

RISK MITIGATION IN SUPPLY CHAIN DISRUPTION DURING PANDEMIC COVID-19 IN EPC PROJECT, STUDY CASE PT XYZ

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ARTICLE INFO

ABSTRACT

Keywords:

COVID-19 Risk, Construction Safety, Mitigation Strategies, Supply Chain Management, Disruption.

COVID-19 pandemic has been the largest worldwide disaster in beyond years in early of 2019 which remains exist till these days in 2022. apart from the unprecedented variety of deaths and hospitalizations, the pandemic has resulted in global economic effect, widespread enterprise disruptions, and extensive hardships. The spread of the COVID-19 pandemic has impacted the economy of the world in all industry which includes production, resort and tourism, finance, meals and beverage and creation industry in Indonesia. Many projects in Indonesia were plagued with time and cost overruns due to the COVID-19 pandemic. site paintings development came to an abrupt halt, and productivity stagnated. With that in thoughts, this examine was conducted on the idea of first time experience in managing the COVID-19 pandemic and the way it has affected the construction industry. This look at analyzed the mitigating of the COVID-19 pandemic on EPC construction groups in Indonesia primarily based on targets had been achieved via 3 respondents of SCM Departments consist of SCM manager and Logistics manager in 3 major international EPC oil gas, power, petrochemical, and different offerings where executing on going EPC venture in Indonesia. The respondents offered the statistics based their revel in address the pandemic disruption, including the overall and destructive effects skilled, new possibilities created, and risk control efforts being undertaken. The reported damaging outcomes blanketed vast delays on projects, incapacity to cozy materials on time, discount in productiveness costs, additional logistics price, material charge escalations, exchange mode of transportation from sea freight emerge as air freight for you to seize construction agenda, and others. There have been some impact in the Supply Chain disruption such as material where the movement and delivery flow were disrupted to be delayed, finance flow where payment term both in seller and buyer side were having disruption, and information flow from any aspect of human resources, information of material stocks, quotation, inspection, HSE and time where risk management measures that were largely enhance adopted such as measures to enhance safety HSE and reduce other project risks such as delay in the delivery and handover. The safety aspects such as requiring employees / staffs to wear medical face masks, body temperature check shall be below 37 degree, applying of social distancing protocols, staggering of construction operations, offering COVID-19-related training, administering temperature checks prior to entry into the workplace, frequently antigen test / PCR test and others.

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1. INTRODUCTION

The COVID-19 pandemic has hit Indonesia since the first case was detected and officially announced by the government in early March 2020. After that, the number of positive confirmed cases increased and spread throughout Indonesia. Several COVID-19 countermeasures policies have begun to be implemented, including by implementing large-scale social restrictions (PSBB). The implementation of this PSBB has an impact on almost all sectors of socio-economic life. One of the sectors that has really felt the impact of Covid-19 is the construction sector which has exacerbated the situation because construction is an important component of the national economic development agenda. Some

Risk Mitigation in Supply Chain Disruption During Pandemic COVID-19 in EPC Project, Study Case PT XYZ. Arpan Marwazi Lubis, et al

construction projects, both those whose sources of funding come from the APBN, APBD and the private sector, are forced to experience temporary delays or at least experience a decrease in productivity. In addition, the lockdown or PSBB policy in the form of closing access to entry and exit of certain areas as well as restrictions on public transportation have had an impact on the availability and limited mobility of labor and construction materials.

The energy sector has been significantly affected by the COVID-19 pandemic. In the commercial sector, many have reduced their hours of operation, resulting in a decrease in energy demand in this sector. In the transportation sector, the need for fuel oil (BBM) has reduced drastically due to operational restrictions on modes of transportation (number of airplanes, public transportation in operation) and the effect of the implementation of the work from home (WFH) policy. Globally, the decline in fuel demand has led to a drastic drop in world crude oil prices. This has resulted in several refineries being forced to stop operating, because they are less profitable than imported fuel. Likewise, the development of new renewable energy (EBT) is becoming less and less prospective due to excess energy supply due to decreased energy demand. (Buletin Konstruksi Edisi 4 Tahun 2020).

The COVID-19 pandemic and subsequent strict lockdown measures have caused significant disruptions to the construction industry's supply chain management, including construction, procurement, and logistics. This disruption has affected both developing and developed countries, resulting in material shortages and project delays. The pandemic has led to short-term stress in the non-residential and residential sub-sectors, causing a decrease in GDP and an increase in unemployment. The economic activities of the manufacturing and construction sectors have been severely impaired due to lockdowns and social distancing measures resulting from insufficient numbers of employees. As a result, there is a growing concern that the supply bottleneck will lead to a scarcity of construction materials. This study aims to identify the impact of COVID-19 on the Construction Supply Chain (CSC) and analyze the factors influencing Supply Chain (SC) performance during uncertainty in the construction industry.

