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Intelligent Decision Support System for Supply Chain Risk Management Process (SCRMP) with COBIT 5 in Furniture Industry

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***Abstract*—Sustainable supply chain management can be a new strategy in the industry, especially in the furniture sector. In its implementation, different sources of risk factors emerge because the nature of the supply chain is too complex, causing supply and demand uncertainty for production. The furniture industry needs to implement supply chain risk management to overcome problems and cause a loss of trust from customers. This study aims to identify and manage supply chain risks in the furniture industry using the Supply Chain Risk Management Process (SCRMP) and COBIT 5 methods. After identifying the risk, the risk impact measurement uses the COBIT 5 method with the Deliver, Service, and Support (DSS) domain implemented into the decision support system. To find out changes after system implementation, the author conducts a risk assessment according to the COBIT 5 standard and evaluates the possibility of a risk occurring. The result of this study is a mapping of the handling of negative scenarios of risk after implementing the system that includes governance standards and input data to produce output documentation. Documents are applied to the decision support system to reduce risks in the supply chain. The SCRMP and COBIT 5 methods can manage supply chain risk more effectively. It guides the risk assessment area and provides information technology governance to the system. The implication of future research is to define standard operating procedure documentation for applying decision support systems in all divisions of the furniture industry.**

***Keywords*— Supply Chain Risk Management Process (SCRMP); decision support system; DSS COBIT 5.**

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I. INTRODUCTION

The industry faces demands not only to increase production and the economy but also to be responsible for environmental sustainability [1]. Supply chain management consists of all the stages involved, directly or indirectly, in meeting customer demands and managing flows (products, information, and money) [2]. Supply chain management is an integrated system that supports each other [3]. The furniture manufacturing industry is a sector with a complex supply chain. Kocoglu et al. [4] revealed that supply chain management consists of several aspects: integrated supply chain, performance supply chain, and distributed supply chain information [5]. Competitiveness in the industry, achieving optimal trading an effective value chain influences performance [6]. Therefore, these activities' uncertainty makes the supply chain more vulnerable and at high risk. Risk arises due to the magnitude of the deviation between the expected rate of return and the actual rate of return. Several risks that arise due to supply chain uncertainty can affect several parts of the business in an industry. These risks may relate to organizational operations, work processes, technology, human resources, finance, physical accidents, corporate strategy, politics, economics, regulations, and laws. Delay of risk factors can be associated with the occurrence of any event.

The emergence of the risk of supply chain failure results from global competition and complex problems in the furniture industry. Various kinds of risk problems in the furniture industry come from the operational, economic, environmental, and social aspects. Risks that arise include demand and supply uncertainty, failure to respond quickly to changes in demand, inability to monitor and reduce production errors, a decline in market share, natural disasters, inefficient use of resources, and user access. Chiayemba and Phiri [7] revealed that information protection is one of the main challenges faced by the industry. Therefore, the furniture industry needs to redesign supply chain risks. The furniture industry needs to understand the interdependence of supply chains and identify potential risk factors, the possibilities that arise, and the consequences and levels of these risks. The supply chain's uncertainty of demand and supply indicates the need for risk management that includes a contingency plan and a backup plan. Risk governance or risk management needs to be implemented in a large industry, especially in the production sector. All risks that arise can have negative and positive impacts but must be appropriately managed. Risks that have a positive effect can be addressed to increase the achievement of the furniture industry by taking advantage of existing opportunities. At the same time, risks that have a negative impact also need to be managed so as not to hinder the achievement of the furniture industry's goals. It is crucial to implement risk management from the supply chain to be adopted in a system.

