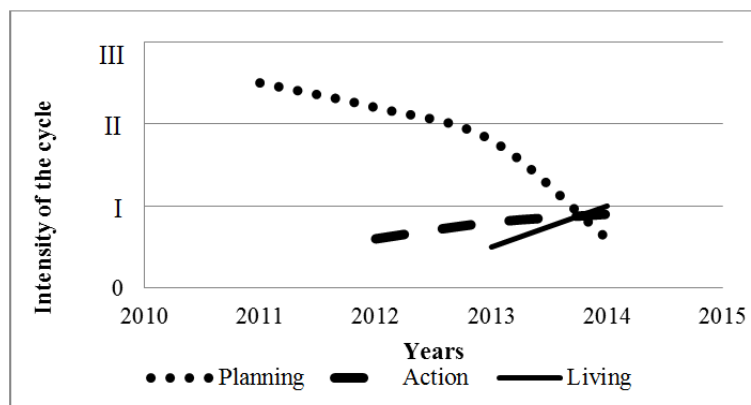


Fig 14. The Behaviour Plan-process of *Jonggol Islamic City*

The analysis shows that high intensity of planning happened since 2011 for the concepts, vision and mission of the *Jonggol Islamic City*. It is continued in 2012 and going down in 2013-2014. The vision and mission is the soul of this city's development which has been considered in the planning process of each zone. The action is getting started and until 2014 the intensive action only happened in *Sunda Zone* and started to occur in *Medina Zone*. However, the small amount of buildings and infrastructure in *Sunda Zone* has opened an opportunity in *Jonggol Islamic City* to be inhabited by permanent students of the Junior High School and the Islamic Teacher Academy. It also opened networking with government, private company, and volunteers which held some events involving the villagers.

The time dimension of three years is quite short. As an educational city with a large area, *Jonggol Islamic City* needs some time to achieve its ideal plenary condition. However, the opening of Junior High School will drive the City Manager to keep adding the infrastructure every year until the last level of the students. The events which involve visitors and temporary students will also encourage the City Manager to complete the area with supporting facilities.

6 CONCLUSIONS

Application of Lourenço's model has been done to monitor the urban development of *Jonggol Islamic City*. The model shows that the planning has been done intensively since 2011. However, the action is still in the initial stage which involves intensive building infrastructure in Sunda Zone, one of the three zones according to the planning of this development. Infrastructure building is a basic need to support several activities for the inhabitants. Likewise, the availability of infrastructure in this zone has created a new education-oriented living area. The green concepts have been applied for farming, raising livestock, using local material for the buildings, and conserving water resources. During the three years of *Jonggol Islamic City's* plan-process, the intention to implement the ideal city to integrate education and tourism has remained. However, due to the basic needs stage currently under way, economic and social value is the first priority for today meanwhile green concepts in environment preservation represent the soul of this city that will enhance its future development.

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