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The Second International Conference on Engineering and Technology Development

2nd ICETD 2013

27, 28, 29 August 2013, Bandar Lampung, Indonesia

PROCEEDINGS

In Cooperations With :

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Hosted by :
Faculty of Engineering and Faculty of Computer Science,
Bandar Lampung University (UBL), Indonesia

2nd ICETD 2013

The Second International Conference On Engineering And Technology Development

28 -30 January 2013
Bandar Lampung University (UBL)
Lampung, Indonesia

PROCEEDINGS

Organized by:

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PREFACE

The Activities of the International Conference is in line and very appropriate with the vision and mission of Bandar Lampung University (UBL) to promote training and education as well as research in these areas.

On behalf of the Second International Conference on Engineering and Technology Development (2nd ICETD 2013) organizing committee, we are very pleased with the very good response especially from the keynote speaker and from the participans. It is noteworthy to point out that about 80 technical papers were received for this conference.

The participants of the conference come from many well known universities, among others : University Kebangsaan Malaysia – Malaysia, APTIKOM – Indonesia, Institut Teknologi sepuluh November – Indonesia, Surya Institute – Indonesia, International Islamic University – Malaysia, STMIK Mitra Lampung – lampung, Bandung Institut of Technology – Bandung, Lecture of The Malahayati University, B2TP – BPPT Researcher – lampung, Starch Technology Center – Lampung, Universitas Islam Indonesia – Indonesia, Politeknik Negeri Malang – Malang,University of Kitakyushu – Japan, Gadjah Mada University – Indonesia, Universitas Malahayati – Lampung, Lampung University – lampung, Starch Technology Center – Lampung, Universitas Riau – Riau, Hasanuddin University – Indonesia, Diponegoro University – Indonesia, King Abdulaziz University – Saudi Arabia, Parahyangan Catholic University – Indonesia , National Taiwan University– Taiwan, Surakarta Christian University – Indonesia, Sugijapranata Catholic University – Indonesia, Semarang University – Indonesia, University of Brawijaya – Indonesia, PPKIA Tarakanita Rahmawati – Indonesia, Kyushu University, Fukuoka – Japan, Science and Technology Beijing – China, Institut Teknologi Sepuluh Nopember – Surabaya, Researcher of Starch Technology Center, Universitas Muhammadiyah Metro – Metro, National University of Malaysia – Malaysia.

I would like to express my deepest gratitude to the International Advisory Board members, sponsor and also to all keynote speakers and all participants. I am also gratefull to all organizing committee and all of the reviewers who contribute to the high standard of the conference. Also I would like to express my deepest gratitude to the Rector of Bandar Lampung University (UBL) who give us endless support to these activities, so that the conference can be administrated on time

Bandar Lampung, 29 August 2013-08-26

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Climate Adaptive Technology In Maintaining Vernacularism Of Urban Kampong Case study: *KampungAdat* (Indiginous) Mahmud, Bandung District,West Java

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Abstract - *Vernacular architecture has been developed to fulfill human need and to encourage their live, which make architecture has close relationship with human culture(Rapoport, 1969). These process make vernacular building has a uniqueness, such as :a) non-engineered construction in response to the needs of their occupants, b) Struggle with their physical environment, c) it cannot be separated from locality, d) ecological wisdom. Such holistic approach promotes architecture should have paradigms : 1) buildings which physically last long, require little maintenance, and save in energy, 2) the way architecture and environment ought to be in fostering man's spirit. Kampung Adat (indigenous) Mahmud as urban kampong has implemented climate-adaptive technology in sustaining the built enviroment which such vernacular wisdom. The aim of the research is to get better understanding how community of the Kampong could do climate-adaptive technology, which includes : 1) to identify and to evaluate climate challenge, 3) to analyse technology as adaptation to climate, 4) to evaluate the effectiveness each technology, 5) to develop the potential of climate adaptive technology. The methodology of research is qualiative descriptive, which based on observation and actual measurement. The useful of the research is: 1) to get better understanding of local technology in adapting to climate, 2)to develop such adaptive technology. Such principles must be applied in : 1) House Shape which can better minimize or withstand the impact of natural disaster, 2) Building method; sustainable construction practices are low cost, practical and environmentally appropriate, 3)Building Components, 4)Building Materials,which are either made from naturally available sources or from organic raw materials.*