The construction services sector, as part of the economic actors, is also affected by this the covid-19 outbreak. The reality on the ground is that not a few construction activities took part stopped due to the Covid-19 pandemic. Usually this is due to activity The construction does not stand alone, but also depends on the sector another business. The cessation of construction activities also does not only come from users of construction services, but can also come from service providers the construction. Construction activities stopped due to the impact of Covid19, for example, there were imported raw materials whose delivery was stagnant or even cannot yet be sent from a country of origin that is undergoing a lock down, for example. Or maybe there are workers who have tested positive for Covid-19, so cause other workers who are in the same environment need to be done first quarantine. Or work construction also experienced a slowdown due to policies or appeals Large-Scale Social Restrictions or (PSBB). One of them is the slowdown due to limited material distribution due to the PSBB policy. (R. Yudha Triarianto Wasono, 2020)

Another effects of the covid-19 or corona virus in the world of construction as follows; reduction of workers in the field, materials industrial raw materials that are difficult to import from outside the area, the project has been withdrawn from specified targets, several projects were terminated for the safety of its workers, several projects were canceled a lot, and in general making projects that completely impossible to complete it's just too late in work, even if only because the supply chain has been badly damaged. Government has also ordered that certain businesses stop working, but the industry construction is not generally subject to shut down for a number of reasons. Project can still run normally if the workers can follow the protocol which has been determined by the government. This protocol was created so that workers can protected while on the job. If the protocol is not followed with well then the project should be temporarily stopped for the sake of safety for all workers on the project. Supply chain conditions during a pandemic are much more difficult compared to pre-covid-19. During a pandemic, distribution of goods follows the schedule of the local government which often implements restrictions or also known as PSBB. In addition, the Health protocol requires having a negative Covid-19 result is actually a challenge, because an allocation is needed special covid-19 fund for procurement of goods (Susanto, 2020).

A construction project can be successful if it can be completed according to a predetermined time plan, achieving the required quality and obtaining benefits from the work (Rani, 2021). However, in terms of implementation, projects often experience various obstacles, causing losses that impact time and costs. Several construction projects, especially multi-year (multi-year) projects, are at risk of losses in the event

of a delay (Sajiah, 2020). According to Ervianto (2005), there are three characteristics of the project, as followings:

- a) Construction projects are characterized by their uniqueness, as no two projects are identical, although they may have similarities in terms of their activities. Additionally, construction projects are temporary and involve a variety of different workers and stakeholders.
- b) The successful completion of a construction project requires the allocation and management of various resources, including money, machinery, materials, and human resources such as workers. The task of organizing and managing these resources typically falls to the project manager.
- c) Effective management of a construction project requires a high degree of organization, as the project involves multiple individuals with diverse skills, interests, personalities, and uncertainties. The success of the project is dependent on the ability of the project manager to effectively coordinate and manage these various factors towards achieving the project goals.

This study investigates the impact and mitigation of the Covid-19 pandemic on the implementation of EPC construction projects in Indonesia. From the preliminary interviews with respondents in this research, who are multinational construction companies working on projects in Indonesia, data gathered cover information on the participant's background, i.e., professional role, workplace location, and experience in no. of years. The research will be conducted in an EPC construction company engaged in oil and gas, power plant, petrochemical, and other energy sectors. The respondent sample starts from SCM Managers, Logistics Managers, and Material and Warehouse Managers from multinational EPC companies constructing energy projects in Indonesia.

Literature Review

Epc Construction Project

EPC construction industry is an activity that focuses on implementation with limitations on cost, time, and quality. When a project is constrained or even stopped, it will have an impact on rising costs, delayed time, and decreased quality of work (Hu & He, 2014; Wang et al., 2021). For example, in the United States there were labor shortages, project suspensions and cancellations, as well as supply and logistics disruptions (Jeon et al., 2022). Most of the construction companies in South Africa experienced significant disruption in the completion of their projects, workers lost their jobs, and people's mobility was disrupted (Aigbayboa et al., 2022). Meanwhile, in countries that have implemented lockdowns, they experience confusion in procuring materials (Han et al., 2020). Therefore, excellent strategies are needed in the form of policies from the government and contractors as executors.

Project activities in construction are temporary and carried out within a limited period, with specific and intended sources of funds allocated for tasks with clearly defined objectives. The implementation of construction projects involves numerous activities and parties, which can give rise to complex problems, as noted by Soeharto (1995). The process of construction project development involves the organized transformation of specific resources and funds into desired outcomes within a certain period, using budgeted funds and available resources, according to Dipohusodo (1996). Construction projects are typically short-term and involve a series of activities that are carried out only once. Additionally, such projects are characterized as unique, requiring five essential resources (man, material, machines, money, method), and demanding a high degree of organization, according to Ervianto (2005) and (2002).

- a. Unique
The uniqueness of a construction project is that there is never a series of activities that are the same (there are no identical, there is a kind); the project is temporary and always involves different groups of workers.
- b. Required resources
Every construction project requires resources such as humans (man), materials, work tools (machines), money (money), and work methods (method).
- c. Organization
Every project organization has a variety of goals; it involves some individuals with varying expertise and uncertainty.
- d. Supply Chain
The supply chain process begins with the collection of existing resources, which are then managed and transformed into finished products before being distributed and marketed to the end customer. This process takes into account various factors such as cost, quality, availability, after-sales service, and reputation. The supply chain itself relies on the collaboration and synergy of

suppliers, manufacturers, and retailers who work together either directly or indirectly, as noted by Wisner et al. (2012, p. 6).

