



Identification of Sustainable Contractor Supply Chain Patterns in Tasikmalaya City

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Abstract The current supply chain is not just an activity but has moved towards effectiveness & efficiency of performance called the sustainable supply chain. With the threat of inefficiency, construction service business actors are expected to be able to manage their respective businesses' supply chains. Specifically for the construction industry in Tasikmalaya City to manage the construction supply chain, this study was conducted with the title Identification of Sustainable Construction Supply Chain Patterns in Projects in Tasikmalaya City. This study aims to identify the supply chain system patterns of construction service companies, especially contractors, and what development patterns can be carried out by construction service companies in increasing the competitiveness of construction service businesses in Indonesia, through literature reviews and case studies on contractor companies in Tasikmalaya. This research method, unique in its use of descriptive microanalysis from the results of semi-structured interviews, sets the stage for a comprehensive understanding of the subject. Data will be collected by direct interviews with construction project owners or managers in their respective projects. Based on the results of descriptive analysis of the information obtained, a general model is compiled that describes how the supply chain system pattern is carried out. The preparation of the supply chain pattern resulting from the identification will refer to the pattern developed by Susilawati in previous research, where the supply chain pattern has a relationship from the owner to the lowest subcontractor. From this study, three supply chain patterns were identified where the pattern has a maximum of 4 tiers, and the selection of the supply chain pattern is based on the type of project being worked on and the company's ability to manage the project. The critical points for building an integrated supply chain are knowing the value desired by the client, building long-term relationships with suppliers, integrating activities, collaborating to manage costs, developing continuous improvement, and mobilizing and developing human resources. These findings have significant implications for the construction industry in Tasikmalaya City and can guide future research and industry practices.

Keywords: Supply Chain, Sustainable Supply Chain, Construction

INTRODUCTION

The construction industry, a vital sector that produces physical infrastructure and basic facilities for economic and social sector activities, plays a crucial role in economic development. To achieve good construction business development, the strategy that needs to be optimized is to carry out integrated cooperation between parties to reach common goals. According to Oliver and Webber, supply chain management describes a collaborative network of companies that work together to create, process, and deliver products to end consumers [1]. The national construction supply chain management system intersects with the construction management system, the national logistics system, the national economic system, and the industrial economic system [2].

The current supply chain is not just an activity but has led to an effective performance called a sustainable supply chain. The sustainable supply chain is a supply chain activity from upstream to downstream that is considered.

Environmental and energy aspects in the context of lean construction. The demand for efficiency forces companies to form more superficial organizational structures, encouraging companies to focus more on their core business and leave their supporting activities to other parties. The involvement of various parties in the construction implementation process results in inefficiencies and problems at every stage of the construction process. This trend has led to long-term relationships with strategic suppliers and customers. Consequently, a company's competitive advantage is no longer solely dependent on its resources and capabilities. Instead, it relies on how efficiently and effectively the company identifies, integrates, manipulates, and deploys a unique combination of resources and capabilities available internally and across its network to create core competencies that can achieve and sustain a competitive advantage. Therefore, a company's relationships with its suppliers and customers have become a crucial part of the business management process [13].

According to Chopra and Meindl, the supply chain has a dynamic nature. Still, it involves three constant flows, namely the flow of information, products, and money, which aims to meet consumer needs in which there is a flow and transformation of goods from raw materials to end consumers accompanied by the flow of information and money [3]. According to Abduh, the Construction Supply Chain is a system of suppliers, manufacturers, transportation services, distributors, and sellers created to convert basic materials into construction products so that users can utilize them according to the value they demand [4].

One of the efforts that can be made to reduce the risk of project success is the existence of good management of the construction industry supply chain. Vrijhoef argues that, basically, the supply chain is a tangle of cooperative companies that interact to deliver products (goods or services) to the final customers of various parties ranging from upstream to downstream relationships, in different processes and activities to produce goods and services of value to the last customer [5]. Vonderembse argues that the success of implementing a supply chain also depends on the characteristics of the supply chain itself [6]. The characteristics of the construction supply chain concerning its structure and function, according to Vrijhoef, is that the supply chain concentrates the flow of materials on construction projects where a single object or product in the form of a building or other to be assembled comes from materials supplied from outside, temporary supply will produce a construction project through the re-establishment of the project organization. Therefore, the construction supply chain is unstable and fragmented, especially between the design team and the project's construction, and is typically [5]. The high complexity and dependence between components are characteristics of the current supply chain based on the characteristics of the supply chain and the need for supply chain management [6].