Key words: *Climate adaptive technology, maintain, vernacularism, urban kampong*

INTRODUCTION

There are environmental issues, especially in urban context, have been raising since last decade, such as : Degradation, population growth and agricultural limits leading to global famine, pollution of air and water. Such disastrous potential climate has given effect the atmosphere, which have been examined in exhausting details. Controversial evidence has proven such degradation. Knowadays significant philosophical shift has taken place in urban area, as an implementation of the vernacularism wisdom; ecology-oriented and community participation. Such concept, its implications to the urban's development must be understood to get a better urban's friendly environment, especially as a response to climate. Vernacular architecture has specific characteristics, such as ; architecture without architect, local materials usage, traditional structural systems, humble. Local environment uniqueness, especially ecology which surrounds the building is main aspect; symbolically, ethic and realization, engineering of ecosystem. Indigenous society in various regions in. Indonesia, is an example of vernacular societies, which can survive until now, even in urban area , such as Kampong Mahmud in Bandung district,West Java.

Architecture has been developed by human being to fulfill human need, to encourage their live, which make built environment has related with human culture. Vernacular architecture is the result of human tradition by trial and error [1], which have had tradition, with related to their culture and norm. Human culture, norm, climate, and environment have effect on their environment and their built environment. These process make vernacular architecture has a uniqueness, as a result of ancient tradition which is gradually improved along time [3]. Struggle with their physical environment such as resistance to earthquake; combine with their climate, etc, make these building survive until today[1] [2]. All forms of vernacular architecture are built to meet specific needs which accommodating the values, economies and ways of life that produce them [2]. The owner is usually an active participant of the building process; he performs a permanent maintenance program [3]. He also adapts the building to the expanding needs of his family. Building and repair are an everyday affair, where impermanent materials and unsettled ways of life demand constant reconstruction and repair. Vernacular architecture has sustainable concepts, such as : 1) environment aspect; architecture is built with some consideration to their environment,especially climate, 2) social aspect, this building is accepted by their society, 3)economic aspect, this building is low cost which according to their society economy.

Local wisdom of vernacular architecture is very fundamental aspect, content of universal values, such as; ecological wisdom. In that sense, it is a must to have a meek attitude to learn from the ecology wisdom of vernacular architecture, which has ecology-oriented. The essence of ecology wisdom of indigenous villages (*Kampong Adat*) is sustainable architecture. Within a given ecological setting, human cultures evolve an adaptive response to their environment, especially climate. The cultures develop technologies as means of fulfilling individual, collective needs and desires. Finally, these technologies result in environmental impacts. Ecological wisdom includes consciousness of dynamic of sustainability, such as: 1)Ecology **:** the branch of biology which deals with the relationship between living organisms and their environment, 2) Culture: the ideas, beliefs, customs, skills, arts, etc. of a given people in a given period, 3) Technology: the science or study of the practical or industrial arts,

applied sciences, method, process, etc. At its highest level, sustainability involves the mediation between ecology and technology and relies on culturally appropriate attitudes and behavior (Diagram 1). Built environment are treated more as a cultural resource, legacy for future generations to come, such as; the role of sustainability; principle on rational settlement culture and tradition are developed pararelly with the development of built environment.

