The study of sustainable procurement in the procurement of ready mixed concrete supplier

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Abstract. Nowadays, the concept of sustainable construction has been known, namely the implementation of construction that considers social and environmental aspects in addition to the economic aspects. Sustainable construction has been mandated in Law Number 2 of 2017 concerning Construction Services. The success of sustainable construction is inseparable from the role of its supply chain network, the supply chain involved is selected through the procurement process so that the procurement process needs to consider sustainable aspects as well. This study discusses the sustainable procurement of ready-mixed concrete suppliers carried out by Indonesian contractors in order to realize the implementation of sustainable construction. The level of procurement process implementation of the ready-mixed concrete suppliers will be compared with ISO 20400 which is a sustainable guideline for flexible procurement and sustainable procurement best practices at the London Olympics 2012 project as well as various literature on sustainable concrete work to see more detailed about the implementation of sustainable criteria of Ready-mixed concrete job. The study was conducted by analyzing qualitative data obtained through semi-structured interviews conducted on 4 BUMN contractors and 1 BUMS contractor in Indonesia that had carried out green building projects. Based on the results of data processing and analysis, it was found that the process of procuring concrete by the contractors fulfilled about 44% - 76% of the principle of sustainable procurement at ISO 20400. In this study, an overview and comparison of the sustainable procurement practice of ready-mixed concrete suppliers is described by contractors in Indonesia with ISO 20400 standards, as well as sustainable procurement best practices and what obstacles are faced in the implementation of sustainable procurement, and how contractors in Indonesia can increase implementation of sustainable procurement when procuring ready-mixed concrete supplier in the future.

1. Introduction
The mandate of implementing sustainable construction is written in Law No. 2 of 2017 concerning Construction Services and that the Implementation of Construction Services in Indonesia is based on the principle of sustainable development. The principle of sustainable development is the implementation of Construction Services carried out by thinking about the impact it has on the environment that is continuously maintained concerning ecological, economic and socio-cultural aspects. To be able to realize the concept of sustainable construction, it requires sustainable supply chain management. In construction projects, the parties or supply chains involved and has the role to determine the success of the project are selected through the procurement process. This is what underlies the need to consider sustainable aspects in the process of procuring suppliers.

In the construction industry, concrete materials are still the favourite material to form structural...
components of buildings due to its advantages compared to other materials, especially in terms of strength, durability, flexibility, and ease of obtaining them. The ready-mixed concrete is widely used because it has better quality control and can be produced with large volumes in a faster time than traditional concrete. However, the use of concrete material raises problems in social and environmental aspects. Danurendro (2013) in his study stated that problems arising from the use of concrete include CO2 emissions, NOx emissions, solid particle emissions, visual pollution, congestion, noise, workers’ declining health quality, and water pollution. Furthermore, the aggregate component in the form of gravel (broken stone) and sand from natural quarry during the extraction might disrupt the balance of the ecosystem thus; environmental aspects must be taken into account.

Based on the explanation above, the use of ready-mixed concrete material is dominant in the construction process and it has a large environmental impact. This study examines the sustainable procurement of ready-mixed concrete supplier conducted in order to realize the implementation of sustainable construction on Construction Services by providing an overview of procurement practices by contractors who already have experience in green construction and comparing them with existing practices and standards for sustainable procurement. In this research, a study will be conducted on how to plan for sustainable procurement, integration of sustainable principles in specifications, supplier selection, contract management, evaluation of bidding and supplier performance in organizing sustainable concrete work. The research objective to be achieved through research is to find out the description of procurement practices of ready-mixed concrete suppliers carried out by the contractor related to the sustainable aspects and provide recommendations on the implementation of a sustainable procurement process for the ready-mixed concrete suppliers.