A supply chain involves all parties, both direct and indirect, that are responsible for meeting customer demand. This includes manufacturers, suppliers, transporters, warehouses, retailers, and customers. Within each organization, such as a manufacturer, the supply chain encompasses all functions related to receiving and fulfilling customer requests, such as product development, marketing, operations, distribution, finance, and customer service, as noted by Chopra & Meindl (2010, p.20). The design and management of the supply chain, including the flow of products, information, and funds, are closely related (Chopra & Meindl, 2010, p.23).

In Vrijhoef's (1999) definition, the supply chain is regarded as a network of corporate entities that collaborate to provide products, whether goods or services, to the final customer. Similarly, Nyoman (2005) defines the supply chain as a network of interconnected companies that work together to produce and deliver a product to the end-user. According to Christopher (1992 in Kuntoro, 2007), the supply chain is a network of organizations involved in various processes and activities, both upstream and downstream, that create value in the form of products or services for the end customer. The construction supply chain is the connection between various parties in a series of construction processes that produce product construction (Capo et al., 2004). In projects, construction often encounters a high level of complexity in coordinating procurement of shop drawings, equipment, materials, human resources, and financing because it involves many parties in the implementation process, raising inefficiency. According to Wisner in Sutoyo (2011), that chain management supply can lower costs, increase efficiency, and improve the timely delivery of the final product or service to the customer. According to Bertelsen (2002), poor construction supply chain management is likely to have the potential to increase project costs by up to 10%.

Supply Chain Management

The management of the supply chain involves the movement of products or services from one location to another, including the storage of raw materials, work-in-process, and finished goods, all of which are necessary to fulfill customer orders end-to-end. Keith Oliver introduced this concept in 1982, which highlighted the interdependence and linkages between various processes and external parties involved in the supply chain, as noted by Randall et al. (2011). The production process of manufacturing industries relies heavily on the adequacy, accuracy, and inventory of raw materials, as pointed out by Garay-Rondero et al. (2020). In the same vein, the distribution of manufactured products through the supply chain is equally crucial. According to Sparks (2010), a smooth supply chain management process from upstream to downstream is necessary for consumers to receive products. Hence, many parties are involved in the supply chain process, as noted by Rana et al. (2015). The transporter party plays a crucial role in the material flow of supply chain management and requires reliable and accurate data on supply, stock, and demand to integrate the numbers and types of products requested, existing, to be sent, and currently in distribution.

Meanwhile, the Institute for Supply Chain Management (ISM) defines supply chain management as the design and management of seamless processes that add value within and across organizations to identify the genuine needs of end customers.

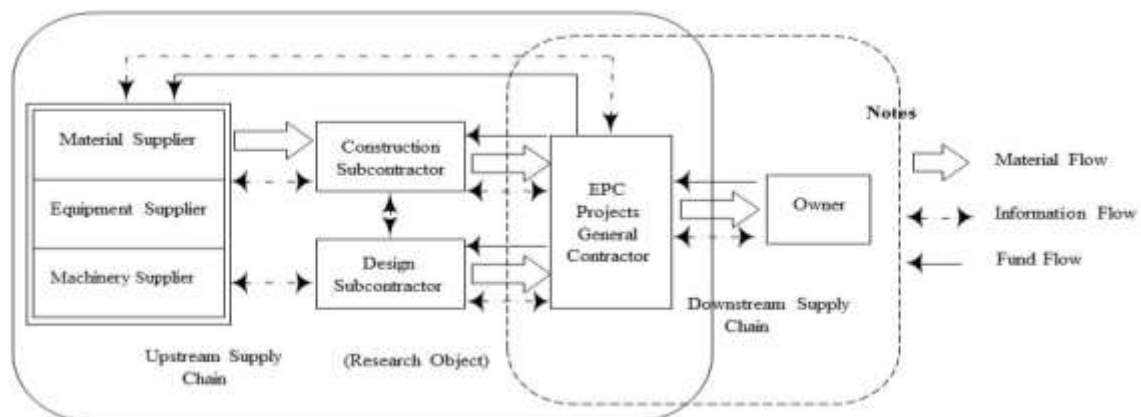


Figure 1. Supply chain in EPC Construction
Source: (Sholeh & Fauziah, 2018).

Supply chain management is very influential on company performance because, according to Anatan and Ellitan in Rohaesih (2013), chain management applications Supply has three main objectives, namely, cost reduction (cost), reduction of capital (capital reduction), and service improvement (service improvement). So with the implementation of supply chain management as a strategy, The company is expected to be able to create a competitive advantage, because of the advantages Competing is the basis for companies to be able to create value for end customers that can exceed the costs incurred by the company to create that value for customers. Three kinds of flow must usually be managed in supply chain management: Flow that flows from upstream to downstream. The flow of money or the like that flows from downstream to upstream. Information flow can occur from upstream to downstream or vice versa.