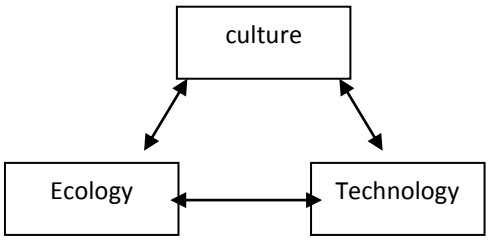

Diagram 1.Ecology wisdom of vernacularism

Urbanization, modernization process has changed urban-kampong area, it has been growing up rapidly. Therefore there is a nudge between urban modernity and village traditional, both physical and social, especially at fringe area. Such case have been worried to replace rural uniqueness, both physicaly and social- culture. At the present, non-physical and physical nudge tendencies at urban kampong, has shown urban modernity's loss of the rural vernacularism. Fringe area which has agrarian characteristics with its wide farming land; spontaneous and naturally growth, become as nudging area, which caused by urban growth. Such nudging area become transition area, the result is urban kampong transformation; physical element and social element. Urban-kampong improvement is the controlled-transformation, which can be achieved by developing kampong for providing enough social-culture spaces. In that case, the function of settlement is for social- culture need. The urban kampong improvement, such as Kampong mahmud is reviewed, which kampong as representation of vernacular's climate adaptive technology.

Procedure

Study area:Mahmud Kampong locates in southern part of Bandung district, at the edge of Citarum river. It is an urban kampong which consist of: a) settlement: dwelling area and sacre cemetery area, b) farmland area. The uniqueness og the kampong is a place of religious pilgrim,especially from Bandung traditional mosleum. The process of normalization of river and recent development has transformed the kampong, but still maintain the vernacularism of the kampong.

Identification; The implementation climate adaptive-technology in maintaning the kampong's vernacularism, can be seen in accommodating Social-culture needs of urban kampong. Such case can be seen in three main levels, such as : a)Kampong : transformation of kampong morphology, b)Neghbourhood: the ability in accomodating social space needs, c)Building: the ability in maintaining vernacular building.

Implementation of vernacular's Climate adaptive technology in level of Kampong; it can be seen in normalization of Citarum river, as main aspect of Kampong morphology's transformation. Citarum river's normalization has become a significant infrastructure which improve the kampong, as a response of environment problem, especially climate. Such implementation has been done as a

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response to high rainy, flood and high humidity which often happened in the rainy season at the past. Such implementation can be seen in two phases, such as :

1. Village Settlements before Normalization; Kampung Mahmud settlements was formed by the union of settlements, agricultural land / plantation and sacre-cemetery. Village territory ; it has ample rice land boundary on the north, the river on the South, and elements of the funeral on the eastern and western kampong. Residential Units are in the middle of the village, which paddy fields in the northern part, the cemetery is in the western part nearby tomb's village founders and old mosques. Physical distance between buildings can be seen in the area around the old mosque and, which around the mosque is also home of the village elders. The building occupied by the elders indicate the importance of cemetry and old mosques. Mosque is a religious facility for worship, both locals and visitors from outside the area, who intend to do pilgrim. The pilgrim is done by Friday prayer,also other religious events in the mosque. The mosque is located in the northern part of the village, almost bordered by rice fields where the inhabitants work.

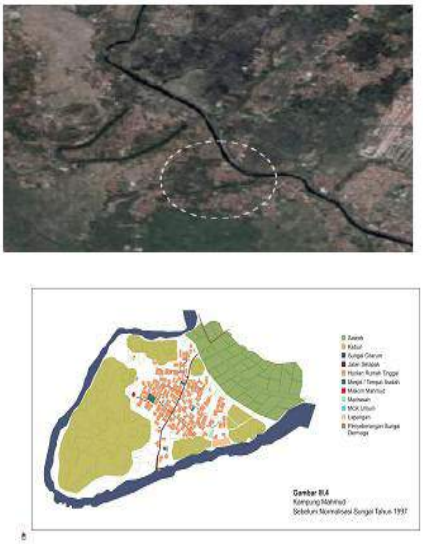

Figure 1-2: Kampong Mahmud before river normalization

2. Village Settlements after Normalization Progam**;** There was normalization of Citarum river by local governments in 1997. Such normalization was done in the form of meandering and widening the river, 6-7 times the original 's width. The result original was the separation of Mahmud kampong into two areas; a) residential centers and funeral homes, b) farmland. After normalization, Mahmud kampong is surrounded by the river Citarum (Fig.3-6). Clear physical boundary changes contained in the northern part of the village, which used to be agricultural areas. Straightening and widening of the river, followed by the construction of the bridge (almost 40 meters length) and inspection road along the river banks, connect the kampong with other villages. After normalization, the kampong settlement locate in secure area from flood treat, and give supporting for the farmland
3. irigation. Meanwhile,the inhanbitant's farmland still exist, as representation of ecology preservation.