2. Literature Review

In simple terms, sustainable procurement can be defined as a process of fulfilling goods/services that are beneficial to the owner, the social environment (the community), and the economic environment by minimizing damage to the environment (DEFRA, 2006). There is a flexible frame of reference for general procurement that is ISO 20400 Standard moreover, there is a document issued by the Department for Environment Food and Rural Affairs (DEFRA). It is the best practice of sustainable procurement in the field of construction, which describes the success of the implementation of sustainable procurement in construction of the 2012 London Olympic venue. Sustainable concrete work consists of the contractors’ and suppliers’ scope of work. This study will show how the contractor carries out the procurement of sustainable ready-mixed concrete suppliers. Thus, we need a sustainable ready-mixed concrete supplier criterion that will be one of the aspects considered by the contractor in the process of procuring concrete suppliers. The criteria for sustainable concrete work in this study were formulated from the results of a research conducted by Danurendro (2013) which has sources from various literature or standards from abroad as contained in the following table:

| No | Document Name                                      | Published by                          |
|----|----------------------------------------------------|---------------------------------------|
| 1  | Sustainable Concrete Plant Guidelines 2011         | National Ready-Mixed Concrete Association (NRMCA), USA |
| 2  | Environmental Guidelines for Concrete Batching Industry 1998 | Environment Protection Authority (EPA), AUS |

The United States and Australia both have a guideline type standard that regulates the implementation of ready-mixed concrete manufacturing activities to be more environmentally friendly. However, not all of the criteria in this standard can be applied in Indonesia. Danurendro (2013) in his research entitled "Formulation of Environmentally Friendly Criteria for Ready-mixed Concrete Work in Indonesia", recommends criteria for environmentally friendly concrete work in the scope of work for suppliers to be used as a reference in the preparation of instruments in this study.

3. Research Methods

The research method used for this study was qualitative descriptive. This study will describe a phenomenon or event that occurs in the process of continuing procurement of ready-mixed concrete...
suppliers by high-rise building project contractors in Indonesia that are certified as a green building. Data were obtained from questionnaires and in-depth interviews conducted directly to respondents. There are two reviews in this study. The first one is a review of how the process of sustainable procurement, which is sourced from guidelines or general standards of sustainable procurement that are internationally referred to as ISO (International Organization for Standardization) 20400. ISO 20400 is not a standard for certification but is guidance or flexible framework that contains guidelines for organizations wishing to integrate the concept of sustainability into the procurement process. The second review is about the performance criteria for sustainable concrete work. The performance criteria for sustainable concrete work in this study were adopted from previous research findings by Danurendro's (2013) entitled "Formulation of Environmental Friendly Criteria for Ready-mixed Concrete Work in Indonesia". The criterion for environmentally friendly concrete work is an important aspect of a sustainable ready-mixed concrete procurement process. Then the two reviews are contextualized, integrated, and formulated in a sustainable procurement process.

There are 6 categories with 19 dimensions and 91 Indicators (59 indicators on aspects of the sustainable procurement process and 32 indicators on aspects of sustainable concrete performance criteria) used in the assessment of procurement implementation of ready-mixed sustainable concrete suppliers are obtained. The contents of the category and dimension compilers as well as the achievement indicators are shown in the following table.

### Table 2. Sustainable procurement indicator.

| Category: Sustainable Procurement's Planning (Code: PB) | Code | Dimension | Source : ISO 20400 Sustainable Procurement | Indicator |
|-------------------------------------------------------|------|-----------|------------------------------------------|----------|
| PB 1 | Integrating key elements of sustainable procurement | 7.2.1 Integrating key elements of sustainable procurement | 7 |
| | of sustainable procurement | 5.3 Aligning procurement with organizational objectives and goals | |
| | | 6.2 Enabling people; 6.5.3 Benchmarking | |
| PB 2 | Considering sustainability risks and opportunities | 7.2.2. Assessing sustainability risks (including opportunities) | 6 |
| | | 5.1 Committing to sustainable procurement | |
| | | 6.3.3 Engaging the supply chains | |
| PB 3 | Analyzing the costs | 7.2.3 Analysing the costs | 2 |
| PB 4 | Analyzing organizational needs and market | 7.2.4 Analysing organizational needs | 3 |
| PB 5 | Sourcing strategy | 7.2.5 Analysing the market | |