Fawcett and Magnan mentioned that supply chain management is generally related to the availability of sophisticated information technology, fast, responsive logistics services, and practical and maintaining customer relationships [6]. According to Anatan and Ellitan in Rohaesih, supply chain management applications have three main objectives: cost reduction, capital reduction, and service improvement [5]. Supply chain management in the construction industry is believed to be one of the strategic efforts to increase a construction company's competitiveness amid increasingly intense local, regional, and global competition, as well as other industries. One of the crucial elements of this supply chain management is the structure of an influential network because an efficient supply chain is considered to provide high competitiveness to the companies that are part of it.

In the construction world, sustainable development is implemented with sustainable construction principles. Baloi states that sustainable construction is part of sustainable development in the construction industry. In addition, it is also emphasized that sustainable construction refers to the main issues, including social, economic, and environmental. Karji et al. reiterated that the United Nations has identified 17 main points of sustainable development and categorized them into three pillars, including social, economic, and environmental sustainable goals [7].

Sustainable development is a development effort that includes economic, social, environmental, and even cultural aspects for the needs of the present but does not sacrifice or reduce the needs of future generations. This concept demands harmony between the area's environment, society, and economy.

Sustainable construction is a concept or guideline in the construction world that supports realizing the Global Goals for Sustainable Development, which is often referred to as 17 (17) goals for sustainable development. In Indonesia, regulations governing sustainable construction have been emphasized in the Law and Government Regulations. Regulation of the Minister of Public Works and Housing (PUPR) number 9 of 2021 is a reference or guideline for implementing Sustainable Construction. The alignment between international, national, and regional programs is vital to introducing sustainable construction to the community. Susetyo emphasized in his research reviewing the concept of sustainable construction that sustainable development is strongly supported by understanding and sensitivity to environmental issues [8].

This research aims to identify the pattern of the supply-chain system of construction service companies and what

kind of development patterns can be done by construction service companies to improve the competitiveness of construction service businesses in Indonesia through a literature review and case studies on contractor companies in Tasikmalaya.

Susilawati's Supply Chain Pattern

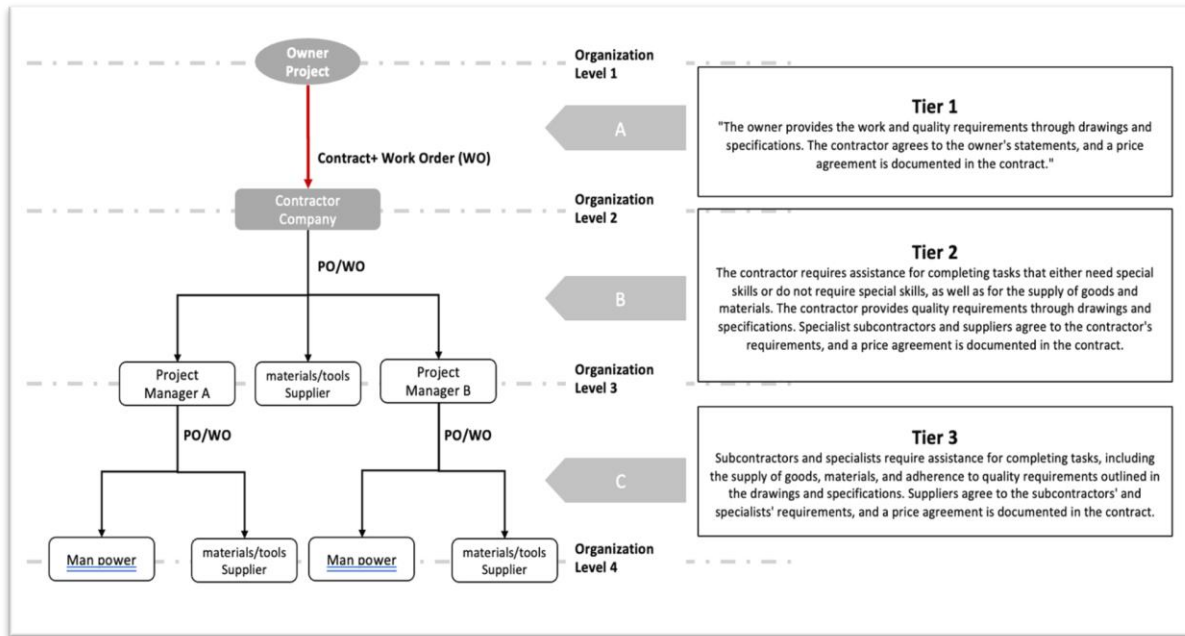


FIGURE 1. Contractor Supply Chain Pattern by Susilawati

The model shown in Figure 3 illustrates the concept of a supply chain that focuses on managing the flow of goods and services between organizations involved in the implementation of construction from upstream (raw materials) to downstream (finished goods) and even to the last customer.

