

## **Self-sufficiency in the provision of Indonesian construction materials**



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### **ABSTRACT**

In line with the plan of the Indonesian government to build and develop the infrastructure as well as building a million houses for middle low incomers, the provision of local construction material is strictly prerequisite. The purpose of building up the infrastructure (i.e. roads, dams, power plants, drainages and ports) in addition to mass houses is providing the job opportunity and increasing the public services demand.

The use of sustainable construction materials in Indonesian construction business is still considerably low, whereas the use of local material is rare. Business purposes with economical benefit considerations remain to be the major issue in the local construction firm.

Java as the most developed region in Indonesia customarily supplying woods for construction purposes from the tropical rainforests of Borneo and Sumatra, even though the use of these material are more durable but in the other hand its energy consuming and lack environment awareness. Furthermore its construction sand materials had been largely taken from the beach area, which brings about a number of serious environmental degradation. Likewise the construction material for Borneo, Sumatra and Eastern Indonesia most of the advanced production for material supplies such as cement, pre-fabricate concrete, steel and finishing material are mostly coming from Java region. This article aims to generate the knowledge vis-a-vis the possibility of self sufficiency and sustaining its construction material durability within local construction firm throughout the country.

### **KEYWORDS**

Sustainability, construction-industry, material, material supply , Indonesia

## **1 INTRODUCTION**

### **1.1 Government Plans**

In line with the new government plan to develop new infrastructure (road, dams, plants) and house for lower and middle class citizen in Indonesia, the construction company becoming one of the major factors involved to make it real. In Indonesia the construction sector always becoming first choice from central and local government for reducing the unemployment and reflecting the economics development. The demands to provide low and middle class houses undeniable, the accumulation for providing the lack of housing is nearly 5,9 million units in year 2003. Furthermore not to mention added by a necessity growth 800.000 thousand new house units as effect of the population growth [Kompas 2004]. Java as the most dense population in Indonesia have to provide a decent house for most of the population around the country, more than 55 percent of all Indonesian population live in this fourth biggest island in Indonesia [BPS 2002]

The new elected president promised in his campaign to provide cheap housing units for middle and low class citizen. This promise is very important for the shake of equalization and to minimize difference socialized gap. But in the other hand the Housing and Region Infrastructure as the government representative should prepare everything to make it real, the preparation not only the region housing planning, procurement and tendering but also the preparation of self sufficient for all of the region to provide its construction material. Java Island as the most dense population area should prepare the lack of raw material for the construction demands especially the lack of structural woods. Furthermore Borneo, Sumatera dan Eastern Indonesia should prepare the lack of production from process material such as asphalt, cement, pre-fabricate concrete, steel bar and steel plates. Those needs of the raw and process material for construction purposes definitely have to be fulfilled by the local government and its parties involved around the country. Providing local material and developing or giving the opportunity for local industry to proceed raw material becoming ready material will forcing a competitive price and less environment impacts.

### **1.2 Unbalance Material Supply in Indonesia**

Some years lately the raw material inventories of natural resources especially wood in Java Island had been degraded, this is caused by the depletory of natural forest. The effect of political reformation spread out from district to the remote area and every villages in Java Island. The illegal logging which is either individually or organized progressively worsen the forest condition in this island, furthermore this is obvious that since Soeharto leadership orientation to developed a self sufficient of food resource and industry. Those policy and acts resulting wide spread deforestations in Java Island, since then the forest area only left 19,6 percent and this is by means that not all of this forest area consist of forest plants but some part represent a degraded forest plants.

In fact that most of the main construction material in this country had been supplied from any other places, some coming from the neighborhood area or known as local material but plenty of them had been taken from across the region or province and even across the island. For instant, most of the raw wood material for supplying houses roof structure in Java Island had been taken from Borneo. Asphalt as the main material ingredients for constructing roads and bridges in Sumatera have to be taken from Java (in fact that the raw material are coming from eastern part of this country) and even more importing from Singapore. In this case Sumatera does not have any asphalt production they only have a storage place.