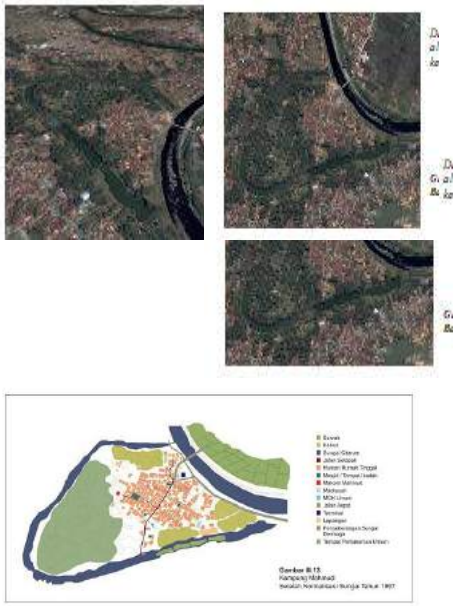

Figure 3-6: Kampung Mahmud after river normalizaton

4. Normalization was followed by some steps; a) a road construction for inspectioning river, which evolved into the street outside the kampong, influence the accesibilty into kampong settlement, b) the development of public - transport terminal at the village gate, c) preservation of the raft terminal in the southern part of the village,which give an easy way to across the river. The normalization of river, was still harmonized with traditional kampong. Circulation infrastructure's was developed in the form of bridges and roads on the outskirts of the Citarum river into the early development of the village settlement Mahmud, after 1997. The kampong become increasingly open to external influences. The existence of the kampong as a pilgrim place more known, and visited by many visitors from outside the area. The presence of craftsmen furniture and building component's experts continues to grow up in kampong, the industry is growing as the expertise of the craftsmen, especially wood- craft works increasingly recognized by various regions outside the kampong, even in verios region in Java.

In general, Such normalization has given contribution to cohesiveness of kampong settlement; Residential land and public burial places remain united within the village, in secure area from flood treat. Meanwhile, the existence farmland guarantee the ecology og the kampong. The existence of local bridges and roads connecting the village with the other regional, has opened opportunities for interaction the kampong inhabitant with outsider. The result; Mahmud kampong became famous place for religious pilgrim, and development of wood craftment home industry. Pilgrims from all over the area in Bandung and West Java to visit this place on a Friday night every week, and religion events.

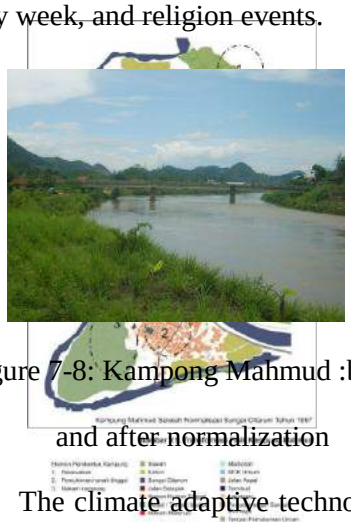

Figure 7-8: Kampong Mahmud :before and after normalization

The climate adaptive technology in providing neighbourhood's social space; Open land around the settlement has been turned into a garden and home stay. Dwelling house formerly a bamboo wall partially changed permanently brick complete with yard fence. Distance between buildings can be used as circulation for placement bathroom facilities, on each side of the house residents. Outside space in the form of yard / patio homes began to be replaced with a slightly changed form of a small shop or stall,as a place to peddle his wares. Economic activity in the form of informal trade continue to grow, it slightly changed the previous kampong livelihood. The main circulation that connects the village to the entrance gate of pilgrim place became a place for trader, *informal* economic activity has become the livelihood of the kampong. There is an increase in the inhabitant economy. Such condition is supported by the availability neighoburhood street and path (figure 9-