The contractor (second-tier organization) is under contract with the project owner for only structural or entire works. The contractor as the construction executor generally consists of the main contractor and several other service providers, such as subcontractors who perform the main contractor's work and specialist subcontractors who perform specific or specialized work. In this supply chain pattern, tier three and four organizations do not involve nominated subcontractors. The tier three organizations are selected by the contractor based on some criteria at the contractor's discretion, while the tier four organizations are chosen by the tier three organizations without interference from the contractor. Direct contracting occurs between tier two organizations (contractors) and tier one organizations (owners) and between tier two organizations (contractors) and tier three organizations (specialists/subcontractors and supplier contractors-labor suppliers, tool suppliers, and material suppliers). Indirect labor contracts occur between tier-two organizations and tier-four organizations. Fourth-tier organizations have direct work contracts only with third-tier organizations. The leading actor in the supply chain is the contractor, who acts as the executor of the construction work based on the technical planning and specifications set by the assignor. From the contractor's point of view, the actors who act as upstream actors (raw goods) in this model consist of subcontractor services as suppliers who do some of the same work or all different parts of the main contractor's work, suppliers as suppliers of materials and equipment, and foramen as suppliers of skilled/non-skilled labor for project implementation. The downstream actors (finished goods) from the contractor's point of view in the hypothetical model are the owner as the assignor and the end customer who determines the requirements for achieving quality, meaning that if the requirements are met, then the building produced has quality. If the quality has been met, the quality assurance part of the quality has also been met.

METHODOLOGY

This research will present the pattern of the supply chain of construction service companies in Indonesia. This research method uses descriptive microanalysis from the results of semi-structured interviews. The data collection is carried out by literature study and interview techniques to collect data on how the procurement and purchase management process of materials and services is carried out by the supply-chain actors. Based on the results of descriptive analysis of the information obtained, a general model is developed that describes how the pattern of the supply chain system is carried out.

Interviews were conducted in semi-structured depth interviewing. According to Sugiono, semi-structured interviews are included in the in-depth interview category, where the implementation is freer when compared to structured interviews. This type of interview aims to find more open problems, where the interviewees are asked for their opinions and ideas [9]. Respondents appointed or authorized by the construction service company to answer questions are respondents who are competent with the procurement, purchase, and quality assurance carried out by the company.

The information collected will be analyzed through the following steps:

1. Identify the supply system that occurs in the current research object.
2. Identify problems encountered in the existing supply system.
3. Investigate the cause of the problem
4. Investigate the efforts that have been made to overcome the problem.
5. Representation of identified supply chain patterns

The discussion is carried out using the microanalysis method and discusses descriptively the results of data collection that have been done. The data collection is limited to contractor companies in the Tasikmalaya City area, declared members of the Tasikmalaya City branch of the contractor company association.

This study will present the supply-chain pattern of construction service companies in Indonesia, whose data collection is done using literature study techniques and interviews to collect data on how the supply-chain actors manage the procurement and purchase of materials and services. Based on the results of descriptive analysis of the information obtained, a general model is developed that describes how the pattern of the supply chain system is carried out.

RESULT AND DISCUSSION

Based on the results of interviews conducted with service providers, especially several general contractor companies in Tasikmalaya with minor company qualifications, it is known that the supply chain is not strictly managed because small-class companies handle projects that are small in value. Hence, supply chain management is only traditional, where the company looks for suppliers who can provide the cheapest materials, tools, and services. However, even though management is not strict, there are some common supply chain patterns that are commonly used in every company. The similarity of the supply chain management pattern itself is driven by the company's awareness of the need to streamline the operating costs of project implementation to increase the company's revenue as well as the competitiveness of the company itself.