Even some basic stone substance for roads foundation in Sumatera Island are abundance, but the fact still occurs that this material have to be taken away from district Merak (West Java). The basic aggregates as the main ingredients from concrete also had been taken from Java, The unavailability asphalt material mentioned because of industry processing petrify mining ( mining milestone) yielding

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quality aggregate with delicate quality are seldom there, while in Java a lot of industry and investor capable to building up and penetrate the industry.

The Java Island densities reaching almost 60% from entire Indonesia resident result demand for the housing progressively insist on, as Kompas [2004] explained the housing demands almost reach 6,4 million houses which, the consequences most of this house demands have to build in Java. The necessity of raw material of construction will can be avoidance.

## **2 SUSTAINABLE COSNTRUCTION MATERIAL**

According to CIRIA [1995] sustainability is an issue of great importance for society, and for the building sector. Sustainable for building and construction must be affordable, material durable, safe & healthy, energy-efficient and local material oriented. Sustainable buildings are designed, constructed, maintained, rehabilitated, and demolished with an emphasis throughout their life cycle on using natural resources efficiently, while also protecting global ecosystem [Forum explores sustainable building envelope materials 2000]. In terms of sustainability the use of local material to support the whole construction material needs also play an important role to force the more sustain in construction industry.

As part of the sustainable development process, the sustainable construction are required the durability of its building and the use of existing local resources in order to minimize the negative impact to the environment.

The building sectors are a great consumer of resources comparing with other sectors, the use of cement, milestone, wood, bricks and sand. As CIRIA [1995] stated that almost seventy five percent of the construction material comes from natural resources and as one of the riches country in terms of natural resources, mainly the Indonesian constructions industry including the material supplier and material assembly does not have any significant problem to supply its construction material especially the raw material.

### **2.1 Transportation Play Negative Impact for the Environment**

As Plum [1977] explained that the distance traveled to the site is an additional consideration. Choosing materials that are local or regional makes good sense. Local materials are usually more economically viable and climatically appropriate, thereby contributing to natural energy conservation. Supporting a local or regional economy is equally important as a cultural contribution. Moreover the use of local material will decrease the time consuming and surely supported the less construction cost.

<i>Type of transport</i>	<i>CO<sub>2</sub></i> [g/ton km]	<i>SO<sub>2</sub></i> [g/ton km]	<i>NO<sub>x</sub></i> [g/ton km]
Diesel: road	120	0.1	1.9
Diesel: water	50	0.3	0.7
Diesel: rail	50	0.05	0.75

**Table 1 Energy pollution from different forms of transport. Source, Fossdal [1995]**

The construction material transportation account huge impact for the environment especially for its gas emission (table 1). Furthermore in Indonesia transportation surely play a negative impact as well in terms of air pollution, noise, energy consumption, global warming and acid gas emission, the across island transportation and road transportation with more than 50 km distance from quarry to the site TT6-225, Self-sufficiency in the provision of Indonesian construction materials, Agya Utama, Robert Kodoatie, Aretha Aprilia

will resulting a negative impact for the environment. Air pollution one of the negative impact, furthermore the noise nuisance during its transportation across city, passing trough the rural area and dense population in the city then the dust occurs during their transportation in the remote or village area. Moreover the water transportation, accept resulting 50 g/ton km (table 1) of CO<sub>2</sub> and amount of SO<sub>2</sub> and NO<sub>x</sub> also tend to degraded the water sea quality in term of the poor knowledge for handling the oil machine used.

### 3 INDONESIA CONSTRUCTION MATERIAL FACTS AND FIGURES

#### 3.1 Indonesian Construction Industry

The Indonesia construction industry accounts for ten percent from GDP and employed in about four million people [BPS 2002]. The used of natural material resources in Indonesian construction industry consumed in more than ten trillion rupiah or more than six hundred and sixty six million pound sterling (1 £ = Rp 15.000), Iron concrete account the biggest in more than four hundred million pound sterling and the second one is woods in more than two hundred and sixty two million pound sterling respectively [BPS 2002]. And the indices trend up to year 2002 had shown an increasing number for all type of construction in Indonesia.

