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INDONESIAN CONSTRUCTION SUPPLY CHAINS COST STRUCTURE AND FACTORS: A CASE STUDY OF TWO PROJECTS

Muhamad Abduh[1], **Biemo W. Soemardi**[2], **Reini D. Wirahadikusumah**[3]

Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung,
Jln. Ganesha No. 10, Bandung, Indonesia
E-mails: [1]abduh@si.itb.ac.id (corresponding author); [2]b_soemardi@si.itb.ac.id; [3]wirahadi@si.itb.ac.id

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Abstract. Studies of Indonesian construction supply chains have been in the early stage. Previous studies have described very well the structures of construction project supply chains. Moreover, one of strategies that have been considered by construction companies for gaining a competitive advantage is to reduce the cost of their supply chains. The research's objective is to identify the cost structure of construction supply chains in Indonesia and factors that could influence it. By knowing these factors, construction companies are expected to be able to determine strategic efforts needed for reducing cost of their construction supply chains. Two construction projects operated by a large construction company were explored as case-studies. Rebar material was chosen for this supply chains study. It was found that the cost of purchasing was very significant. Meanwhile, costs of transportation and inventory were insignificant. It can be concluded that efforts to reduce supply chains cost by reducing costs of inventory and transportation would not be effective. Therefore, factors that could influence the cost of supply chains are related to management of supply chains, such as procurement policy, material requirement planning, supplier qualification, selection process, contract, and supplier development.

Keywords: construction supply chains, cost structure, factors, inventory cost, purchasing cost, transportation cost.

1. Introduction

It is well acknowledged that construction is a highly "fragmented" industry. The industry consists of thousands of companies; while they are repeatedly involved in the same projects, these companies do not intensively communicate and maintain relationships. Increased construction costs, delays, conflicts and disputes, are partly caused by fragmentation, shaping construction as an inefficient industry. One potential ways of improving the efficiency is by managing the construction supply chains.

A supply chains is complex, dynamic, and involves the flow of information, materials, and funds, between different and independent stages. The appropriate management of these flows is required in order to respond to the clients' expectations and keep supply chains costs at a satisfactory level. The Construction Industry Institute's definition of supply chain management (SCM) is "the practice of a group of companies and individuals working collaboratively in a network of interrelated process structured to best satisfy end-customer needs while rewarding all members of the chains" (Tommelein *et al.* 2003). Thus, nowadays a company's competitiveness depends on its supply chains (Christopher 1998).

Construction supply chains management has been an emerging research area in Indonesia. Initial studies include an analysis of relationships between contractors and subcontractors (Nurisra 2002) and development of a model for selecting suppliers on construction projects (Syachrani 2005). More comprehensive research performed by Susilawati (2005) described the patterns and the underlying processes of construction supply chains discovered on high-rise building projects. Subsequent research focused on relationships among the numerous stakeholders: owner, contractors, subcontractors, suppliers, etc. Identification and understanding the general practices have been the main focus and this should be followed by analyzing the relationships which form more effective and efficient construction supply chains. Wirahadikusumah *et al*. (2008a, b) suggested a set of performance indicators for construction supply chains, and a general overview of supply chains performance on high-rise building projects based on Indonesian case studies.

The next research effort in addressing construction SCM in Indonesia is related to reducing the supply chains costs. The International Group for Lean Construction (IGLC) has invited international researchers to develop models for supply chains costs, which include purchasing cost, production cost, inventory cost, and transportation cost. While standard supply chains cost model, such as Supply Chains Operation Reference (SCOR) (Ayers 2004), is widely known in manufacturing, specific model for construction industry purposes has still at large in question.

2. Supply chains in construction

The construction industry in general is highly fragmented with significant negative impacts, i.e., low productivity, cost and time overruns, conflicts and disputes, and result-

ing claims and time-consuming litigations. These have been acknowledged as the major causes of performance-related problems facing the industry. The legacy of this high level of fragmentation is that the project delivery process is considered highly inefficient in comparison with other industry sectors (Tucker *et al.* 2001). There has been a growing recognition that it is important to integrate the various disciplines/participants in a construction project including integrating all the members of the supply chains.