Supply chain risk management is essential in the furniture industry because it is a strategy-setting process to identify potential events that may affect the entity and manage risks to achieve adequate assurance. Tummala and Schoenherr [8] defined the stages of the Supply Chain Risk Management Process (SCRMP) in previous research, starting from identification, measurement, assessment, evaluation, making mitigation plans from negative scenarios, and monitoring the implementation of the decision support system [9], [10]. Use of the SCRMP framework to identify potential risk factors and mitigation strategies. To assist the identification process of mitigation strategies, the approach combined with SCRMP is IT Governance, namely COBIT 5 with the domain Deliver, Service, and Support (DSS). COBIT 5 is an assessment tool for current supply chain security, service continuity, training, and ongoing data management. The combination of COBIT 5 and the SCRMP framework to overcome the problem of supply and demand uncertainty in the furniture industry to assess its impact on business processes. Madyatmadja et al. [11] revealed that the measurement of maturity level could use the COBIT 5 standard, a business framework for the governance and management of information technology companies. Wolden et al. [12] have researched to reduce cyber-attacks in the Supply Chain Management System (SCMS) using COBIT 5 standards and the System Development Life Cycle (SDLC) method [13]. The method used in the previous study focused on using the COBIT 5 standard but was not applied thoroughly to each phase of the SDLC. The results obtained are only a descriptive security control document as a condition for verifying the security of SCMS. The development of documents carried out in previous research needs to be maximized because it has not been implemented thoroughly in the existing system.

Based on the problems that existed in the previous research, a decision support system was implemented based on the risk assessment results to overcome the uncertainty and supply issues in the furniture industry. This study defines the risks in the supply chain today to measure the impact of risk on business processes using COBIT 5 assistance. However, even though the risk assessment results have been adjusted to COBIT 5, the decision support system is still being evaluated to define negative scenarios that arise after the implementation of the system so that risk management can be prioritized based on its level. Risk levels will be categorized as a risk mitigation plan based on standard governance practices. Each risk requires input data or standard operational documents to obtain the appropriate risk management output. The results of this risk management are implemented in a decision support system. The proposed system follows operational standards following the documentation for handling harmful risks from the implementation of the system. The entire risk management process is based on the SCRMP framework because it has advantages in the performance or visualization of the results obtained. The research object focuses on supply chain risk management by implementing a decision support system using SCRMP and risk assessment based on standard governance practices, namely COBIT 5. Supply chain risk can be managed more effectively when implementing a decision support system because it can present negative risk scenarios to be standardized following information technology governance practices and risk mitigation strategies that are useful for the system. Thus, the result of this study is the implementation of a decision support system based on mapping to mitigate negative risk scenarios so that the system can manage risks that occur in the supply chain.

II. MATERIALS AND METHOD

A. *Decision Support System for Risk Management*

Risk management issues involve different decisions for the relevant parties to make in various decision-making issues. Decision support systems can support complex problem-solving because they can be customized to support intelligent decisions [14], [15], [16]. Utilization of the decision support system can determine the risks that affect the achievement of the furniture industry targets. There are several risks of concern during supply chain activities, such as technology risk, material, and raw material risks, inflation risk, risk of changes in government regulations, risk of contractor error, and many other risks. To finalize the implementation of the decision support system, risk management stages are applied systematically, starting from identification, measurement, assessment, evaluation, and control and monitoring [17]. Failure risk by implementing a decision support system can be minimized using technology that meets governance management standards.

B. *Step of Research Process*

Aguila and ElMaraghy [18] argue that risks in the supply chain can certainly disrupt industry flows. Therefore, the furniture manufacturing industry should realize the importance of mitigating supply chain risks. The furniture manufacturing industry can improve its supply chain strategy to survive and bounce back in the production process, resulting in reconfiguring the supply chain strategy [19], [20]. This re-configuration process uses SCRMP and DSS COBIT 5 to produce the decision support system in Figure 1.