Indonesians total surface area is 1.9 million square km, with total populations in about 213.6 millions [Worldbank 2002]; furthermore Indonesian annual deforestation 1.2% reflected that the concern towards forest depletion and destruction was very low. A researcher from LIPI Umar [2004] giving an survey that Java forestry area only 7 percent left, which its have to 30 percent for the forest area in every region as a standard. This 7 percent is not enough to supply the water and fresh air demand as well as the wood industry in this island. Furthermore it is very bad the fact that 7 percent is not entirely full of forest plants but already being deforested by local citizen for farming purposes and illegal logging for business purposes.

Forests play an important role in Indonesia from economic, socio-cultural and ecological perspectives. Yet, in line with population and national economic growth, pressure on forest resources is constantly increasing. This is evident from the high deforestation levels (deforestation rate of approximately 3 million ha. per year for the past three years), moreover as GATRA [2002] observed the deforestation in Indonesia more than 57 million hectare, then half of all the destruction comes from permanent Indonesian forestry. Then 90 percent of the destruction resulted forest wood which are for construction and furniture purposes and 10 per cent for the destruction is from the extraction of mining industry.

#### 3.2 Field Study

The un-self sufficient material supply within Indonesian construction industry seems not an important issue for the Indonesian government and other parties in the construction industry. The abundant of the natural resources to provide construction material needs tends to be a major reasons, the explanation below will measure the un-self sufficient material supply from the Indonesian construction industry-related.

<i>Distance</i>	<i>0-10 km local material [%]</i>	<i>10-25 km [%]</i>	<i>&gt;25 km Across region/province [%]</i>	<i>&gt; 500 km Across island [%]</i>	<i>Imported [%]</i>
Concrete	9.09	9.09	63.63	9.09	-

aggregates					
Cement		27.27	72.72	-	-
Bricks	72.72	18.18	9.09	-	-
Sources of Woods	-	-	-	100.00	-
Aluminums	10.00	70.00	20.00	-	-
Stone and rocks	9.09	54.54	27.27	9.09	-
Asphalts	9.09	18.18	63.63	9.09	-

**Table 2. The main Indonesian construction material; type and resources distance from the site**

As can be observed in the table above, there are 7 main materials for construction projects that are mostly having a projects site in Java Island. The projects consist of road, water installation and building projects. Three of the materials such as concrete aggregates, cement and asphalt mostly being supplied from across region or across province. As shown in the table that the percentages obviously more than 50% of the site were coming from other region or other province, the distance is vary starting from 10 km up to 25 km away. Concrete aggregates as one of the biggest part of the construction material projects had been taken from specify quarry and being proceed in another place. Most of the concrete permanent batching plant planted in the capital city of the province in Java, and there were seldom movable batching plants in Java (only huge concrete companies provide a movable batching plants). The consequences that there are not plenty options to obtain concrete supply from the local concrete batching plants will be very difficult for construction site to provide its concrete supply in the others island except Java, even though Java having quite plenty batching plants, but the place is not scattered proportionally, only the province capital city provide the concrete batching plants. Another problem measure with the batching plants in the capital city, most of its sand raw material had been taken from beach area; this is because of the lack of good quality of raw sand material in the neighborhood (most of this sand beach problem occurs in Jakarta). As well as the aggregates, the cement production also have a limited place to produce, and mostly placed in Java Island and Sumatera, if the project conducted in Sulawesi or Papua the whole cement supply have to deliver from Java or Sumatera Island.

Based on the observation of the Asphalt, shown that the production/factory mostly in Java Island meanwhile its raw material had been supplied from Sulawesi or Batam (500-1000 km) from Java Island, Furthermore presently the development of the Indonesian infrastructure like road, bridges and dams will be constructed in Sumatera, Borneo and Eastern part of Indonesia (Sulawesi, Maluku and Papua). The complicated and unsustainable transportation will be measured for decades to come and this phenomenon needs a serious assessment and a real act from government and the local government to provide the demands of asphalt products.