Supply Chain Management Risk

Supply chain management is very influential on company performance because, according to Anatan and Ellitan in Rohaesih (2013), supply chain management applications have three main objectives: cost reduction, capital reduction, and service improvement. So the implementation of supply chain management as a company strategy is expected to create a competitive advantage because the competitive advantage is the foundation for companies to create value for end customers that can exceed the costs incurred by the company to create value for the customer. In general, there are 3 (three) flows in the supply chain managed, namely,

1. The flow of material flowing from upstream and downstream (downstream),
2. The flow of money and the like that flow from downstream to upstream,
3. Flow information can occur from upstream to downstream or vice versa (Nyoman, 2005)

Risk management is a way of reducing threats and impacts that has been widely used in companies, including the construction industry. The steps of risk management are identify the risks, analyze the risks, evaluate and rank the risks, treat the risks, and monitor and review the risks (Cooper et al., 2005; Labombang, 2011). EPC with all its complexity has a big potential risk in the event of disruption due to Covid-19. Therefore, identification up to risk monitoring is needed by parties in the EPC project, especially contractors, in maintaining the stability and success of the project. Concerning its structure and function, according to Vrijhoef et al. (1999), the characteristics of the construction supply chain include the supply chain centralizes the flow of materials on construction projects where the object or a single product in the form of a building or other that will be assembled comes from materials supplied from outside. A temporary supply chain will produce one project construction by re-establishing the project organization. Hence the chain construction supplies could be more stable, especially between design teams with project construction.

The construction supply chain has a significant role in it; parties are involved, parties act as suppliers, and parties act as customers. Viewed from the contractor's point of view, the party that plays a role in the production process at the construction site can be grouped as a "supplier," regardless of whom the party has a contractual relationship with. The party who will receive or use the product the supply chain produces is the "customer." Thus, some relationship cooperation occurs in the construction production process; namely, the relationship between the contractor and the owner shows the downstream and upstream relationship between the contractor and the parties involved in the production process. Contractor Performance According to Soeharto (1995), a project's performance is closely related to achieving project objectives, where project objectives are limited by 3 (three) limitations: budget, the project must be completed at no cost over budget; the project must be scheduled according to the period and specified end date; and project activities' quality, product, or results must meet the specifications and criteria required.

Supply Chain Disruption

Craighead et al. (2007) provide a definition of supply chain disruptions as unexpected events that disrupt the normal flow of goods and materials in a supply chain, leading to operational and financial risks for firms. While Wamba (2020) focuses on the severity of disruptions, Ellis et al. (2010) consider the probability and magnitude of disruptions. Supply chain disruptions can spread throughout the supply chain (Blackhurst et al., 2005), and the risks associated with these disruptions are often interdependent (Chopra and Sodhi, 2004). This means that a single disruption can impact the performance of other elements of the supply chain, whether upstream or downstream.

An integrated supply chain model typically includes three interrelated flows: material flows, which consist of purchasing, transformation, and distribution stages; informational flows, which involve electronic data exchange or website linkages; and financial flows, which encompass payment to suppliers and subcontractors for goods and services, as well as payment by customers to retailers for final products

(Waller, 2003). Although physical distribution is a critical component of supply chains, information and financial aspects are equally important in many cases. Additionally, it is important to highlight the role of knowledge inputs in supply chain processes, as close coordination between intellectual inputs, such as design, and physical inputs, including components and prototypes, is necessary for the supply chain process of new products.

The flow direction in a supply chain is not solely forward, from the first supplier to the final customer. Goods can also move back up the supply chain for various reasons, such as service or repair, remanufacturing, recycling, or disposal. The reverse chain plays a significant role in areas such as customer satisfaction, environmental protection, and recycling. Reverse logistics involves a range of programs or competencies that focus on moving products in the reverse direction in the supply chain, from consumer to producer. Related activities may include handling product returns, recycling, material reuse, waste disposal, refurbishing, or remanufacturing (Moise, 2008, p.198).

1. Material Flow

The majority of participants in the study reported either experiencing or anticipating delays in material delivery, which were expected to cause significant schedule disruptions and delay overall project progress. These delays were particularly relevant when the supply chain involved materials or raw materials from overseas, such as China, Europe, Japan, Korea, and Germany. For instance, one of the supply chain management project managers noted that the majority of instrument equipment was supposed to be shipped from Europe, but manufacturing plants in China were non-operational due to the COVID-19 pandemic. Other participants mentioned similar disruptions in the supply chain, which included materials and raw materials from China, Korea, Japan, and other countries.

The study participants also experienced material shortages due to social distancing and quarantining requirements in some countries, which led to a reduced workforce within supply chain organizations. In many instances, the participants were unable to accurately predict the extent of the delays, given the numerous factors that can affect delivery times during a pandemic.