Studies by Bertelsen (2002), indicated project cost increases of up to ten percent because of poor supply-chain design. Supply Chain Management (SCM) analyzes the impact of facility design on the construction process and enables superior project planning and management, avoiding the fragmented approach of other methods. Through SCM, all parties are kept aware of commitments, schedules, and expedited activities. All the parties work as a virtual corporation that can source, produce, and deliver products with minimal lead-time and expense.

Vrijhoef and de Ridder (2005) explains that the supply chain is basically representing a series of serial and parallel connections between clients and suppliers leading to the delivery of one or more products to one or more end clients. Basic social and economic rules dictate that clients buy products when this adds value to them, and suppliers produce products when this delivers profit. Clients want to increase the value added, and suppliers want to increase their profit. These interests are basically opposite, however aimed at a common goal: the transaction at a certain price. In order to combine the interests of both clients and suppliers, two basic strategies are optional, based on a collaborative approach These strategies are firstly aimed at the increase of the total benefit (value minus costs), and then on sharing the benefit. In construction, this is often organized in a collaborative and dynamic process between suppliers and clients. This requires faith and trust of both clients and suppliers in a "dynamic approach" to define value, costs and price in a collaborative process, resulting in benefit for both. When the strategies are extended through the supply chain, basically the model will include multiple parties and thus multiple transactions. The strategy will then have to be collectively grounded, and must be aimed at achieving collective benefit for all parties. The complexity increases with the number of parties involved, and so does the level of coordination of parties.

SCM in a project delivery setting is unique; many project supply chains are relatively short-lived, they must be established, configured rapidly, and remain flexible to match demands that vary over the course of project execution. Furthermore, in project production systems, owners tend to be involved throughout project delivery and influence their project supply chains directly. This phenomenon referred as "presuming" means involving the customer in production, in contrast to traditional supply chains serving the customers (Tommelein *et al.* 2009).

The supply chain has been defined as "the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate customer" (Christopher 1998). SCM looks across the entire supply chain, rather than just at the next entity or level, and aims to increase transparency and alignment of the supply chain's coordination and configuration, regardless of functional or corporate boundaries. The traditional way of managing is essentially based on a conversion view on production, whereas SCM is based on a flow view of production. The conversion view suggests that each stage of production is controlled independently, whereas the flow view focuses on the control of the total flow of production (Koskela 1992).

Supply chains management has emerged as a popular and useful concept in the construction industry and research community since the mid 1990s. In Indonesia, the research in the area of construction supply chain as a means to achieve lean construction was just started. Wirahadikusumah and Susilawati (2006) studied several high-rise building construction projects in the city of Jakarta and portrayed the construction supply chain patterns, general as well as specific patterns found in those projects. This initial understanding of the characteristics of construction supply chains was then followed by a study on developing their performance indicators (Wirahadikusumah *et al.* 2008a). These indicators were developed based on the three concepts of lean construction, i.e., "conversion", "flow" and "value". The proposed system can be used as a tool in assessing the effectiveness and the efficiency of the chains.

Wirahadikusumah *et al.* (2008b) have also used the performance indicators to obtain general portrayal of the construction supply chains on high-rise building projects. The study found that in general, Indonesian large construction firms have managed their supply chains but mainly with regard to the concept of "conversion". These firms have maintained long-term relationships with major suppliers and subcontractors. The companies use centralized procurement for main materials and distribute them to projects around the country as needed.

The management practices related to the "flow" and "value" concepts have yet to be implemented. Efforts in managing the "flow" include identifying and minimizing non value-adding activities. Achieving the value as requested by the client is the main goal of the whole production processes. However, in general, contractors have been focused on fulfilling the contract clauses with limited regards for conducting lean production process while at the same time they need to focus more on the client's satisfaction.

The real challenge is how to establish the effective and efficient supply chains for the construction projects considering the characteristics of the construction projects are different from the one of the manufacturing system. There is already available a standard supply chains cost model, i.e., Supply Chains Operation Reference (SCOR) (Ayers 2004), in manufacturing industry that is aiming to create such effective and efficient supply chains. Yet, that kind of specific model for construction industry purposes is not available and, therefore, many research efforts have been put into this issue to be solved.