| Category: Selecting Suppliers (Code: PPS) | Code | Dimension | Source : ISO 20400 Sustainable Procurement | Indicator |
|-----------------------------------------|------|-----------|------------------------------------------|----------|
| PPS 1 | Prequalifying suppliers | 7.4.2 Prequalifying suppliers | 7 |
| PPS 2 | Tender process | 7.4.3 Managing tenders; 7.3.5 Evaluating that sustainability requirements are met; 5.4 Understanding procurement practices and supply chain; 7.4.4 Awarding the contract | 9 |

| Category: Managing the Contract (Code: MK) | Code | Dimension | Source : ISO 20400 Sustainable Procurement | Indicator |
|-------------------------------------------|------|-----------|------------------------------------------|----------|
| MK 1 | Managing the supplier relationship | 7.5.1 Managing the supplier relationship; 7.5.2 Implementing the contract; 7.5.4 Managing performance and relationships | 6 |
| | | 7.5.5 Encouraging supplier-customer joint initiatives | |
| MK 2 | Promoting sustainability target | 7.5.7 Managing disposal and end of life | 3 |
| | | 7.4.4 Awarding the contract | |

| Category: Evaluating the Contract (Code: EK) | Code | Dimension | Source : ISO 20400 Sustainable Procurement | Indicator |
|---------------------------------------------|------|-----------|------------------------------------------|----------|
| EK | Evaluating the Contract | 7.6 Reviewing and learning from the contract | 4 |

| Category: Sustainable Concrete Works Requirements (Code: KP) | Code | Dimension | Source : Danurendro (2013) | Indicator |
|-------------------------------------------------------------|------|-----------|---------------------------|----------|
| KP 1 | General condition | Danurendro : IV.2.1 General condition | 7 |
4. Data Processing

Data processing from the interview results is done by interpreting the answers of respondents regarding the company's procurement practices based on the results of records and notes during the interview. To complete the description of the company's sustainable procurement practices in this research, additional information is also sought through the company's annual/sustainable report. Interviews conducted in this study were carried out with face-to-face meetings with the respondents. Respondents were asked to explain in detail the answers chosen during the interview that was carried out by asking questions in the questionnaire that had been made previously. The documented interview results are then interpreted and grouped by category and dimension and then the results with each indicator (which is an instrument of research) for each dimension and category were compared to see the level of achievement based on a predetermined assessment. Each respondent's answer in the questionnaire and/or interview is given an assessment score based on conformity with the indicator with a value of 0-1. A value of 1 means the respondent's answer is in line with the indicator, i.e. the process that is in ISO 20400; sustainable concrete work standards are also contained in procurement practices respondent company. While the value of 0 means that there is a process in ISO 20400 or standards for sustainable concrete work that do not exist in the company's procurement practices. There is no special weighting in the assessment of achievement level. All indicators are considered having the same level of importance.

5. Respondents Profile

The first stage in data collection is the identification of contractors who have worked or are currently working on green building projects. The target respondents in this study were procurement team personnel at contractor companies. The green building that is the target of the study is the building that has been registered and/or certified by GBCI. Only 5 out of 8 contracting companies contacted in this study (consisting of private contractors and SOEs) were willing to become respondents. The five companies will be referred to as Contractor A, Contractor B, Contractor C, and Contractor D, and Contractor E.

6. Data Processing Results and Analysis

6.1 Assessment of the Implementation of Sustainable Concrete Procurement by Category

This section discusses the implementation aspects assessment of the sustainable procurement of each respondent. The achievement level of the implementation on each company can be seen from how much conformity the practice of the procurement process conducted by the respondent's company, with indicators on the research instruments. We will look at the level of implementation for each category.