To mitigate the significant delays in material delivery, particularly from overseas and across the country, many workplaces took proactive measures to identify alternative material sources and reduce the risk of project delays. Preference was given to local suppliers and manufacturers who were more likely to deliver on short notice. Contractors, in collaboration with procurement and engineering, were able to identify alternate materials and equipment that local suppliers could quickly ship. As a result, there was a significant increase in demand for these local suppliers. For example, one supplier reported a substantial increase in sales compared to previous years. Additionally, there was added demand from local suppliers for supplies such as piping, cable, instruments, and welding consumables, among others.

2. Information Flow

The study participants provided significant insight into workforce-related challenges. Most participants reported that a large number of furloughs and layoffs were being initiated due to projected substantial decreases in workloads within the construction industry. One project engineer even mentioned that the projected workload reduction could range between 50% and 60% compared to previous years. Furthermore, contractors and subcontractors are facing significant cash flow challenges, and many participants noted that furloughs and layoffs were necessary to address these issues, as businesses may not be able to make payroll. There is also much uncertainty about the future, and the demand for craft workers remains unclear due to the early stages of the pandemic. In addition to craft workers, project engineers, estimators, administrative employees, and others are also likely to be impacted by furloughs and layoffs.

In addition, several participants highlighted additional challenges associated with the transition to remote work, as much of the workforce was not familiar with the newly adopted digital solutions. For instance, some individuals were not accustomed to using virtual private networks (VPNs) to connect remotely to the business network. Others struggled with adapting to new communication platforms like Zoom, Microsoft Teams, and Slack. Some employees also found it difficult to connect their work computers to their home network for a variety of reasons. Furthermore, a few participants reported experiencing internet outages and poor internet quality, which posed significant challenges for remote working.

3. Finance Flow

Productivity was also affected by cash flow challenges faced by contractors and subcontractors, which were exacerbated by rising material prices and delays in owners making timely payments. Additionally, as previously mentioned, productivity was impacted by delays in material delivery, shortages in material availability, and setbacks in inspections and permitting processes.

One of the respondents reported that supply chain disruptions caused an increase in construction material costs, largely due to the closure and reduced capacity of upstream manufacturing and processing facilities. This increase in cost also impacted logistics. Additionally, participants noted an increase in the cost of doing business, resulting in unexpected financial shocks at various points in the supply chain. In some cases, construction businesses may have to bear the additional costs themselves, unless there is relief from the owners and other stakeholders as per the contractual agreement. Such extra costs include managing safety, providing pandemic-related safety training, and securing necessary PPE to protect the workforce effectively.

There was also a rise in costs due to the willingness of some subcontractors to work and travel during the pandemic. According to a project manager, subcontractors who had to cross state lines were particularly hesitant to work, as they preferred to avoid the 14-day quarantine requirement imposed by some states by staying in their city of residence. In such cases, subcontractors often had to be offered higher compensation and incentives, resulting in increased costs and potentially lower quality work. Participants also reported an increase in non-performance occurrences among subcontractors, which further raised costs. As construction operations are delayed, payment delays are likely to follow, leading to cascading cash flow issues. Some contractors may struggle to pay their workforce, subcontractors, and suppliers in a timely manner, according to participants.

Risk Mitigation

In the field of Project Management, risk is defined as an uncertain event or condition that may have a positive or negative impact on one or more project objectives, such as time, cost, scope, or quality (PMI, 2004). Failure to address risk and effectively manage it can lead to project failure. However, many owners and contractors lack the knowledge and expertise needed to identify and manage project risks comprehensively (Walewski, 2005). Risk management involves identifying potential sources of risk and uncertainty, assessing their impact, and developing appropriate management strategies (Thomas, 2003). In today's turbulent markets, risk and risk management have become critical and pressing concerns for companies and managers.

Risk management is a systematic and structured process of identifying, analyzing, and responding to risks throughout the project lifecycle to achieve the optimal level of risk reduction, mitigation, and/or control (Wang et al., 2004). It involves employing techniques to manage uncertainties in a project. Some risk factors are inherent to the parties or organizations responsible for managing them, while others are closely related to external conditions like economic, political, cultural, and operational environments of the project's location (Bakr et al., 2012). Neglecting risk and its management can lead to project failure.

Cohen and Palmer (2004) stated that there are two primary techniques for risk identification: experienced-based risk assessment and brainstorming-based risk assessment. The experienced-based technique involves conducting interviews with project personnel from each discipline within the organization who have experience working on similar projects, and/or examining historical data from prior projects to leverage corporate knowledge. On the other hand, brainstorming sessions involve all key stakeholders in identifying and listing risks. This approach enables stakeholders to exchange opinions and perspectives on potential risks with other members of the project team.

2. METHOD

The research methodology used in this study will be discussed extensively throughout the research process. The case study approach is considered the most suitable research strategy to address all the research questions in this study. The conceptual model developed for this study is intended to define the problem, identify relevant factors, and establish connections to facilitate the mapping of research problems, enabling the comprehensive answering of all research questions.

1. Research Methodology

The research methods section describes how to collect data, the sources and criteria used, and the techniques used to perform data analysis. Figure 2. is a procedure flow that summarizes the research flow.