An effort has been done by Sobotka (2000) to minimize the supply chains costs. The approach is to use simulation technique to improve logistic systems in construction by modeling the physical and information flows that were taken places in construction supply chains. The simulation result showed the needs of re-engineering the logistic process to find the optimum solution of the supply systems. The simulation approach has been also demonstrated by Chan and Lu (2008) to address the importance of material handling system, as part of the internal logistic system, to be designed adequately in order to gain the effective and efficient supply chains of a precast viaduct construction project.

Moreover, in order to create an effective and efficient supply system, Sobotka and Czarnigowska (2005) had proposed three models of supply system for construction projects, since the choice of supply model and method of material flow control could also influence cost levels of project supply chains. The first model is to adopt a decentralized supply system by letting individual contractors to have their own supply systems. The second model dealt with a centralized supply system is managed by general contractor or other party managing the whole project. The last model would be another centralized supply system that is managed by an external logistic company, either existing as an independent business organization or created to serve the project.

Another effective way to make a project cost-effective is to coordinate and plan logistic processes involving each project participant on every stage of the project. Creating supply system of a project at its early stages of the project may help find ways of making the project cost effective and to avoid overlooking important constraints. Even though, today's construction practices do not support integration of the whole supply chains during construction process (Muya *et al.* 1999), it is important to introduce an integration approach, such as Concurrent Engineering (CE), to the supply chains of the project. Khalfan *et al.* (2001) had assessed the readiness of an organization and its supply chains participants prior to the introduction of CE approach. It was found that, in general, the construction supply chains participants are not ready yet to adopt the CE approach and needs significant improvement in monitoring and controlling their development processes.

3. Construction supply chain in Indonesia

Wirahadikusumah and Susilawati (2006) identify supply chains structure, elements in the supply chain link, particularly between the client/owner and the contractor, and the way contractors manage the logistics system of their projects, including how they handle the procurement and logistics of resources through the sub-contractors and suppliers. The findings are mainly based on data collected on high-rise building projects in Jakarta, with private owners. Three basic supply chains patterns have been identified. Each pattern identifies the contractual and coordination relationships amongst project elements at different levels of project organization. Within the supply chains network, the client or owner occupies the top level of organization whereas the bottom level is designated for supply of resources (labor, material and equipment).

The general pattern is basically a representation of traditional contracting method where the general contractor plays the central role of the whole construction process. Under this arrangement, the general contractor organizes all works performed by its own resources and subcontractors, and hires specialty contractors for work packages requiring highly specialized skills (Fig. 1).

The second distinct pattern shows the client/owner has established direct contractual relationships with different contractors (Fig. 2). This arrangement is commonly known as separate contract method. Owners divide projects into many work packages and maintain direct contractual relationship with the main contractor, several subcontractors (smaller work packages), and specialty contractors. In each work package, each construction company is managing its own resources (materials, labor and equipment) to deliver the complete work.

A third distinct pattern shows that in addition to dividing and contracting a project into many work packages with numerous companies, owners also directly procure major construction materials (Fig. 3). The suppliers have direct contractual relationships with the owner, while contractors are responsible only in the installation processes. These distinctive patterns (Figs 2 and 3) are found in projects owned by companies focusing in property/developer businesses. Such companies have in-house capability to perform procurement and to manage multi-contracts; this strategy has been commonly practiced in order to reduce construction costs.