| Code | Category                                      | Contractors Score of Implementation |
|------|-----------------------------------------------|-------------------------------------|
|      |                                               | A   | B   | C   | D   | E   |
| PB   | Sustainability Procurement’s Planning          | 25% | 75% | 50% | 35% | 20% |
| PS   | Integrating Sustainability Requirements into the Specification | 70% | 80% | 70% | 70% | 70% |
| PPS  | Selecting Suppliers                           | 63% | 75% | 63% | 63% | 63% |
| MK   | Managing the Contract                         | 67% | 78% | 44% | 67% | 56% |
| EK   | Evaluating the Contract                       | 25% | 75% | 0%  | 25% | 0%  |
| KP   | Sustainability Concrete Works Requirements    | 19% | 25% | 16% | 16% | 16% |
In the PB category, the level of implementation varies greatly from 20% to 75%. In this category, the main focus is not only on procurement technical planning but also on how sustainability considerations are integrated at a strategic level in the organization’s procurement practices, so that commitments, directives, and top priority organizational sustainability can be achieved. Contractor B has the highest level of implementation because the company has decided that the company is a green contractor which is certainly supported by its top management and corporate strategy tools. For other respondents, the level of implementation is still low because there is no strategic corporate initiative that leads to sustainability, especially the procurement of concrete. PB category to EK is a series of procurement processes that become the authority of the company. For each of these categories, the level of implementation of contractor B is still higher than other respondents. This is the implication of the commitment of top management to be able to implement green construction. In the category of sustainable concrete work performance, contractor B has a higher level of implementation which indicates that there has been more initiation done by contractor B in implementing green construction.

The low KP category is due to the very high influence of the owner in determining concrete work specifications so that the contractor cannot freely implement his ongoing initiatives. The process of procuring concrete is actually a process that aims to get concrete suppliers that have high sustainable performance, so that it can significantly reduce the negative impacts caused by concrete work such as air pollution (CO2 emissions, NOx, dust, etc.), noise disturbance, pollution water, environmental damage, deterioration in health quality. These performance criteria are outlined in the specifications so that to be able to align the procurement of sustainable concrete between aspects of the procurement process and performance criteria, it is necessary to emphasize the process of integrating sustainable principles in the Specifications (PS category).

6.2 The Implementation Analysis Level of Sustainable Concrete Supplier Procurement

From the data processing that has been done then analyzed to further explore the level of implementation of the sustainable procurement process from lowest to highest. The order of implementation of aspects of the ongoing procurement process aspects from dimensions which have the lowest to highest implementation levels can be seen in the table below:

| No | Dimension                                           | Contractors Score of Implementation | Average |
|----|-----------------------------------------------------|------------------------------------|---------|
|    | Name                                                | Code                               | A       | B       | C       | D       | E       |         |
| 1  | Analysing the costs                                 | PB 3                               | 0%      | 50%     | 0%      | 0%      | 0%      | 10%     |
| 2  | Considering sustainability risks and opportunities  | PB 2                               | 0%      | 50%     | 33%     | 33%     | 0%      | 23%     |
| 3  | Evaluating the Contract                             | EK                                 | 25%     | 75%     | 0%      | 25%     | 0%      | 25%     |
| 4  | Integrating key elements of sustainable procurement | PB 1                               | 29%     | 100%    | 57%     | 43%     | 14%     | 49%     |
| 5  | Sourcing strategy                                   | PB 5                               | 50%     | 50%     | 50%     | 50%     | 50%     | 50%     |
| 6  | Promoting sustainability target                     | MK 2                               | 67%     | 67%     | 67%     | 67%     | 67%     | 67%     |
| 7  | Tender process                                      | MK 2                               | 56%     | 67%     | 56%     | 67%     | 67%     | 64%     |
| 8  | Prequalifying suppliers                             | PPS 1                              | 71%     | 71%     | 71%     | 71%     | 71%     | 71%     |
| 9  | Managing the supplier relationship                  | MK 1                               | 67%     | 83%     | 50%     | 67%     | 67%     | 67%     |
| 10 | Defining sustainable procurement criteria            | PS 1                               | 71%     | 71%     | 71%     | 71%     | 71%     | 71%     |
| 11 | Minimum and optional requirements                   | PS 2                               | 67%     | 100%    | 67%     | 67%     | 67%     | 73%     |
| 12 | Analysing organizational needs and market           | PB 4                               | 67%     | 100%    | 100%    | 100%    | 100%    | 73%     |