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10)

Figure 9-10. Neighbourhood Infrastructure ;street and path

The main access to the village entrance Mahmud was getting stronger by the presence of the bridge across the river Citarum that was built after 1997. The main entrance gate of the village is next to the southern tip of the bridge. The main circulating form of the linear order is an important element forming village settlements. Old and new Citarum river become a physical boundary which surrounds the village, therefore the kampong is able to distinguish from other local settlements. Changes in the elements forming the northern part of the village has changed both the physical characteristics of the settlements, and social identity of the village community. Most of the people who previouly farmers have turned into a mere cultivators, traders and even furniture craftsmen, which lead to the demanding needs of different spaces. Normalization of the river make the kampong easier to receive outside influences, which create social interaction between locals and migrants,especially occurre in spiritual - pilgrim activities. The developent of open space is a main infrastructure to accommodate such social- relationship needs such as; the patio, yard and open space. Each of these elements integrate with each other as a form of social terrace (fig.11-12).

Figure 11-12.social terrace

Porch or front yard into a dwelling house of each member of the family to interact. Another resident who became his neighbor also take advantage of the role of the terrace as a place to interact with other members of the family. The terrace was used as a place where children play or parents caring for their children in the afternoon and evening. Relatively close distance without physical boundaries between the individual it easier to interact (fig 13-14). Dwelling units of residential buildings form buildings cluster, which is connected by open spaces, become residential housing typologies of the kampong,. The spatial pattern formed on each residential unit, make the cluster (grouping), which public facilities / social as complementary. The presence of the buildings gap is still wide enough to allow the creation of sirculation between neighbors. The orientation of adjacent buildings, presence of building's side become an main infrastructure to accommodate social-function. (fig.15-16).

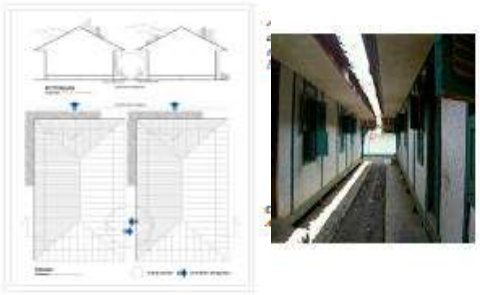


figure 13-14.Social terrace

The dwelling unit's side is now used also as a small shop or furniture industrial development. Although most of the trail leads to a form of circulation, but the building still has openings such as doors or windows to the side and rear that are often faced with the doors and windows of other houses. The condition is created because there is a considerable distance between the mass of the building. (fig.17-21)

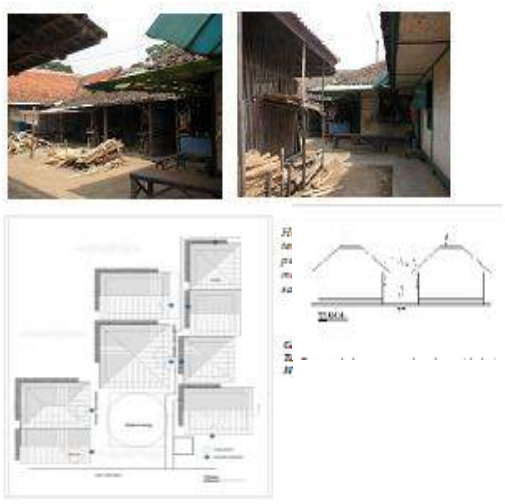
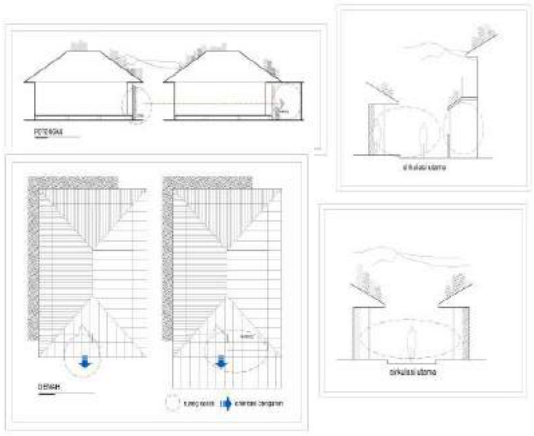