Furthermore woods for supporting the construction industry in Indonesia still high, its account 25 – 50 percent of the whole construction progress. Mostly the use of timber for roof construction at the mass housing projects and scaffolding for medium multi-storey building, for the first purpose usually using a good quality of wood which has been supplied from another island (Borneo and Sumatera) meanwhile most of the mass housing projects are conducting in Java Island. The lack of good quality wood for supplying its woods material demands in Java, because of the governmental policy changes under Soeharto leadership and being worsen in the reform era (where the rural inhabitants feel free to exploits the national forest). Most of land use in Java had been changed from forest into farming, industrial area and housing.

<i>Distance</i>	<i>0-10 km local material [%]</i>	<i>10-25 km [%]</i>	<i>&gt;25 km Across region/province [%]</i>	<i>&gt; 500 km Across island [%]</i>	<i>Imported [%]</i>
Concrete	9.09	9.09	63.63	9.09	-

Steel	8.33	8.33	66.67	8.33	8.33
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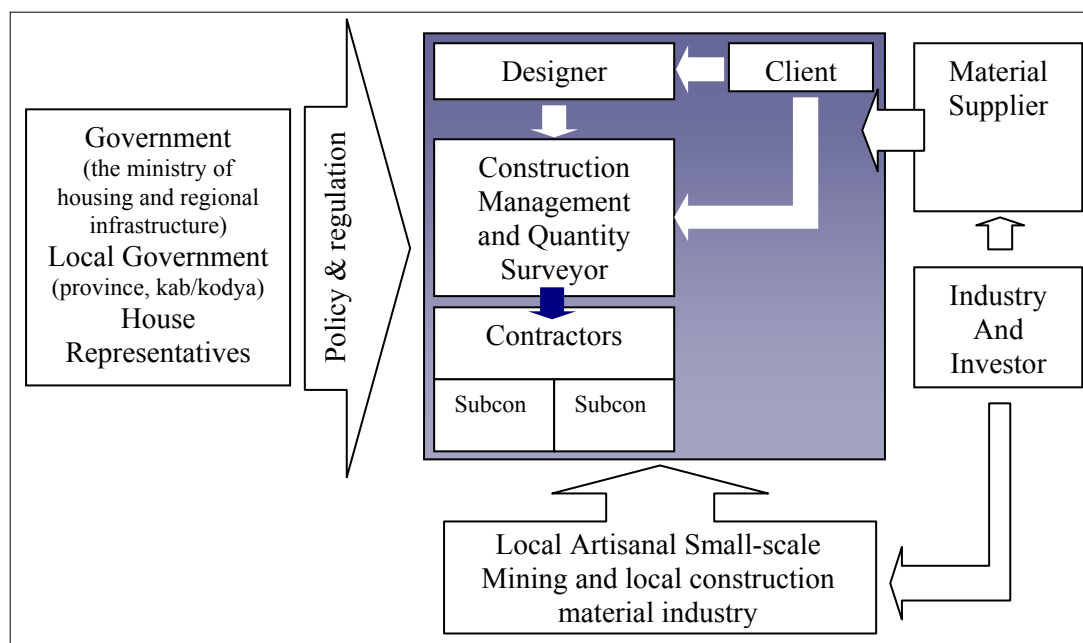
**Table 3. The distance of pre-fabricate material from the factory or supplier to the site**

Buildings based on prefabricated technology and require the minimum of concrete mixing, steel bar assembly, carpentry work, site clearance, and excavation. They produce less construction waste than any other available options, and they are also relatively easy to extend at a later date. The prefabricated components are easy to assemble on-site, thus reducing construction time, costs and more environmental friendly in terms of noise and dust.

Even though the percentage of steel and pre-fabricate concrete consumption in Indonesian construction industry barely small, but the trends for years to come will increase in line with the new government program. In fact that most of the pre-fabricate steel or concrete only in Java specifically in western part of Java (Banten province and Surrounding Jakarta) worsen the unsustainable use of construction material in Indonesia. Most of the infrastructure project will be concentrated in Eastern of Indonesia and Borneo Island, which less or none steel assembly and concrete fabricate.