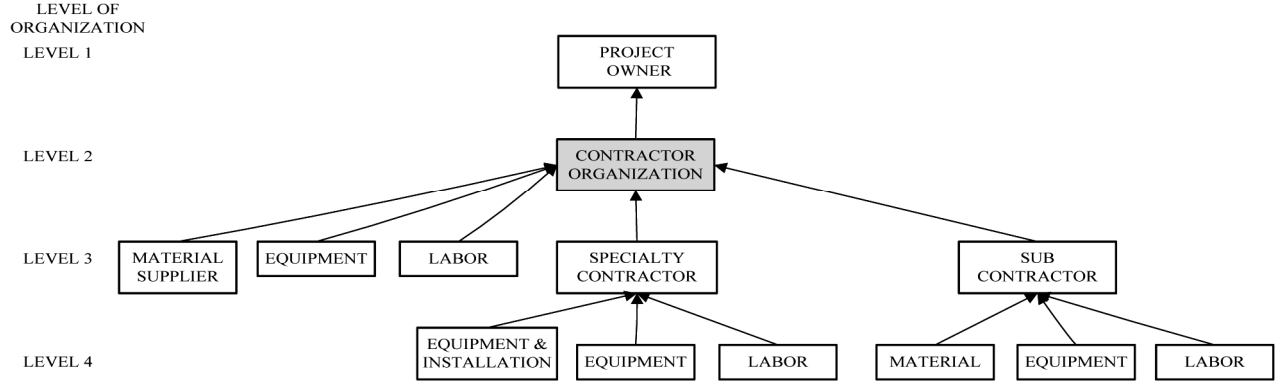

Fig. 1. General pattern of construction supply chains (Susilawati 2005)

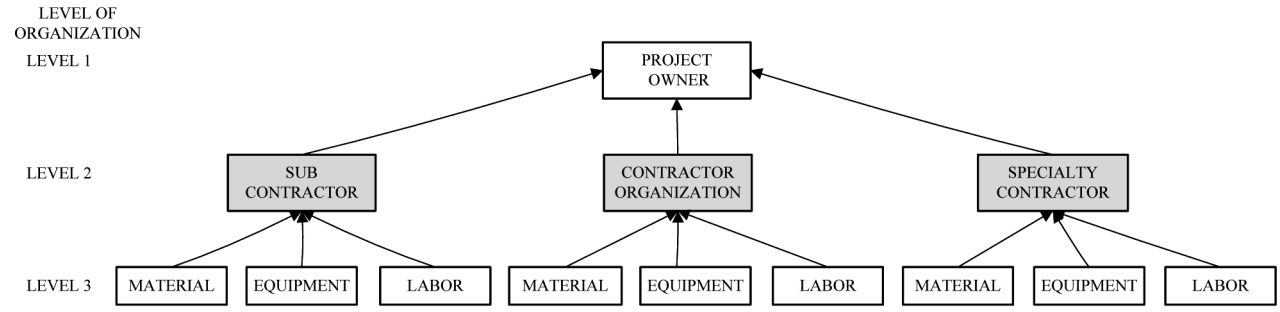

Fig. 2. Distinctive pattern Type 1 of construction supply chains (Susilawati 2005)

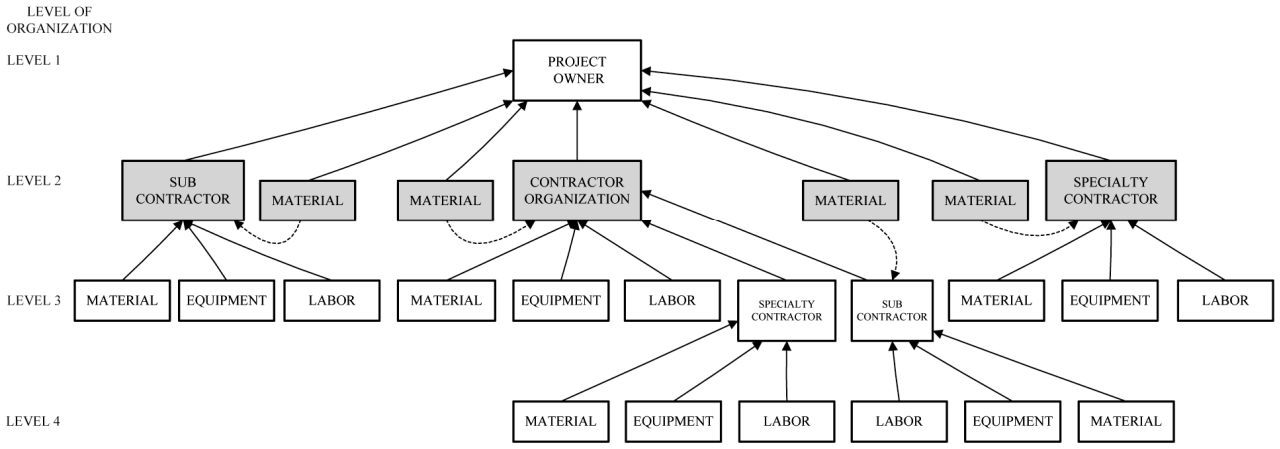

Fig. 3. Distinctive pattern Type 2 of construction supply chains (Susilawati 2005)

In general, main contractors potentially play a key role in managing various supply chains networks in construction sites. However, in many cases of high-rise building projects, owners are involved in the procurement of major construction materials. In this context, the main contractor is required to focus more on managing its supply chains during the production phase. Main contractor has the potential to improve its performance through better coordination with all other parties involved during production process, including with the companies directly contracted by the owner.