Figure 17-19. Binding element between the mass of the building

As with any open space on the front of new mosques and the pitch blank in the back of madrassa, the terrace is transformed into a stall area residents to interact anyway. Social-relationships formed bymaccommodated, mediated by enough building distance (Figure 19-24). Porch, yard and circulation forming communal social space where they used to work as a furniture craftsman.



igure 20-23.Comunal space

There is also the founder village's tomb which many people do pilgrim, the existence of the oldest mosque located right before entering the tomb became the center of the village population. All religious activities are predominantly Muslim population that took place there. Although there are other mosques, but for large religious activities, such as Friday prayers and celebrations all done on the building resembles a bamboo walled house measuring 12x24 ^{2}. Religious activities at mosques that provide religious and social significance. Mosque to be a combination of conditions that describe the physical space and the process of formation of the symbolic meaning of the objects around it. Social relations that occure in the mosque formed as facilitated, accommodated by open space. Mosque is a physical limit religious activities of the residents. Religious activities that stimulate and maintain social interaction between the inhanbitants. Mosque became a religious facility that serves as a social space. Besides being used by the locals, the

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mosque is also used by people who want to do pilgrim. They do worship before and or after doing pilgrim to Mahmud tomb, located nearby the mosque in advance. Religious activities that can stimulate social interaction in building mosques. The similarity of interests of visitors to go pilgrim enable them to interact. At this mosque then created a social space for visitors who do pilgrim. Public facilities for religious activities available in almost every neighborhood, although the form of a small mosque. The mosques are only used for daily worship, pray five times and do a recitation. Friday prayers and other religious festivals take place in the old mosque which is in the western part of the village. Formed in addition to the mosque as a religious facility, social interaction took place in the east village madrasa building. On building children's recitals every evening took place. Open space in the form of building's front yard formed by the integration of each of the buildings in the surrounding areas, which become a place for kids for playing before and after class. There is also open space between madrasa on the outskirts of the river.Open space in the form of lawn and garden around the madrasah able accomodate social relationships, which form the lining of the children when they remain. In the open space was created for children territories, form an association of social linked, mediated through the courtyard and open space.

The existence of this public facility to be a place also for residents to interact with each other. It lies in front of the new mosque, is making public toilets as a means of support for religious activities. Social interactions that occure in public sanitation, such as; toilet, makes the facility as part of the village social space. (figure 25-26).

Figure 25-26.Public sanitation

Open space at the front of the madrasa is a result of the integration of orientation buildings surrounding. The existence of the space to create harmony with the open space in the form of an empty field on the outskirts of the river where the children play.Open space in the form of an empty field nearby the madrasah is integral part of a building. Each space is integrated by the same pattern of activity. Buildings and open spaces that become part of the social space formed in the kampong settlements. Order form of mass religious facilities such as buildings with open space was found also in the area where the new mosque was established. Though new but this mosque is physically trying to apply the norms of the village in the form of banning the use of materials of glass in buildings. So the mosque walls were made of wood frame and polycarbonate

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materials. The mosque became a place of worship for residents and visitors who did the pilgrim. The existence of the mosque's courtyard make religious activities and other community events can be accommodated here

Figure 27-35.Open space as infrastructure for religious activies

New mosques and open space in front of it became a place for people carrying out religious activities and the celebration of national holidays. New mosque became a node for village settlements. The existence of open space to the front of the mosque element supports the formation of social space.In addition to the existence of madrassas and mosques as public and social facilities, there is also a formal school madrasah tsanawiyah junior high school level. Although the infrastructure is adequate but its existence has not been able to be an important element forming village settlements. Schools in the western outskirts of the village next to the river Citarum is a educational facility for the villagers who are mostly educated. It lies still in the village settlements into supporting elements forming social relationships hometown. School became a physical space for activities which also accommodate social activities.