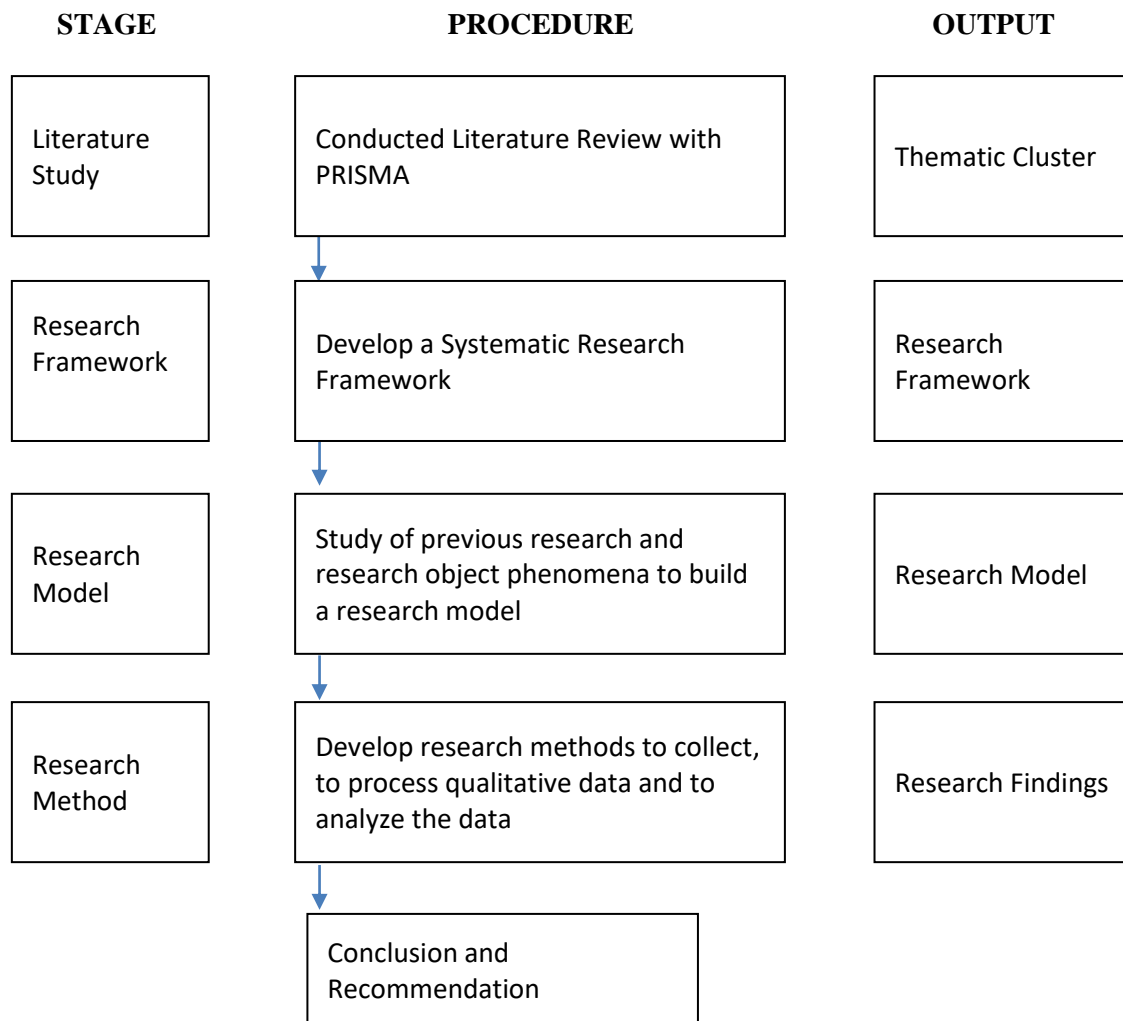


Figure 2. Research Flow

Based on the research flow, this research is based on the philosophy of positivism and is evaluative research. Positivism research deals with observable social realities and standard research results (Saunders et al., 2016). In line with this definition, this qualitative study deals with the supply chain risk mitigation of EPC construction companies that are highly measurable and observable. This study's general results can be applied to EPC companies within a particular scope. Evaluative research in business and management usually assesses the effectiveness of a risk business strategy, policy, program, initiative, or process (Saunders et al., 2016).

This research utilizes a qualitative approach to investigate risk mitigation in the EPC construction industry during pandemic Covid -19. The qualitative approach as it allows for the description and exploration of the quality of these phenomena. It focuses on understanding the meanings and experiences of the respondents involved and takes place in natural environments to capture the richness of the settings (Yin, 2014; Eisenhardt, 1989). The emphasis is on identifying processes rather than predicting outcomes. The qualitative approach enables high interaction and communication between the researcher and the investigated actors.

The research employs a case study methodology, precisely a multiple case study approach. This approach allows for replication and extension among individual cases, meaning that specific problems can be independently corroborated and more elaborate theories can be developed. Using multiple case studies increases the robustness of the findings and leads to more decisive analytical conclusions when similar findings emerge from different cases. Contrasting findings among the cases contribute to a deeper understanding and the discovery of underlying reasons. To conduct

multiple case studies, comparable phenomena in comparable contexts and the availability of resources and time are necessary. The presence of these elements facilitates a broader exploration of the interaction among the investigated actors and enables the derivation of empirically grounded conclusions (Schirmer, 2013; Langdrudge, 2004).