In some cases, small companies usually work on projects with contract values above Rp. 2.5 billion, the supply chain pattern developed is to divide the materials into two groups. The first group is materials, tools with high economic value, are routine, difficult to obtain in the market, and have particular specifications. The second group is materials, tools with low monetary value, non-routine needs, and readily available in the market. This group division is used to divide responsibilities in terms of procurement in a construction service company organization because, in general, medium- and large-class construction service companies do not work on only one project at a time. Responsibilities are distributed respectively to the corporate office organization and the project organization itself. The first group of tools is responsible for procuring materials at the head office. As for the procurement of materials, the second group of tools is accountable to the project organization. This division of responsibilities is based on differences in supply chain management, particularly in the first group of supply chain relationships.

Are well managed and long term. Meanwhile, for the second group, supply chain management is short-term (ad hoc) because it adapts to the project's characteristics and the location where the project is carried out.

The use of supply chain patterns in contracting companies is always adjusted based on the type of project and the company's ability to complete the project. Few small qualified contractor companies in Tasikmalaya choose to involve subcontractors in their work due to the company's limited human resources. The following are some identified supply chain patterns commonly used by small qualification contractor companies in Tasikmalaya.

First Supply Chain Pattern

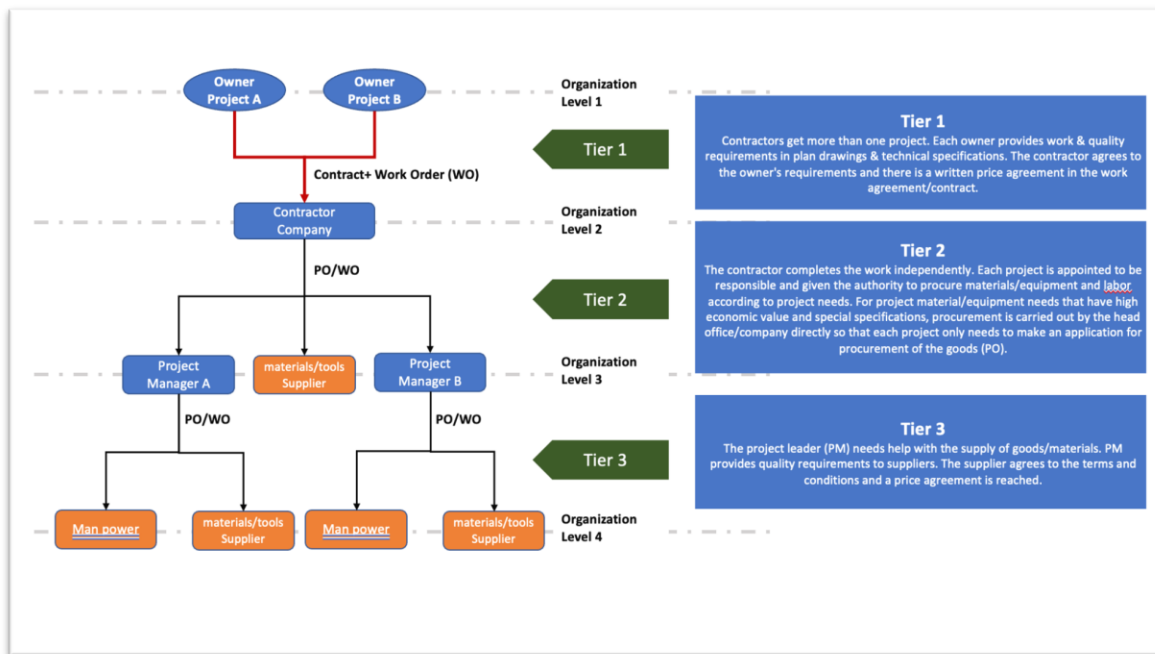


FIGURE 2. First Supply Chain Pattern

That is a 3-tier supply chain pattern, where:

- Tier 1: Contractor gets more than one project. Each owner gives work & quality requirements in plan drawings & technical specifications. The contractor agrees to the owner's requirements, and there is a price agreement in writing in the work agreement/contract.
- Tier 2: Contractors complete the work independently. Each project is assigned a person in charge and given the power to procure materials/tools and labor according to project needs. For project materials/tools of high economic value and unique specifications, procurement is carried out directly by the head office/company so that each project only needs to make a procurement request (PO). Usually, this relationship is long-term.
- Tier 3: The project leader (PM) requires assistance with the supply of goods/materials. PM provides quality requirements to the supplier. The supplier agrees to the PM's requirements, and a price agreement is reached. Usually, this relationship is short-term/ad hoc.