Based on the table above, the dimensions with the lowest implementation level or below 50% is the dimensions of PB3, PB2, EK, PB1, and PB5. This illustrates that the contractor has not carried out a strategic planning for the procurement of sustainable concrete, one of which is in the procurement of ready-mixed concrete, not analyzing the costs incurred as a whole and not considering the opportunities and risks of sustainable procurement, this is due to the unavailability of life cycle assessment equipment and the low top management’s commitment to the adoption of sustainable concrete procurement and the absence of regulatory tools and company-level policies that encourage sustainable aspects to be incorporated in the procurement process.
The dimensions with the highest implementation level are PB4, PS1, and PS2. The contractor in the procurement of concrete has considered meeting the needs of the organization and market analysis and in determining concrete specifications or criteria there are minimal requirements and additional requirements that allow flexible criteria for sustainable concrete to be included in the specifications. In the execution of the contract, the contractor has made contract management efforts so that the implementation of sustainable concrete works can be carried out. Moreover, contractor B is actively seeking information regarding the specifications of sustainable concrete in a market that meets or approaches sustainable criteria that can be considered in the requirements.

From the data processing that has been done also analyzed the level of implementation of the aspects of performance criteria for sustainable concrete work from the lowest to the highest, can be seen in the table below:

Table 5. The level of implementation of sustainable concrete work criteria.

| No | Dimension Name | Code | Contractors Score of Implementation |
|----|----------------|------|------------------------------------|
|    |                |      | A  | B  | C  | D  | E  | Average |
| 1  | Tools washing and waste management | KP 7 | 0% | 0% | 0% | 0% | 0% | 0% |
| 2  | Material storage | KP 4 | 25% | 25% | 0% | 0% | 0% | 10% |
| 3  | Mixing materials | KP 5 | 17% | 17% | 0% | 17% | 0% | 10% |
| 4  | Management of work environment | KP 1 | 14% | 29% | 29% | 14% | 29% | 23% |
| 5  | Use of material and additive | KP 3 | 25% | 25% | 25% | 25% | 25% | 25% |
| 6  | Raw material and suppliers selection | KP 2 | 50% | 50% | 0% | 50% | 0% | 30% |
| 7  | Delivering to site | KP 6 | 25% | 50% | 50% | 25% | 50% | 40% |

Based on the table above, the level of implementation is still low, all dimensions of the level of implementation are still below 50%. This is due to the lack of initiation of the implementation criteria for sustainable concrete work by the contractor because the specifications/performance criteria for concrete work are largely determined by the project owner, the contractor considers concrete work in the batching plant to be the supplier’s responsibility. The dimensions with the lowest implementation level are the KP7 and KP4 dimensions. This illustrates that the contractor in the concrete procurement is to buy good quality concrete and the mindset that is in the contractor is for washing tools and handling waste in the batching plant (utilization of used water, use of high-pressure low volume hoses, decompressing concrete waste, rainwater management), and storage of concrete raw materials (sandfills, cement piles, storage admixture) is the responsibility of the supplier. Whereas the dimensions with the highest level of implementation are KP 6 and KP 2. In the requirements for delivering concrete to the project site, all contractors require the use of mixer trucks with fuel-efficient specifications as seen from the age of the car and the selection of effective routes so as to get the best travel time and require that suppliers who will supply concrete must use and prioritize cement suppliers that have a certified environmental management system.