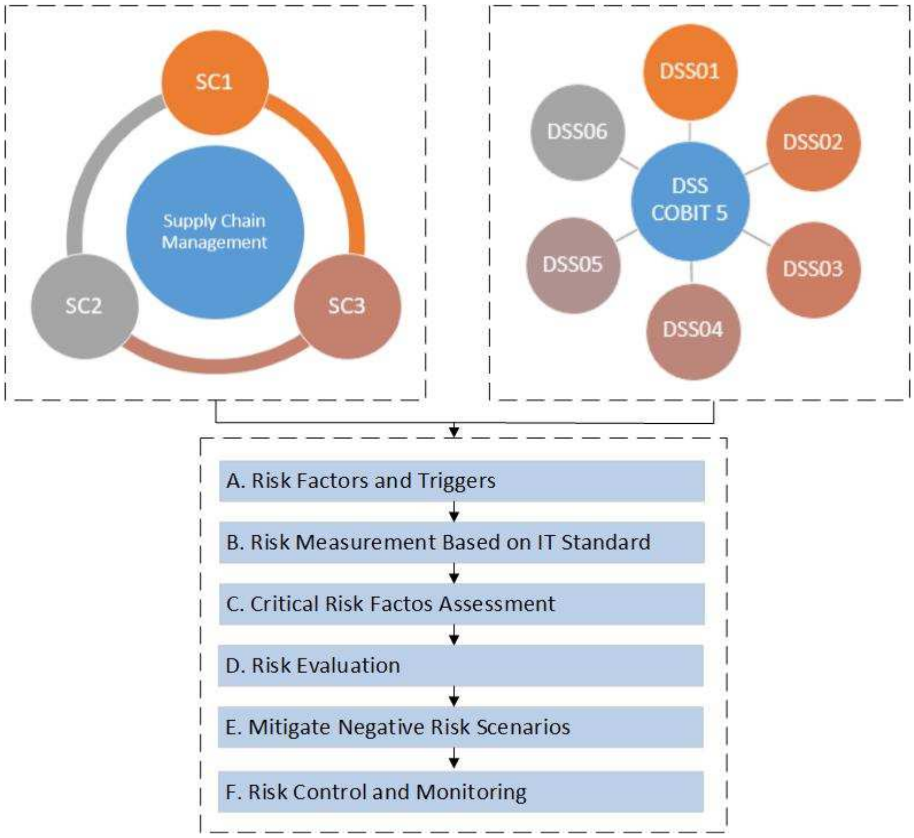

Fig. 1 Research Stages [4], [8]

Figure 1 shows the stages of SCRMP implemented with the help of the COBIT 5 DSS approach. This research is divided into several stages [21], [22] as follows:

1) Risk Factors and Triggers. Identify risk categories by illustrating the risks that have emerged from each part of the furniture industry. Identify risk categories by illustrating risks from each part of the furniture industry supply chain. Risk identification is based on three supply chain activities: integrated supply chain (SC1), performance supply chain (SC2), and distributed supply chain information (SC3). In addition to the risk factors that arise, the causes of the emergence of these risks are also defined. The risk identification process starts with mapping the supply chain or existing conditions to get an overview of the business processes that occur in the furniture industry.

2) Risk Measurement Based on IT Standard. After identifying the risk factors that arise, the risk is measured using the help of the COBIT 5 DSS. Each risk factor will be classified based on the COBIT 5 DSS process, namely:

- DSS01 Manage Operations. Coordinate the implementation of activities for internal and external parties. This process includes five sub-processes containing statements of consent by the respondents.
- DSS02 Manage Service Requests and Incidents. Provide effective responses regarding incidents that arise, starting from actions before the incident occurs and handling when the incident occurs until after the incident occurs. This process includes seven sub-processes containing statements of consent by the respondents.
- DSS03 Manage Problems. Identify problems to produce repair reports. This process includes five sub-processes containing statements of consent by the respondents.
- DSS04 Manage Continuity. Define corrective rules and procedures to prevent the risk from recurring. This process includes eight sub-processes containing statements of consent by the respondents.
- DSS05 Manage Security Services. Protect company information and access rights. This process includes seven sub-processes containing statements of consent by the respondents.
- DSS06 Manage Business Process Controls. Define appropriate control information to generate valid data. This process includes six sub-processes containing statements of consent by the respondents.

From the results of risk measurement, the impact value of each risk is obtained as a consideration for making risk mitigation mapping to implement the decision support system.