4. Research objective and method

The aforementioned studies have described the structure of construction project supply chains that help understanding the interaction among parties involved. Problems of inefficiencies of the processes in construction supply chains are obvious and need more attention to be seriously alleviated by the construction companies that manage their supply chains. A strategy that should be considered by construction companies for gaining a competitive advantage is to reduce the cost of their supply chains.

The research objective is to identify the cost structure of construction supply chains in Indonesia and factors that could influence any cost components of the structure. By knowing the cost structure, its components, and factors influencing them, construction companies are expected to be able to determine strategic efforts needed for reducing cost of their construction supply chains.

Two construction projects operated by a large construction company were explored as case-studies. In order to identify the cost structure of those construction projects' supply chains, the research was initially set to explore the financial report of the construction projects as well as the construction company's annual financial report. Unfortunately, this approach could not come into realization since the company did not allow those financial data to be investigated, even though the company had agreed to collaborate on a research with authors. Therefore, the authors changed the approach of conducting research to an interview method for collecting data regarding the structure of cost, amount of spending for each cost components, and as well as factors that could influence those cost components. The approach was considered more challenging as well as more prone to resulting in inaccurate data since the amount of spending of each cost component would have to be estimated and calculated before being analyzed.

In order to reduce the amount of work in analyzing the spending of each cost components of the projects, the object of the research was limited to analyzing the cost component of three supply chains activities, i.e., purchasing, transportation, and inventory, which are related to rebar material supply chains only. Rebar material was chosen since this material was considered as a major contributor, as much as 70%, to the total cost of civil work in both case-studies.

A questionnaire for interview was developed based on a comprehensive literature study to identify cost structure of the projects' supply chains. Several previously available cost structure models of supply chains, i.e., SCOR model (Ayers 2004), O'Brien (1997) supply chains cost trade-offs, were used as a basis for identifying the cost components that were considered and accounted for on both projects. The questionnaire was used to interview project respondents, such as the project manager, site engineering manager, site operational manager, site administration manager, and manager of procurement division of the company. The cost structures identified from the interview were then analyzed by comparing the findings to the previously available cost structures of the supply chains of the construction project as well as to the cost structures of the manufacturing industry.

Moreover, the questionnaire contained also questions to collect information on prices and costs related to rebar material and its supply chains activities. The gathered information on prices and costs were then used for estimating all related and identified cost components of the supply chains. All estimated costs were then analyzed to find cost distribution and potential cost components that could be reduced by comparing them based on percentage of each cost to the total estimated cost. Meanwhile, factors that could potentially influence each cost component were analyzed using a cause-effect analysis.

5. Description of case studies

The construction company that operated two construction projects used as case-studies in this research is considered as a large contractor in Indonesia. The company was established 55 years ago, and it is operating nationwide in the fields of building and civil engineering constructions. In managing procurement, this company has a policy to decentralize this activity to the project level as well as to centralize several major materials to the headquarters' procurement division. On average, about 70% of project budget for material is procured by headquarter, and the rest is delegated to be procured by the project to some local sub-contractors and suppliers. To some extent, this company has been practicing strategic procurement as well as supply chains management activities.

Rebar material is considered as major and strategic material by this company, therefore the procurement of this material for its projects nationwide is managed by the headquarters' procurement division. Yet, immediate and small lot-size need of rebar material could also be procured by the project manager if necessary. This company intended to obtain savings as much as 1% from the total annual sales by practicing centralized procurement for this material. A blanket contract with a certain supplier of rebar material was executed by this company to gain time and cost efficiencies. Moreover, this type of contract delivered more benefits to the company, such as a guaranteed volume of supply, fixed price for certain period of contract, exchange of technology and market related information, and economics of scale for big lot-size orders.