6.3 Comparative Analysis of Best Practice Sustainable Procurement in the Procurement of Ready-mixed Concrete Suppliers

The best practice of sustainable procurement of ready-mixed concrete in the construction industry is found in the 2012 Olympic and Paralympic Game venue construction project in London. At the 2012 London Olympics, the initial estimate of the use of concrete on the venue required 500,000 m$^3$ of ready-mixed concrete and an aggregate of around 1 million tons. In general, the criteria for sustainable concrete work in London 2012 are on the dimensions of Management of the work environment (KP1), use of raw materials and additives (KP3), Measuring and mixing materials (KP5), Delivery to project sites (KP6) as well as washing of equipment and handling of waste (KP7). The following is a comparison of the ready-mixed concrete work specifications in London 2012 and the respondent contractor of this study:
In this research, several factors were found to cause the implementation of the ready-mixed concrete industry to be continuously inhabited by the contractor, including as follows:

| No | Dim. | London Practices 2012 | Contractor Practices in Indonesia |
|----|------|------------------------|----------------------------------|
| 1  | KP 1 | • All contractors are required to use on-site suppliers;   | • SOPs, warning signs and workers’ obligations to use personal protective equipment |
|    |      | • All suppliers operate under an ISO 14001 accredited Environmental Management System | |
| 2  | KP 3 | • Coarse aggregate substitution with weathered granite material; Use of recycled aggregates (EcoFrog tools) | • Use of Supplementary Cementitious Materials such as fly ash, slag or silica |
|    |      | • Substitution of cement material with Pulverized fuel ash (PFA) and Ground granulated blast-furnace slag | |
| 3  | KP 5 | • Use of polycarboxylate (PCE) superplasticizer | • Suppliers are encouraged to use energy-efficient equipment |
|    |      | • Test mix design proposals based on Quality Scheme for Ready-mix Concrete (QSRMC) | |
| 4  | KP 6 | • Bulk material delivery using rail-based transportation | • There are criteria for the use of mixer trucks with fuel-efficient specifications, |
| 5  | KP 7 | • Harvesting and use of rainwater and concrete truck washing water as a supplement for batching plants | • - |

One of the keys to the successful implementation of sustainable procurement is at Pre-Procurement Process stage. The following is a tabulation of the comparison of the pre-procurement process in London 2012 with pre-procurement at the contractor:

|London Pre-Procurement 2012| Contractor Pre Procurement Practices|
|---------------------------|-----------------------------------|
|1. The concept of sustainability is considered from the beginning and from top management. | 1. The concept of sustainability was initiated by the owner |
|2. Identification of materials and suppliers in terms of opportunities and challenges of sustainability | 2. Contact the supply chain when the contractor has won the tender. Pre-tender contractors contact concrete suppliers only for reference price quotes |
|3. Create a ‘Meet the Buyer’ event to inform the industry about contract opportunities and required requirements | 3. There are contractors who form part specifically deal with the implementation of sustainable principles |
|4. Use of aggregate industries concrete tools to rank specific green guidelines for each building element | |

### 6.4 Analysis of Implementation Obstacles

In this research, several factors were found to cause the implementation of the ready-mixed concrete to be continuously inhabited by the contractor, including as follows:

a. Higher implementation costs;

Based on information obtained from respondents, all said that the main obstacle in implementing sustainable concrete procurement was the high cost. Especially for owners who do not support in the form of allocating special costs for the implementation of this matter, the contractor is reluctant to set aside some of the profits to implement sustainable concrete procurement. This also causes the contractor to choose a ready-mixed concrete supplier based on the lowest bid price, and consequently, the supplier does not prioritize the sustainable aspects of his bid to compete in providing cheap prices.

b. Low knowledge of ready-mixed concrete works and sustainable procurement processes.

Procurement of ready-mixed sustainable concrete is a new thing in the world of construction in Indonesia. From the owner's side, many understand the design of green buildings but do not pay attention to green construction. There is still little guidance or literature regarding the procurement of ready-mixed concrete, making it difficult for contractors to develop a business performance that meets sustainable principles. The contractor still lacks understanding of the sustainable procurement process and sustainable concrete work.

c. The unreadiness of the ready-mixed concrete industry

Based on the information obtained in this study the ready-mixed concrete industry is not ready to carry out ready-mixed work that is sustainable. Several factors cause this between the absence of commitment from the top management of the supplier company to apply the principle of sustainable and expensive facilities and equipment to support work or sustainable concrete production.

d. Vision and commitment are still low
Based on the data obtained, the contractor does not yet have the vision and commitment to implement a sustainable concrete procurement, this is because the contractor only does the work in accordance with the contract with the owner, while the owner himself does not have specific sustainable concrete specifications in his project. From the contractor's side, there are separate considerations when wanting to innovate by initiating sustainable concrete procurement, including the risk of costs incurred to be borne by the contractor, which of course will reduce the company's profit and the lack of added value when implementing sustainable concrete procurement, because the contractor's performance is considered good when doing work in accordance with the specifications set by the owner.