3) Critical Risk Factors Assessment. Each risk factor is assessed after the implementation of the decision support system. The assessment is based on each COBIT 5 sub-processes capability level to find out if any emerging risks have been handled following the IT Governance mechanism. The assessment process is carried out by distributing questionnaires to respondents containing statements on risk management after the implementation of the decision support system using capability level assistance.

4) Risk Evaluation. The results obtained from the risk assessment process are evaluated to define any negative scenarios arising from each risk after implementing the system. Negative scenarios are created as a basis for risk evaluation to select risk management strategies and define appropriate risk plans. A likelihood scale is used to find out how likely each risk is to occur. Gbadeyan et al. [23] describe the possibility of each event in a negative scenario based on a likelihood assessment scale with criteria [24].

- High. The risk is likely to occur or occur between ten and one hundred times a year.
- Moderate. The risk is likely to occur between one to ten times a year.
- Low. The risk is unlikely or occurs less than once yearly but can occur more than once every ten years.

5) Risk Mitigation and Contingency Plan. The risk evaluation results in a mapping of mitigated negative risk scenarios based on standard governance practices. Each risk requires input data to obtain risk management outputs.

6) Risk Control and Monitoring. This last stage focuses on implementing risk response plans and corrective actions in case of deviations in achieving supply chain effectiveness and efficiency, which is implemented in a decision support system.

C. Define Object Research

This research uses SCRMP and IT Governance approach (DSS COBIT 5). The object of this research focuses on three furniture manufacturing industries. First, Central Furniture Jepara produces cupboard furniture, sofas, chairs, dining tables, and more with authentic teak wood. The business process currently carried out by Central Furniture Jepara is experiencing problems when collecting data on customers who buy products to make orders. In this process, difficulties arise in processing order administration, starting with choosing shipping methods, customer categories, and more. Then, problems occur when withdrawing data from marketing to accounting due to data collection in the accounting department, which is still lacking, especially in making sales invoices and travel documents. Data collection on charts of accounts, cost codes, budgets, tax-affected companies, and others still uses printed paper. If there are changes, it will undoubtedly affect other stored data. In the furniture industry, Hema Medhajaya has problems in terms of financial reporting. Hema Medhajaya produces ergonomic chairs, desks, and tables for office use. This industry is often hampered in the financial reporting process due to standard operating procedures that have not been defined, such as insufficient report data, incorrect calculations in the production process, and many more.

Then, Lita Home Industry produces leather chairs or sofas and traditional wooden tables for household use. Lita Home Industry has production problems, such as data collection for making work orders slower due to a mismatch in the stock of raw materials. In addition, production conditions that rely only on machine assistance cause the production process will be hampered if there is a machine breakdown. When a production machine breaks down, the handling of repairs is still not standardized because there is no list of precautions to be taken, a list of handling when it occurs to handling after the incident. Transferring or migrating data from one division to another requires considerable time and effort due to the large amount of data assigned one by one. Based on the business conditions experienced by the three manufacturing industries, the risk always occurs due to an uncertain business environment.

D. Data Collection

The data collection process comes from interviews and questionnaires that have been distributed to every part of the furniture industry [25]. The focus of the questions used are:

- Are there activities to support the supply chain services?
- Is there an operational schedule and performance management for each supply chain functional activity?
- Has there been verification that all supply chain process data is received and processed completely, accurately, and on time?
- Is there an incident definition, especially for significant and security incidents?
- Have there been activities for documenting and communicating problem findings to stakeholders?

E. Current Supply Chain Process

The supply chain process in the furniture industry currently includes six parts.