The two construction projects used as case studies were located in Jakarta. Those projects were different in nature. The first one was a civil engineering construction project (P1) and the second one was a building construction project (P2). Project P1 was a jetty construction project owned by the Indonesian government. The contract value of project P1 was about USD 5.2 millions. The scope of work of the project was building a structural jetty including foundation, beam, plate, and accessories. The project area to be covered by this project was about 9,000 m^2 and the project was estimated to be finished in 420 calendar days. For this project, about 1,290 ton of rebar were required. Meanwhile, the project P2 was a 20-storey office building project owned by a private developer. The value of this project was USD 4.7 millions with the scope of work consisting of structural, landscape, interior, and exterior architectural works. This office building had total area of 38,837 m^2 and was scheduled to be completed in 365 calendar days. This project consumed about 2,245 ton of rebar.

6. Findings and discussion

6.1. Cost structure of construction project supply chains

As shown in Fig. 4, the cost structure of both project cases was categorized into 4 cost components of direct costs, i.e., labor, material, equipment, and sub-contractor costs, and 2 cost components of indirect costs, i.e., overhead and finance costs. This type of cost structure is common in construction industry since construction projects are always concerned with managing resources for the construction operation in the field. Those cost components are commonly defined as cost centers and showing in the lowest level of cost accounts. Yet, in these project cases, more aggregative structure of the costs was not recognized either. This leads to the conclusion that the construction company had not developed proper cost accounts and, therefore, could not sufficiently control its project costs based on activities, physical elements of project, or any other attributes that will be needed to measure the project's performance.

This aforesaid finding contributed to the change of research method in collecting data regarding the cost components of rebar supply chains activities. Since there was no information related to total costs of purchasing, of

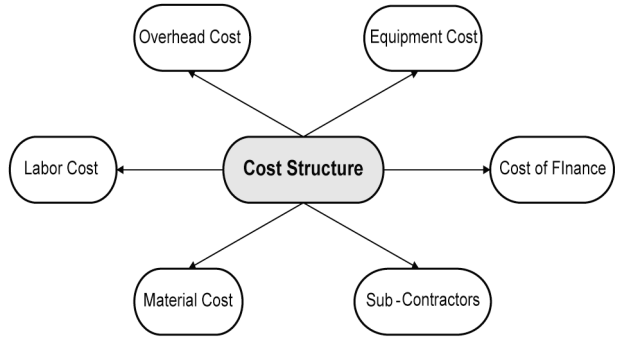

Fig. 4. Costs of construction projects

inventory, and of transportation from the cost structure of project cases, those cost components were then identified based on estimation and cost analysis. Fortunately, more elaborate and detailed cost components of rebar supply chains could be acknowledged through interviews.

The research also concluded that the project cases, as well as the construction company, did not officially delineate more detailed cost accounts that will be valuable for managing cost of the company. The similarity of cost structures for both project cases revealed that different levels of project complexity were not reflected in the cost structure in this case, which it may be true for many other Indonesian construction companies. This finding is interesting since theoretically, the more complex the project, the finer the level of detail must be. Therefore, for the construction company, it seems that there is no need to classify the level of detail of its cost structure since there is no need to maintain job cost information as well as to control the project acceptably.

Even though the rebar supply chains activities were not explicitly defined in the cost structure of project cases, the available cost structures were able to discover all expenses related to rebar supply chains activities in the level of resources expenses. Yet, not all expenses could be broken down further to identify more detailed cost components of each supply chains activity. This condition differs from the manufacturing industry, where the cost structure of supply chains may get very detailed in order to track down all information of expenses, and to manage the activities, as well as to identify opportunities to trim down particular expenses. Different characteristic of construction project to the manufacturing operation, i.e., unique and temporary in nature, may cause the difference. However, it seems that the less competitive environment of Indonesian construction industry would be the biggest major factor in this case.