2. Data Collection

The research will employ a semi-structured interview template to gather information on the participant's background (i.e., professional role, workplace location, experience in no. of years, etc.). The research will be conducted in EPC construction companies engaged in oil and gas, power plant, petrochemical, and other energy sectors. The respondent sample are interviewed from SCM Manager, Logistics Manager, and Material and Warehouse Manager from major EPC companies in Indonesia engaged in Energy sectors. The data collection process of semi-structured interview uses a questions list for all respondents by interviewing via Zoom meetings and video WhatsApp calls. The responses of the study participants will be transcribed as the conversations progressed. Follow-up questions and relevant examples will be solicited for each of the questions to enhance the quality of the data and the insights gathered from the effort.

The primary data will be collected through semi-structured interviews on several indicators as follows:

1. Obstacles in the distribution of materials and project materials.
2. Slow mobilization of heavy equipment and construction equipment.
3. The difficulty of importing materials and materials from outside the region.
4. There is a reduction in labor.
5. There is a change in working hours.
6. Cutting working hours.
7. There is a change of work shift.
8. Changing the mode of transportation from sea freight to air freight to speed up delivery.
9. There needs to be more certainty about the project's continuity.

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4. Research Model

The research pyramid of this study as illustrated on Figure 3. below:

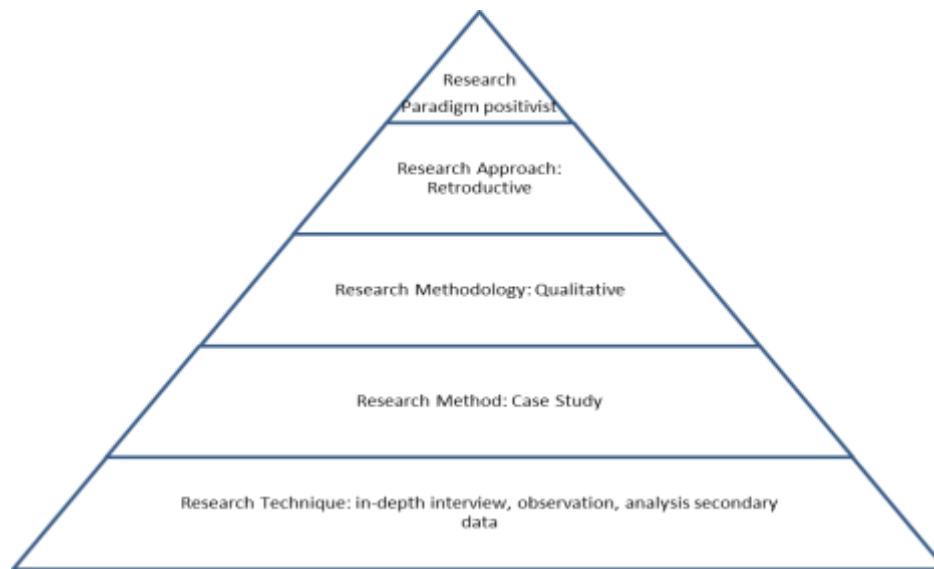


Figure 3. Research Pyramid (Wahyuni, 2012)

The descriptive study aims to examine regular patterns within reality and offer a comprehensive understanding of these patterns by providing qualitative explanations through the assessment of generative causal mechanisms sensitive to contextual and social influences to promote a conceptual model (Salter and Kothari, 2014).

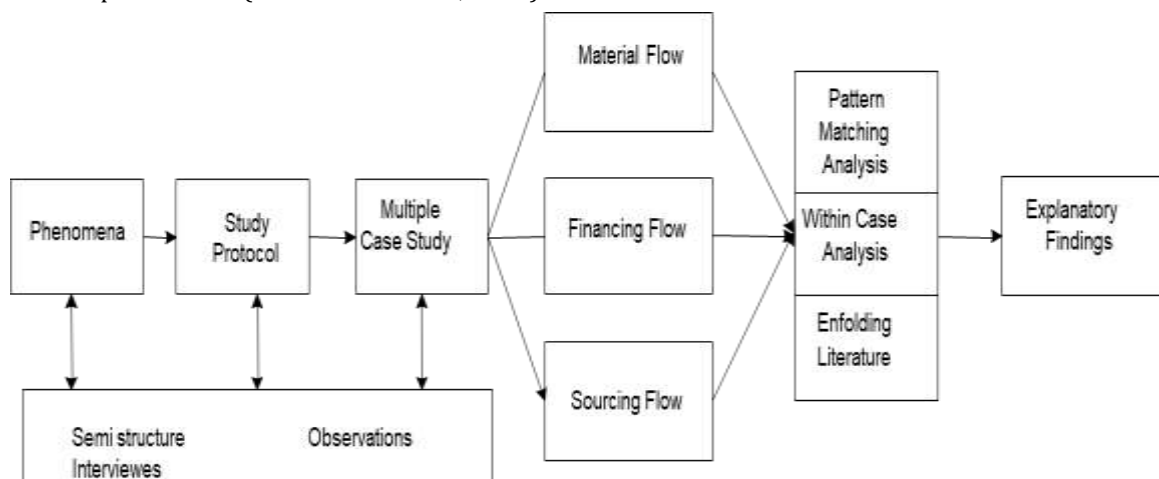


Figure 4. Research Model (Descriptive Study)