Second Supply Chain Pattern

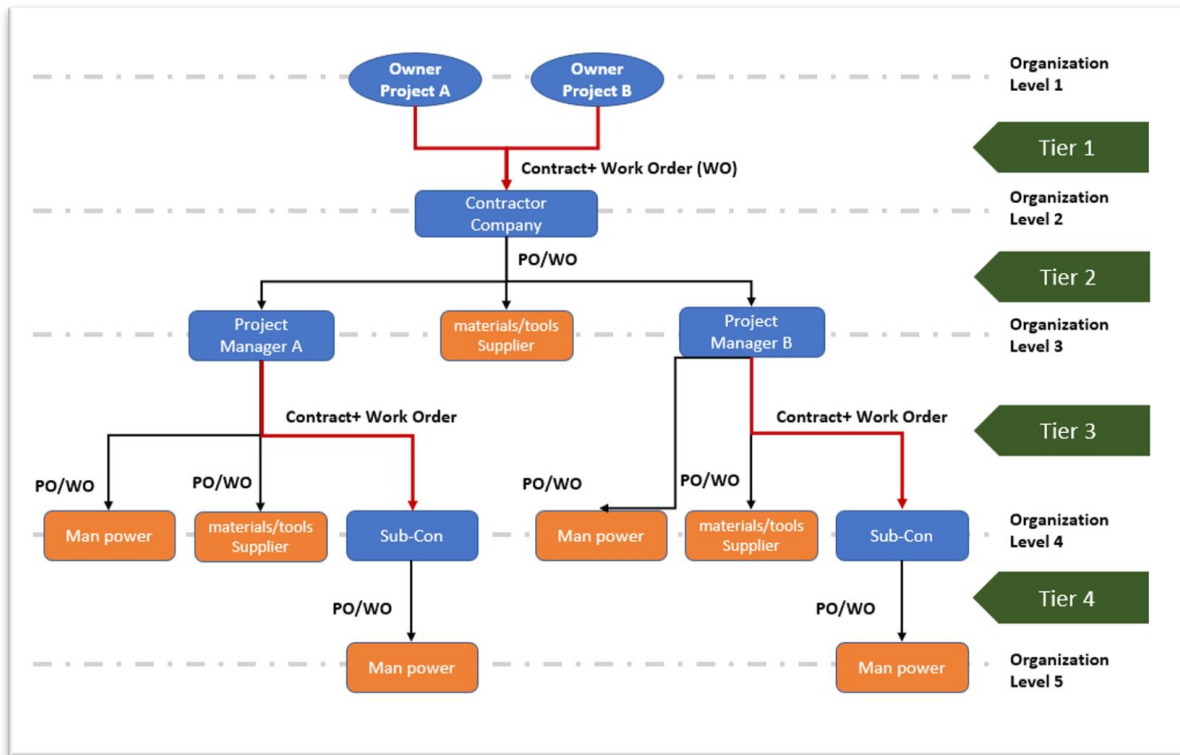


FIGURE 3. Second Supply Chain Pattern

That is a 4-tier supply chain pattern, where:

- Tier 1: Contractor gets more than one project. Each owner gives work & quality requirements in plan drawings & technical specifications. The contractor agrees to the owner's requirements, and there is a price agreement in writing in the work agreement/contract.
- Tier 2: Contractors complete the work independently. Each project is assigned a person in charge and given the power to procure materials/tools and labor according to project needs. For project materials/tools of high economic value and particular specifications, procurement is carried out directly by the head office/company so that each project only needs to make a procurement request (PO). Usually, this relationship is long-term.
- Tier 3: The project leader needs the help of a Subcon to complete typical or specialized work, and time is limited. The subcon provides the labor with the required expertise, and the pimpro provides the material requirements. The subcontractor agrees to the pimpro's requirements, and a price is agreed upon in writing in an agreement/contract. Usually, this relationship is short-term/ad hoc.
- Tier 4: Subcon requires assistance to complete the work by providing labor with the necessary expertise. There is a written price agreement with the labor.