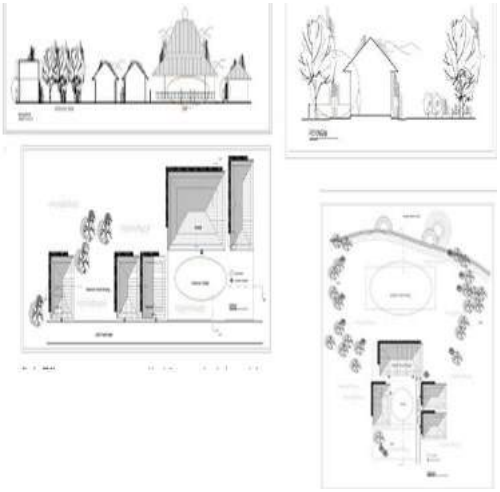

Figure 36-37.Social spaces between school buildings (madrasah)

The usage of soil materials surface influence the environment performance, especially in overcoming problem of climate. Such case is related with albedo, or reflection coefficient, derived-fom Latin albedo "whiteness" (or reflected sunlight), in turn from albus "white", is the diffuse reflectivity or reflecting power of a surface (table 1). A lot of open spaces in Mahmud kampong use nature surface, the fabricated material is used at least as possible. Such approach is done in gaining the environmental friendly kampong (Table 2).

Table 1.Albedo of various materials

(Source: Stull,2000)

number	Surface's material	Albedo(%)
1	Deep water	5-20
2	Gray soil-humidity	6-8

3	Dry-clear-soil	16-18
4	building	9
5	vegetation	10-23

Table 2. Albedo of various social spaces

Number	place of social space	Before 1997	After 1997	Albedo	
1	Terace of residential units	v	v	9	9
2	Terace of residentials cluster	v	v	9	9
3	Hall/yard for furniture cfratmen work	v	v	9	9
4	Rice field/park	v	v	10-23	10-23
5	Tomb of the Kampong founder	v	v	9	9
6	Places for worship:Mosque,madrasa	v	v	9	9
7	Public MCK	v	v	9	9
8	Small café in local house	v	v	9	9
9	sirculation		v		6-8
10	Place for raft	v	v	6-8	6-8
11	Open spaces	v	v	6-8	6-8
12	Terminal for public transportation	v	v	9	9

Climate Adaptive Technology in maintaining Building vernacularism**;** Residential part of the population in the form of dwelling houses are in the middle of the village. Residential buildings typology has stilt houses made of bamboo walls. The residence is equipped by livestock pens, goat or sheep at the back of the building, and utilization under the house to the chicken cage.Space in any residential dwelling with a simple division of the living room as a living room and family room, plus a bedroom next to the kitchen or behind the house. Residential units in the village Mahmud ranging from small size 4 x 6 m², 5 x 7 and 6 x 8 m² m². Broader measure there was complete by the side of the building that juts into and form a patio or yard for the kids to play.No different from other forms of traditional settlements, settlement houses Mahmud villagers mostly bamboo-walled houses on stilts, the main structure is built up of wood with a height of 30-50 cm from the ground.

Degree of homogeneity of mass building which is still largely in the form of bamboo walls and stylish stage creates a distinctive rhythm to the character of the village settlements Mahmud. Previous use

of roofs of palm fiber / shingle change has turned into roof tiles. Door and window openings as wood complete with the use of glass jalousie before evolving. Trust of the population formerly was strictly prohibits the use of glass as building material. Low building density indicated also by the scale of the building is mostly a one-story residential dwelling. The comparison illustrates the traditional village settlements are more human scale than modern residential city.. Settlement of houses that still leaves room for a courtyard or patio initial order of the mass of village settlements widely. Each of these homes was later expanded independently formed group residences. Open space in the form of circulation, patio, yard and garden become binding elements that make up the order of the mass of the settlement.