#### 4 CONCLUSION

Providing self-sufficient construction material in order to support sustainable development as a holistic view is not only the responsibilities of government and the construction related-industry. Local government and local people need to get involve and to be aware to the impact of not developing its local material and the impact occurs from its gas emission. A model to reflect the relationship between all parties in the Indonesian construction industry as explained as follows;



**Figure 1. The relationship between all policy and regulation maker, construction related-industry, material supplier and Industrial/investor.**

In order to generate the knowledge vis-a-vis the possibility of self sufficiency and sustaining its construction material durability within local construction firm throughout the country, can be huge possibility happened but this act should be supported by all the parties involved in this business. Accept the construction industry-related play for sustaining its self-sufficient construction material, the citizen also play an important part to make it happened.

The figure above will be breakdowned as follows;



### **Center Government,**

Represent by the ministry of housing and regional infrastructure, which is directly involve (as a policy maker, supervisor or even a client) with every physical infrastructure development owned by the government;

- To promote and socializing the importance of using local material in the construction related industry.
- To enforce and develop legislation for the government standards as an application to implement the use of local material around the country.
- To deliver a new policy and regulation which is more concentrate to the increasing of the use local materials and local production  
This policy and regulation has to deliver for designer, client, contractors and material supplier and producers.
- Fair law enforcement for violence in every aspect at the non-local utilizations (based of the policy and regulation).
- To support financial alternatives that give priority to the local industry and citizen to develop its capability for producing the local material assembly and processing.
- Providing advance knowledge and technology in order to develop local material processing industry (outside java) for creating more durable material (good quality). This act is to prevent the material supply competition from Java.

### **Local Government**

Starting from municipal level (kabupaten/kotamadya) up to provincial level

- To deliver an uncomplicated bureaucracy to the investor for providing an opportunity in terms of developing a new business material production supply
- Develop the local construction material industry
- Providing a huge quantity of industrial forest for construction purposes
- To form a regional alliance (provincial) in order to prevent the across island construction material trading.
- To encourage local production (especially outside Java Island) to develop more durable type of material in terms of quality (for preventing the material supply from Java).

### **House Representatives**

- To support executive in terms of delivering policy and regulation which support the local industry development.

### **Industry/investor**

- To open opportunity to penetrate its industry for providing construction material in the regional area, such as province and municipal (kotamadya/kabupaten).

### **Supplier**

- To provide construction material with more local ingredients
- Commitment to supply only for local construction site
- Willingness not to supply the material across the island
- To form an alliance and agreement with other supplier, especially supplier outside its province area or outside the island.

### **Local Industry and ASM (Local Citizen)**

Most of the local industries in construction material and the small-scale artisanal mining owed by the local citizens, the understanding of environmental awareness have to be implemented seriously.

### **Client**

Having a clear understanding about the advantages to use local material as its main material ingredients. Continuously deducting all needs of using unnecessary material, especially which is not coming from local production or local natural resources.

### **Designer, Construction management and Quantity surveyor**

- Delivering design with more local material ingredients
- To supervise and control the use of local material in every project site.
- Surveying local material and deliver as an input to the designer and contractors.
- In order to promote the use of local material, the industry should consider to take the the ISO 14000 into account.

### **Contractors and sub-contractors**

As main the main part of the construction industry, contractors and sub-contractors tends to use local material rather than non-local material. Local material assessment has to be implemented in the first place in order to fulfill and maximize the use of good quality with competitive price.

- In order to promote the use of local material, the industry should consider to take the the ISO 14000 into account.
- To support local technologies in order to develop its local materials and quality to make it more durable.
- To encourage local production (especially outside Java Island) to develop more durable type of material (for preventing the material supply from Java)

I believe that this all actions will provide more better self-sufficient construction material within Indonesian construction industry, and this acts will be valid if those parties have a good will to implement the suggested act. Furthermore the desires and needs of using a fancy and imported material should be reduce extensively as well.

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