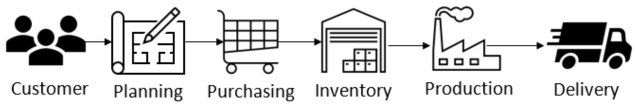

Fig. 2 Supply Chain Process in Furniture Industry

Figure 2 illustrates the supply chain processes in the furniture manufacturing industry. The process starts with the customer who submits a product order. The customer will provide product orders to sales marketing information, such as the number of products ordered and the delivery date. The furniture industry receives the order. The marketing team will send an order letter to the accounting department to create a work order for the production department. The production purchasing department will purchase raw materials after receiving a work order made by the accounting department. The production department will contact the supplier to buy raw and supporting materials and determine the date of receipt. The supplier will send the product and the bill to be paid by the furniture industry. If the order for raw materials and supporting components has arrived, quality and quantity checks are carried out on these materials. If the quality of raw materials and supporting members meet the standards, they are stored in the warehouse. After that, the production department will withdraw these materials into finished furniture ordered by the customer. After completion of production, furniture will be put into the warehouse for delivery by courier.

III. Results and Discussion

A. Supply Chain Risk Factors and Triggers

The emergence of risks in each supply chain activity has not yet received more attention in the handling process [26]. Wuni et al. [27] revealed that risk is unavoidable, so it is crucial to plan, identify, assess, prioritize, and monitor risk factors to control potential negative risk impacts. Fan and

Stevenson stated that risk identification aims to find all relevant risks [28]. Identifying all risk factors in the furniture industry can include several things, such as upstream supply chain management, operational risks, and risks associated with downstream supply chain management in Table 1.

TABLE I
RISK FACTORS AND TRIGGERS OF SUPPLY CHAIN FURNITURE INDUSTRY

Factors	Triggers
Facility operational procedures	Inaccurate demand forecasts, large market competition, failure to select the suppliers, delivery performance, and not having the goods to meet customers' needs.
Incidents	Natural disasters, inefficient use of resources for the production and delivery of goods, cost of capacity, higher product cost
Reports	Communication difficulties, supplier fulfillment, and not putting contingencies in place in case something goes wrong.
Policy and Recovery	Information infrastructure breakdowns, government regulations, key management, personnel, and business process changes, and not complying with environmental regulations or labor laws.
User Access	Lack of knowledge, a good understanding of technology and its operation, outage of system.
Data Validity	Lack of effective system integration, percentage of raw material, and not implementing proper cybersecurity policies and controls to protect against cyber-attacks.

Table 1 shows the risk factors and triggers in the furniture industry that can emerge in the future. Therefore, it is necessary to identify the uncertainties and possible sources of disruption in the supply chain, both internally and externally. These factors are then measured by risk to determine the magnitude of the consequences of all existing risks and whether they significantly impact and threaten existing resources. Risk measurement based on IT standard COBIT 5 with domain Deliver, Service, and Support (DSS).

B. Supply Chain Risk Measurement Based on IT Standards

Xu et al. [29] stated that sustainable supply chain management also involves measuring supply chain sustainability risks. COBIT 5 management guide could be an effective tool for expanding risk assessment information in the supply chain. Supply chain measurement uses the capability to describe how a process is already running and whether it is in line with expectations. In addition, it is also found that process results are still lacking, thus requiring special attention and improvement. The capability level assessment is divided into level 0 (not yet implemented and achieving the process's goals). Level 1 (having completed the process objectives). Level 2 (implementing the model to achieve process objectives but not yet controlled according to standards). Level 3 (implementing the model following the criteria). Level 4 (the process is following a predetermined minimum threshold) and level 5 (the process is continuously improved and directed towards business goals) [30], [31]. The capability level analysis uses COBIT 5 DSS assistance to determine the measurement value of risk impact before evaluating and designing mitigation and contingency plans in Table 2.

TABLE II
RISK MEASUREMENT WITH COBIT 5

Domain	Description	Factors	Impact
DSS01	Manage Operation	Facility operational procedures	2.42
DSS02	Manage Service Requests and Incidents	Incidents	2.5
DSS03	Manage Problems	Reports	2.61
DSS04	Manage Continuity	Policy and Recovery	2.56
DSS05	Manage Security Services	User Access	2.6
DSS06	Manage Business Process Controls	Data Validity	2.64

Table 2 describes the risk impact value obtained and is at level 2 based on the provisions of IT Governance. The risk factors that arise have a large enough impact on supply chain activities. Therefore, it is necessary to reassess to obtain better implementation results and achievements. The measurement process comes from distributing questionnaires to every part of the furniture industry. The results of the risk measurement receive the impact value of each risk as a consideration for making risk mitigation by implementing a decision support system.