6.2. Cost components

Percentage of each rebar cost component to the total cost of each supply chains activity for each project case is described in Table 1. Several blank spaces or zero percentages of cost components in the table indicate that there is no data available on a particular cost component since there is no expense considered by the project related to such cost component in the particular activity. Costs of finance and sub-contractor were not considered in all rebar supply chains activities, i.e., inventory, transportation, and purchasing activities. Meanwhile, costs of material and overhead were considered in all rebar supply chains activities. This unbalanced distribution of supply chains cost to all cost component explain the insufficient cost control system as well as the inattention of the construction company to the important of detailed cost structure.

Moreover, cost of material for all supply chains activities was considered the highest cost component. It is very common situation where the main focus of supply chains activity is to deliver the material from the manufacturer to the installation or production and to protect the value of the material; therefore the material could add more value to the project. It is interesting to notice that there are considerable differences between P1 and P2 for inventory and transportation activities. This is due to different type of construction, i.e., jetty and high-rise building. Since jetty construction project (P1) could be regarded as horizontal-linear project, it required more area to cover on one level of height. Therefore, P1 necessitated more labor to transport materials, a smaller number of pieces of sophisticated equipment, and more effort in managing the temporary and moveable warehouses. Meanwhile, the high-rise building is considered as vertical-linear project, where area to cover per level of height is less but working areas consist of many levels of height. Therefore, P2 needed more sophisticated equipment for vertical movement of material, less labor to transport the materials, and less complicated warehouses.

Table 1 illustrates that, in overall, cost of purchasing was very significant in supply chains activity as a result of the cost of materials purchased. The costs of transportation and inventory were very small by comparison; in total, both costs were less than 0.7% (i.e., 0.59% and 0.67%). From this finding, it can be deduced that efforts to reduce supply chains cost by reducing costs of inventory and transportation would not be effective. Inventory and transportation costs are also related to the type of construction, therefore it is more difficult to generalize the formulation of cost reduction effort for those cost of supply chains activities. Since the most significant cost is the cost of purchasing, the cost of material purchased is worth further examination in order to gain opportunity to lessen the rebar supply chains cost.

6.3. Factors to be considered

Further scrutiny to the purchasing cost, especially to the material cost, is needed to identify potential savings and factors that could significantly influence the effort of cost

Table 1. Percentage of rebar's supply chains cost components

Cost Component	Inventory		Transportation		Purchasing	
	P1	P2	P1	P2	P1	P2
Finance	–	–	–	–	–	–
Sub-contractor	–	–	–	–	–	–
Equipment	–	–	12.22%	37.82%	0.30%	0.58%
Labor	–	–	21.58%	15.64%	–	–
Material	74.70%	90.78%	64.24%	45.48%	99.69%	99.41%
Overhead	25.30%	9.22%	1.96%	1.06%	0.01%	0.01%
Overall	**0.05%**	**0.06%**	**0.54%**	**0.61%**	**99.41%**	**99.33%**

Table 2. Factors to be considered

Factors	Comments
Procurement policy	Centralization and/or decentralization mechanism should be applied
Material requirement planning	Accurate material requirement planning used as basis for material purchasing; Integration and coordination between project and purchasing division is a must
Supplier qualification	Supply base should be available and continuously managed
Selection process	Simple, fast and accountable processes; e-procurement is potential
Contract	Long-term contract with fixed unit price is potential, yet not applicable for sub-contractors
Supplier development	Attentions to the suppliers or sub-contractors, especially labor sub-contractors, will reduce cost of operation

reduction. Unfortunately, data from the project cases could not recommend on this matter due to lacking of apt detailed cost structure. Nevertheless, results from interviews with project personnel could confirm that the approaches and policies put in by the construction company for implementing supply chains management so far could direct the efforts of cost reduction into a reality. Table 2 illustrates factors in managing the construction supply chains that would potentially trim down the cost of purchasing as well as the cost of the project supply chains.

7. Conclusions

This paper discusses an effort to identify the cost structure of construction project supply chains and factors that would influence it. The research itself was a sub sequential part of research agenda conducted in Indonesia on the area of construction supply chains management whereas construction supply chains in project level as well as in construction company level become of the agenda's interest. The objective of the research was legitimate and become a priority of a large Indonesia construction company in pursuing cost reduction of its operation.