7. Conclusion
In this research, the contractor's procurement of ready-mixed concrete supplier practices is compared to the standard and best practice procurement and the performance of existing sustainable concrete. Following are the findings obtained regarding an overview of practices of procurement of ready-mixed sustainable concrete based on data processing and analysis:

a. The level of implementation of ready mixed sustainable concrete mixer by the contractor in the procurement process aspect for contractors who are respondents is 44% to 76%. The lowest level of implementation includes the process of how the contractor analyzes the overall costs incurred for the procurement of ready mixed concrete, considers the opportunities and risks of sustainable procurement, contracts evaluation mechanism and integrates key elements of sustainable procurement in the concrete procurement process.

b. The level of implementation of ready mixed sustainable concrete mixer by the contractor in the aspects of the Implementation of Sustainable Concrete Work Performance Criteria for contractors who are respondents is 16% to 25%. The lowest level of implementation is among them not applying the criteria for washing equipment and handling waste and storing raw materials at the location of the batching plant.

c. Based on points 1 and 2 above, the critical point for the implementation of sustainable concrete procurement by contractors is in the planning category. The contractor is still not convinced to implement sustainable procurement when making decisions during planning, this is influenced by the problem of cost and supplier availability plus the low support from the owner. The result is that in the procurement process, even though there is a principle of sustainable procurement that has been carried out, there are minimum criteria for environmentally friendly performance that is used so that the obtained concrete supplier performance is still not sustainable.

In order to increase the implementation of sustainable principles in the procurement of ready-mixed concrete, a high commitment is required in the implementation of sustainable principles by owners and contractors, encouragement from the government is needed to make clearer and more stringent regulations regarding the implementation of green construction and the contractor must be more courageous in initiating the implementation of sustainable principles. The best practice of sustainable concrete procurement has been carried out in the construction of the London 2012 Olympics venue. Compared to the practice of concrete procurement by contractors there are still gaps including the pre-procurement stage and the determination of sustainable specifications for ready-mixed concrete work, the prequalification process. From the procurement process in the 2012 London Olympics venue construction project, lessons can be drawn that to be able to implement sustainable concrete procurement, good planning is needed long before the implementation of the work so that commitment and readiness arise from all parties. The owner, contractor, supplier, as well as the regulations, have been prepared to support the implementation of sustainable procurement both in the process and criteria.
References

[1] Abduh M 2014 Green Construction Supply Chains for Supporting Green Buildings in Indonesia: Initial Findings and Future Developments International Conference on Construction in a Changing World Srilanka.12

[2] Danurendro A 2013 Perumusan Kriteria Ramah Lingkungan Untuk Standar Pekerjaan Beton Ready mixed di Indonesia Institut Teknologi Bandung 106

[3] Department for Environment Food & Rural Affairs 2013 London 2012 Olympic and Paralympic Games The Legacy: Sustainable Procurement For Construction Projects A Guide 22

[4] Hermawan 2016 Pengembangan Model Jejak Karbon Pada Pelaksanaan Pekerjaan Struktur Atas Beton Bertulang Untuk Konstruksi Bangunan Tingkat Tinggi di Indonesia Institut Teknologi Bandung 265

[5] International Organization for Standardization 2017 Sustainable procurement — Guidance ISO 20400:2017 International Organization for Standardization, Geneva.

[6] Olympic Delivery Authority 2011 Learning Legacy – The procurement and use of sustainable concrete in the Olympic Park