C. Critical Risk Factor Assessment

Jalilvand et al. [32] stated that supply chain management is managing a network of suppliers, customers, and stakeholders to exchange required resources, and these resources become the primary support services for customers. Risk assessment uses the stages in the ISO 31000:2009 framework, starting from identification, analysis, and risk evaluation [33]. The assessment of risk factors is based on the capability level of each COBIT 5 sub-process to determine the suitability of handling emerging risks using IT Governance in Table 3.

TABLE III
CRITICAL RISK FACTOR ASSESSMENT OF SUPPLY CHAIN MANAGEMENT WITH DSS COBIT 5

COBIT 5 Process	F1	F2	F3	F4	F5	F6
DSS01.01	3.27	3.5	3.23	3.3	3.37	3.37
DSS01.02	3.08	3.08	3.25	3.29	3.25	3.13
DSS01.03	3.03	3.17	3.33	3.39	3	3.33
DSS01.04	2.84	3.27	3.23	3.25	3.36	3.19
DSS01.05	2.99	3.08	3.09	3.2	3.12	3.06
DSS02.01	3.13	3.5	3.5	3.3	3.6	3.4
DSS02.02	3	3.28	3.33	3.33	3.28	3.5
DSS02.03	3.61	3.56	3.34	3.67	3.22	3.84
DSS02.04	3.44	3.5	3.5	3.34	3.5	3.5
DSS02.05	3.21	3.33	3.25	3.13	3.33	3.25
DSS02.06	3.25	3.5	3.5	3	3.5	3.5
DSS02.07	3.13	3.17	3	3.25	3.42	3
DSS03.01	2.75	2.97	3.25	3.2	3.08	3.17
DSS03.02	2.89	3.22	3.17	2.89	3	3.22
DSS03.03	2.75	3.25	2.83	3	3.25	3.33
DSS03.04	3.36	3.36	3.44	3.34	3.31	3.45
DSS03.05	3.06	3.22	3.06	3.11	3.14	3.22
DSS04.01	3.04	3.33	3.25	3.21	3.21	3.42
DSS04.02	3	3.11	3.13	3.07	3.23	3.15

DSS04.03	3.02	3.13	3.13	3.04	3.13	3.23
DSS04.04	3.19	3.17	3.25	3.28	3.17	3.22
DSS04.05	3	2.92	3.17	3.21	3.42	2.75
DSS04.06	3	3.22	3	3.17	3.22	3.22
DSS04.07	2.89	3.07	3	3.17	3.17	2.93
DSS04.08	2.92	2.92	3.04	3.25	3.04	3
DSS05.01	3.19	3	3	3.34	3.17	3
DSS05.02	3.19	3.22	2.89	3.34	3.17	3.11
DSS05.03	3.2	2.91	2.95	3.11	3.13	2.95
DSS05.04	3.44	3.19	3.19	3.5	3.25	3.19
DSS05.05	3.6	3.15	3.14	3.57	3.29	3.07
DSS05.06	3.5	3.1	3.1	3.5	3.2	3.1
DSS05.07	3.13	3.1	3	3.3	3.4	2.8
DSS06.01	3.3	3.27	2.77	3.3	3.5	2.97
DSS06.02	3.17	3.23	3.26	3.21	3.34	3.15
DSS06.03	2.92	3.2	3.14	3.17	3.28	3.06
DSS06.04	3.33	3.03	3.27	2.9	2.93	3.3
DSS06.05	2.95	2.95	3.33	2.84	3.06	3.06
DSS06.06	3.17	3.43	3.3	3.2	3.5	3.23
Total	3.13	3.2	3.17	3.23	3.26	3.19