The findings of the research seemed not too compelling in terms of data collected, but it brings to the surface an important issue on the way Indonesian construction companies manage their cost control systems. The cost structure or account for construction project in general was not satisfactorily developed yet. It appears that Indonesian construction company doesn't require classifying the level of detail of its cost structure in view of the fact that there is no necessity to maintain job cost information as well as to control the project adequately. Likewise, cost structure of construction supply chains differs to the manufacturing industry, where the cost structure of supply chains is very detailed in order to be able to track down all information of expenses, and to manage the activities, as well as to identify opportunities to chop down particular expenses. In general, it seems that the less competitive environment of Indonesian construction industry would be the biggest major factor that caused the findings.

In addition, the research also found that the cost of purchasing was very significant in supply chains activity due to merely cost of material purchased. To the contrary, costs of transportation and inventory were trivial. From this finding, it can be concluded that efforts to reduce supply chains cost by reducing costs of inventory and transportation would not be effective. Factors that could influence the cost of supply chains, especially cost purchasing, therefore are very related to management of supply chains, such as procurement policy, material requirement planning, supplier qualification, selection process, contract, and supplier development.

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SĄNAUDŲ STRUKTŪRA IR VEIKSNIAI INDONEZIJOS STATYBŲ TIEKIMO GRANDINĖSE: DVIEJŲ PROJEKTŲ ATVEJO TYRIMAS

M. Abduh, B. W. Soemardi, R. D. Wirahadikusumah

Santrauka

Ankstesniuose Indonezijos statybų tiekimo grandinių tyrimuose labai gerai apibūdintos statybos projektų tiekimo grandinių struktūros. Be to, viena iš strategijų, kurias statybų įmonės nagrinėjo kaip galimybę įgyti konkurencinį pranašumą, buvo išlaidų mažinimas tiekimo grandinėms. Šiuo tyrimu siekiama nustatyti Indonezijos statybų tiekimo grandinių išlaidų struktūrą ir jai įtaką galinčius daryti veiksnius. Žinodamos tokius veiksnius, statybų įmonės turėtų sugebėti nustatyti, kokios strategijos leistų sumažinti išlaidas statybų tiekimo grandinėms. Atvejui tirti pasirinkti du statybų projektai, kuriuos vykdė stambi statybos įmonė. Šiam tiekimo grandinių tyrimui pasirinkta armatūra. Nustatyta, kad pirkimo kaina buvo labai svarbi, o pristatymo ir inventorizacijos išlaidos svarbiomis nelaikytos. Galima daryti išvadą, kad bandymas apriboti išlaidas tiekimo grandinėms, mažinant inventorizacijos ir pristatymo išlaidas, nebūtų veiksmingas. Taigi išlaidoms, kurios skiriamos tiekimo grandinėms, įtaką galintys daryti veiksniai yra susiję su tiekimo grandinių valdymu: pirkimo politika, medžiagų poreikio planavimu, tiekėjų kvalifikacija, atrankos procesu, sutarties sudarymu ir tiekėjų tobulinimo programa.

Reikšminiai žodžiai: statybų tiekimo grandinės, išlaidų struktūra, veiksniai, inventorizacijos išlaidos, pirkimo kaina, pristatymo išlaidos.

Muhamad ABDUH. PhD, Associate Professor at the Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung (ITB), Indonesia. His research interests include the areas of construction engineering and management, especially in the areas of construction supply chains, construction operations, lean construction, simulation, and ICT applications in construction, and infrastructure management. He received his PhD degree from Purdue University, USA, in 2000. He is now also serving as the Director of Logistic of ITB.

Biemo W. SOEMARDI. PhD, Associate Professor at the Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung (ITB), Indonesia. His research interests include the areas of construction engineering and management, especially in the areas of cost engineering, project delivery system, building information modeling, and professional construction education, and also in the areas of infrastructure management. He received his PhD degree from Kentucky University, USA, in 1993. He is now also serving as the head of Construction Engineering and Management Research Division.

Reini D. WIRAHADIKUSUMAH. PhD, Associate Professor at the Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung (ITB), Indonesia. Her research interests include the areas of construction engineering and management, especially in the areas of supply chains management, construction safety, productivity improvement, and cost estimation, and also in the areas of infrastructure management. She received her PhD degree from Purdue University, USA, in 1999. She is now also serving as the head of Graduate Program of Civil Engineering.