3. RESULT AND DISCUSSION

Variables For Discussion

Variables	Impact for EPC Supply Chain Construction
Material Flow	<ol style="list-style-type: none"> 1. Vessel schedule and departure from port of origin (import) is delay with uncertain time which caused material procurement is delay at project site 2. Erection for major equipment delayed due to material delivery delayed 3. Shipping line lack of containers due to unavailability of container stocks, which impact to shipping cost increase, shipping carrier route which normally operated 10 vessel decrease become only 3-5 vessels 4. Mobilization of site crew (engineer, staff, consumable) from Jakarta and Surabaya is delay due to PSBB large scale restriction 5. Material procurement and PO placement is delay due to overseas vendors specially in China and Korea are lockdown 6. PO contract agreement change from DDP to be EXW or FOB, because if using DDP term vendor will find the cheapest vessel, if using EXW buyer can manage the

	collection based on buyer schedule
	7. Layoff engineers and freeze recruitment
	8. Change mode of transportation from sea freight to air freight to shorten delivery time
	9. Maximize capacity for manpower for efficiency,
	10. Maximize the use of meeting application for online expediting report, online fabrication report and online inspection
	11. PO contract agreement change from DDP to be EXW or FOB, because if using DDP term vendor will find the cheapest vessel, if using EXW buyer can manage the collection based on buyer schedule
	12. Find material substitute in local market Instrument items usually place PO in the middle of project after synchronizing with piping, mechanical and other electrical stage, but now PO is placed in early of project, additional cost for instrument engineering review
Finance Flow	1. When bidding a project procurement to sub-cont, sub-cont required for 20% - 30% DP in advance before processing where before Covid-19 Sub-cont did not required it is delayed.
	2. Cash flow disruption in payment of material and services
	3. Cost extension for equipment, crane, lift, barge, etc due to slow of work progress at Site
	4. Additional cost for mandays for vendor's engineer due to quarantine policy
	5. Postpone project bonus payment
	6. Apply and negotiate a force majeure contract
	7. Managing cost efficiency by negotiating contract revise
Information Flow	1. Uncertainty of information such as stock, fabrication status and delivery forecasting from suppliers, sub-vendor, etc
	2. Negotiation with supplier and sub-vendor is not smooth
	3. Meeting and coordination become effective using online meeting platform such as Zoom, g-meet and others
	4. QC inspection using online meeting platform makes easy and faster comparing physical check directly in vendor shop
	5. Difficulties in searching substitute products

4. CONCLUSION

The COVID-19 pandemic, which began in early 2019 and continues into 2022, has been a global catastrophe, resulting in a high number of deaths, hospitalizations, and far-reaching economic impacts. It has disrupted various industries worldwide, including manufacturing, hospitality, finance, food and beverage, and construction in Indonesia. The construction sector in Indonesia, in particular, has faced time and cost overruns, site work stoppages, and decreased productivity due to the pandemic. This study examines how the COVID-19 pandemic has affected EPC construction companies in Indonesia. It analyzes the experiences of 11 respondents from SCM departments, including SCM managers and logistics managers in major international EPC companies in the oil and gas, power, petrochemical, and related sectors engaged in ongoing EPC projects in Indonesia. The study reveals the disruptive effects of the pandemic, including project delays, material supply challenges, reduced productivity, increased logistics costs, and material price escalations. Mitigation efforts have been employed, encompassing safety measures, supply chain management, and the adoption of risk management strategies. In summary, the study sheds light on the significant challenges posed by the COVID-19 pandemic in the construction industry, highlighting supply chain disruptions, financial issues, and information flow challenges. It underscores the industry's adaptability through risk management measures and safety protocols in response to these unprecedented difficulties. Enhance Resilience in Supply Chain Management: To address supply chain disruptions and material supply challenges, EPC construction companies in Indonesia should consider diversifying their sources of materials, maintaining strategic stockpiles of essential materials, and establishing contingency plans for alternative supply routes. Improve Financial Management: Given the financial disruptions experienced during the pandemic, it is advisable for companies to develop financial resilience by optimizing cash flow management, revising payment terms in contracts, and exploring financial strategies to weather economic uncertainties. Leverage Technology:

Embrace digital tools and technologies to streamline communication, information sharing, and project management. This can help in overcoming information flow challenges and improving coordination among various stakeholders in the construction projects. Continue Safety Measures: Continue and strengthen safety measures adopted during the pandemic, such as requiring employees to wear face masks, implementing temperature checks, and promoting social distancing. These practices should remain in place to safeguard the health and well-being of workers.

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