Table 3 shows the results of supply chain risk assessment using COBIT 5. The identified risk factors are divided into six, namely facility operational procedures (F1), incidents (F2), reports (F3), policy and recovery (F4), user access (F5), and data validity (F6). These results indicate that each risk factor assessed has succeeded in reaching capability level 3 after implementing the decision support system. Chandra et al. [34] stated that a decision support system could help make decisions using the data already available by the system. The implementation results estimate each risk's costs or benefits to identify control strategies using a decision support system. The supply chain process has been standardized within the furniture industry as a whole using the help of a decision support system. Information technology process standards are based on IT Governance and apply in the furniture industry. However, even though the results of the risk assessment are under existing standards, it is necessary to carry out a risk evaluation of the supply chain to define any negative scenarios that arise from each risk after the implementation of the system so that risk management can be prioritized based on its level.

D. Supply Chain Risk Evaluation

Basset et al. [35] stated that the industry could use a likelihood scale to understand the nature of risk and assess the likelihood of it occurring. The evaluation of risk scenarios aims to provide adequate material for making supply chain management decisions, adapted from COBIT 5.

TABLE IV
MAPPING RISK FACTORS TO SPECIFIC AREAS

Factors	Negative Scenario	Likelihood of Occurrence
Facility operational procedures	Production and delivery risks in the supply chain are disrupted.	High
Incidents	Volatile prices and costs cannot ensure timely and reliable delivery.	Moderate
Reports	Inflation and variations in currency exchange rates would affect financial concerns.	Moderate
Policy and Recovery	Working conditions under unhealthy operations.	Low
User Access	Failure to involve technology development.	Low
Data Validity	The system lost control, service quality, and delivery performance.	High

Table 4 shows that there are two high-risk risks, namely facility operational procedures and data validity. Both of these risks have an impact on inventory management and outsourcing logistics activities. Data inconsistency issues that come due to overstock, understocking, expired stock, and not achieving the target have caused problems for management. The furniture industry is currently also handing over logistics activities to third parties. In order to make the logistics network more efficient, the company chooses the right supply chain model, cooperates with partners according to the supply chain, and adopts new technology to make better decisions [36]. Then, moderate risks are incidents and risks, as well as the reports section. Both risks have an impact on how to identify problems based on reports from priority levels and make communication reports on problem-solving progress. The risks that fall into low status are policy and recovery and user access because they only have an impact on identifying software that damages and implementing preventive procedures, managing user access rights, identifying documentation of control activities in business processes for strategic and operational needs, and classifying information assets used.

E. Using COBIT 5 DSS Processes to Mitigate Negative Risk Scenarios

Mitigation actions for negative risk scenarios in the form of emergency procedures should be developed based on the supply chain model. The purpose of this process is to control the potential risks in a project, so a specific action plan needs to be developed into a scenario. Qazi et al. [37] stated that risk mitigation strategies are applied to reduce the possibility of occurrence or negative impacts of risks. Therefore, the risk evaluation results are implemented in mapping mitigated negative risk scenarios based on standard governance practices. Each risk requires input data to obtain the output of risk management in Table 5.

TABLE V
MAPPING MITIGATE NEGATIVE RISK SCENARIOS WITH COBIT 5

Negative Scenario	Risk Migration Using COBIT 5 DSS Processes		
	Governance Practices	Input	Output
Production and delivery disrupted.	Maintain operational procedures and tasks consistently.	Operation service definitions.	Operational schedule, backup log
Volatile price and cost.	Verify satisfactory incident resolution.	Risk-related root causes.	Incident status and trends report.
Inflation would affect the financial concerns.	Collect and analyse data to identify emerging trends that may indicate problems.	Incident resolutions, criteria for problem registration.	Problem status reports, problem resolution reports.
Working conditions are unhealthy.	Develop a business continuity plan based on the strategy documents.	List of personnel requiring training.	Monitoring results of skills.
Failure technology.	Ensure that all users have information	Data classification guidelines.	Approved user access rights,

	access rights with their business requirements.		accounts, and privileges.
System lost control, service quality.	Ensure that business information.	Data classification guidelines, data integrity procedures.	Error reports and root cause.