Third Supply Chain Pattern

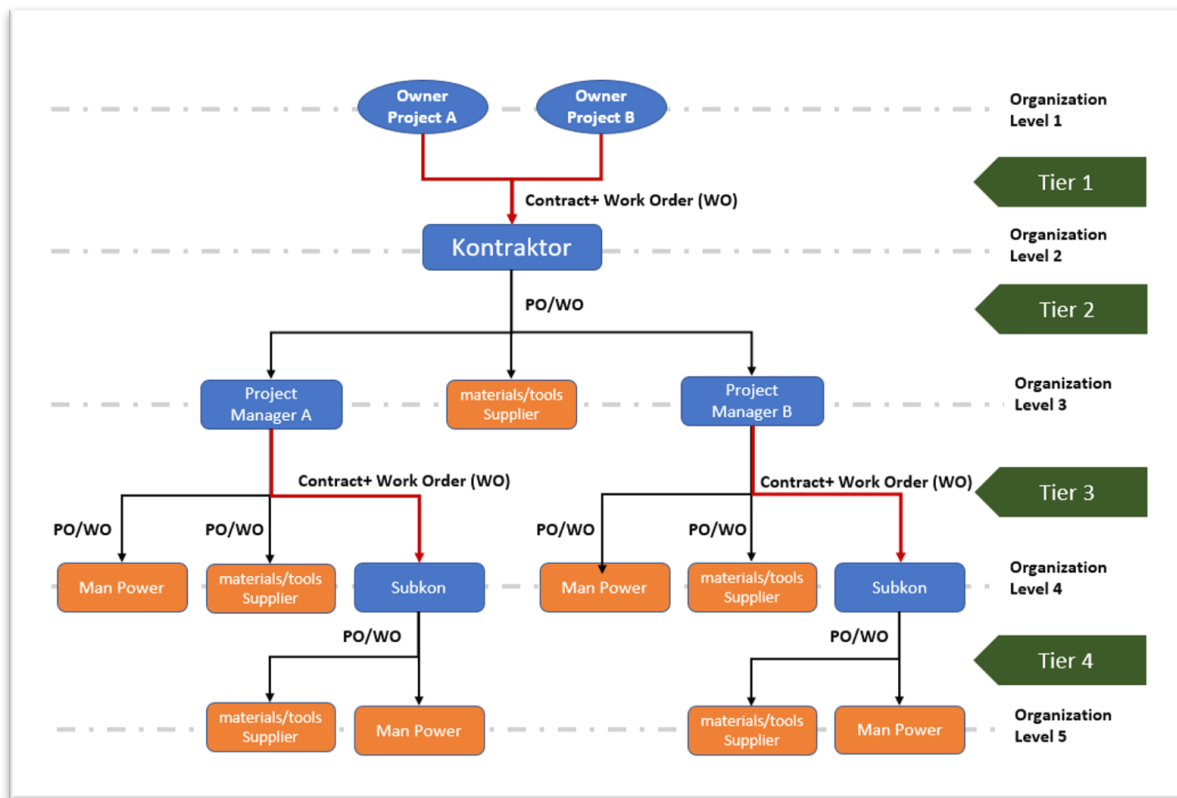


FIGURE 4. Third Supply Chain Pattern

That is a 4-tier supply chain pattern, where:

- Tier 1: Contractor gets more than one project. Each owner gives work & quality requirements in plan drawings & technical specifications. The contractor agrees to the owner's requirements, and there is a price agreement in writing in the work agreement/contract.
- Tier 2: Contractors complete the work independently. Each project is assigned a person in charge and given the power to procure materials/tools and labor according to project needs. For project materials/tools of high economic value and particular specifications, procurement is carried out directly by the head office/company so that each project only needs to make a procurement request (PO). Usually, this relationship is long-term.
- Tier 3: The project leader (Pimpro) needs the help of a Subcon to complete typical or specialized work, and time is limited. The subcon provides labor with the required skills and materials. The subcon agrees to Pimpro's requirements, and a price is agreed upon in writing in an agreement/contract. Usually, this relationship is short-term/ad hoc.
- Tier 4: Subcon requires assistance to complete the work by providing labor with the necessary skills and help from suppliers to supply materials. There is a written price agreement with the labor and supplier. Usually, this relationship is short-term/ad hoc.

CONCLUSION

Based on the analysis and discussion, the following conclusions can be drawn:

1. There are three supply chain patterns commonly used by small qualification contractor companies in Tasikmalaya, which involve up to the 4th tier in the supply chain.
2. The selection of the supply chain pattern is based on the type of project undertaken and the company's ability to manage the project.
3. The key points to building an integrated supply chain are knowing what the client wants, building long-term relationships with suppliers, integrating activities, collaborating to manage costs, developing continuous improvement, and mobilizing and developing human resources.

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