The use of glass in building materials is forbidden, as a form of norm which is still held. Violation of the unwritten rules that can lead to discomfort for the families who occupy, family members can fall sick even to death. However, the population began to dare violate origin normaitu because prestige that once seen and felt by those now gone. Although normalization of Citarum river has been undegone ten years ago , the vernacular characteristics of the kampong still preserved. Citarum river alignment as separate residential dwelling settlements with agricultural land being the main livelihood, do not bring too much direct influence on the identity of the village is still known as Mahmud jiarah hometown. Physical changes in the real village after 1997 did not alter the characteristics of the village as a village Mahmud rich spirituality values. Village famous for the place still visited by pilgrims from various regions, especially on Friday night

Changes in the function of the patio and yard into stalls / kiosks and then followed by a physical change in residential units. The use of stalls / kiosks as a result of economic activity most people change their home into a two-story building, especially building a village located alongside the main circulation. Mahmud villages are becoming increasingly open to newcomers can be shown by several residential buildings that are physically different from the population from villages Mahmud. At certain angles could be found form the walls of houses are made of bricks, tiles and flooring made from the use of glass as a window or door material. The residents of the village of origin Mahmud tend to retain the use of building materials made from wood or bamboo, and avoid the use of glass materials.

Figure 40.stall as residential ‘s social space

RESULTS

In general, vernacular’s climate adaptive wisdom can be done in improving urban kampong, such as; Mahmud kampong, Bandung district, West Java. Vernacularism wisdom is implemented in supporting the function of kampong settlement as social space, which accomodate socio-culture activities,e specially the specific character of the kampong as religious pilgrim place.

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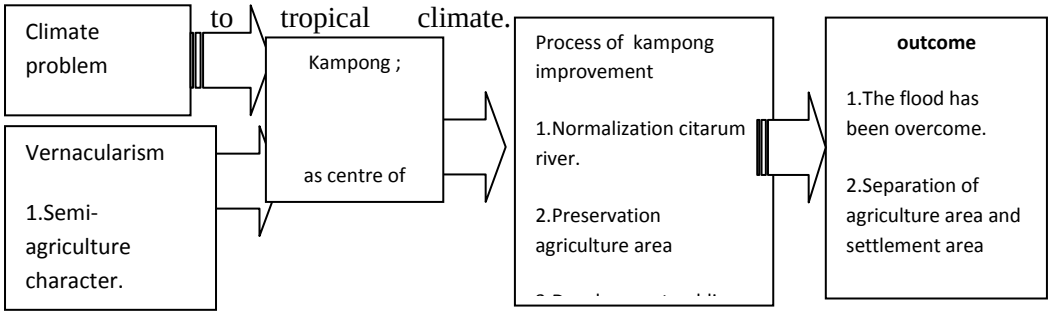
Such implementation was done in three levels :

1. Kampong, transformation of kampong morphology which; the role of the citarum river normalization, a road construction for inspectioning river which evolved into the street outside the kampong, which influence the accesibilty into kampong settlement, the development of public - transport terminal at the village gate, preservation of the raft terminal in the southern part of the village,which give an easy way to across the river.
2. Neghbourhood: the infrastructure for social space, such as: street, path,and open space beween buildings.
3. Building: maintaining vernacular building: local material, local technology, vernacular enclosure as to tropical climate. the kampong as heritage place,especially for religious pilgrim.



DISCUSSION

The framework of the vernacularism's climate adaptive wisdom can be seen in diagram 2. The diagram shows the relationship the cause factor, the implementation of kampong improvement,and the result. The outcome of normalization citarum river is the final result. The kampong has characteristics, such as: 1)the flood has been overcome, 2)the dwelling area of kampong very cohesive, therefore it is relative easy to maintain the vernacularism of the kampong, 3) the preservation of farmland area and social spaces indicate the environment friendly kampong,4) the preservation of vernacular houses support

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Such climate adaptive implementation has shown that the development of kampong regard climate is a main consideration, such as ; how to overcome the problem of flood, how to accommodate social function, how to use nature surface materials which has lowest degree of radiation reflection (albedo), the usage organic material of houses, in order to improve the kampong, physically and socio-culturally.

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