Table 5 presents a mapping of negative risk scenarios based on governance practices. Reducing risk requires some input data that handles risk. These risk-handling inputs have produced outputs for supply chain risk improvement, improving supply chain operations according to recommended governance practices for risk management. The mapping carried out in the negative risk scenario using COBIT 5 can provide a clear picture for prioritizing risk management.

F. Control and Monitoring Risk for Decision Support System

The control and monitoring process is an important step in the risk management process. Risks need to be monitored to ensure environmental changes that occur do not change the priority of risks and ensure effective management processes in design and operation [38]. Tsang et al. [39] stated that monitoring and controlling the industrial environment is considered important to increase product visibility in the supply chain. The risk control and monitoring process for implementing the decision support system discusses how to implement a risk response plan and corrective actions if deviations occur in achieving supply chain effectiveness and efficiency. The achievement of supply chain risk improvement by implementing a decision support system that requires control and monitoring processes.

To overcome the risk of facility operational procedures by collecting data for production needs. The data is in the form of master data for components, leather fabrics, finished goods, unit data, domestic/local master suppliers, overseas master suppliers, types of transactions, warehouse lists, and many more. The calculation formula to estimate the work of finished furniture can also be managed using this system. Each master data is complete with adding, updating, viewing, and deleting data. Thus, the risks that arise during operations can be minimized. Risk of incidents in the furniture industry by implementing several functions of the decision support system, such as data retrieval, data processing at the beginning of the year, and data transfer from one division to another. Then, implement a decision support system to overcome the risk of making reports by displaying each message generated first before being printed to be submitted to stakeholders. Each piece of information also includes each stakeholder's signature to maintain its validity.

According to the latest update in a specific month, policy and recovery risk uses a decision support system with a data repair function. This data correction facilitates the user if there is an error during data creation or retrieval. In addition, in the accounting section, the system provides integrated master data in case of changes. Masters provided include account groups, account posts, cost codes, initial account balances, customers, employees, sales assistants, budgets, agents, a list of taxable entrepreneurs, taxable banks, and many more. User access risk by implementing the decision support system function, each module in the system added a user account that accesses each existing sub-menu, thereby reducing actions from unauthorized parties. The risk of data validity by applying the mail-order category function to maintain data validity when forwarded to other sections.

IV. CONCLUSION

Uncertainty about supply chain activities can make them more vulnerable and at high risk. As a result of this uncertainty, there is a risk of failure in supply chain operations in the form of demand and supply uncertainty, inability to respond to changes in demand quickly, failure to monitor and reduce production errors, a decline in market share, natural disasters, inefficient use of resources and user access. It is crucial to manage supply chain risk before adopting it in a system using the Supply Chain Risk Management Process (SCRMP). SCRMP is combined using IT Governance, namely COBIT 5, with the Deliver, Service, and Support (DSS) domain to assist the identification process of mitigation strategies. The identified risk factors are divided into facility operational procedures, incidents, reports, policy and recovery, user access, and data validity. Measuring the value of the risk impact on supply chain activities produces a large enough effect on operations. Due to the significant impact, the supply chain was reassessed after implementing the decision support system. This assessment results in a standardized supply chain process within the furniture industry using a decision support system. The next stage is to conduct a supply chain risk evaluation to define negative scenarios and risk management strategies based on the level after system implementation. Mapping of negative risk scenarios based on governance practices is carried out by outlining data that handles risks to produce outputs for supply chain risk improvement. This research aims to improve supply chain risk by implementing a decision support system to reduce production risk. Supply chain risks that can be reduced are data retrieval incidents, reporting delays, data updates, user access rights, and data consistency restrictions. The result of this research is implementing a decision support system based on mapping to mitigate negative risk scenarios so that the system can manage risks in the supply chain.

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