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ANALYSIS OF FUEL OIL SUPPLY CHAIN RISK MANAGEMENT AT JATINEGARA LOCOMOTIVE DEPO

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PT. Kereta Api Indonesia (Persero) or PT. KAI is one of the State-Owned Enterprises which is engaged in inland transportation, namely trains. In the process of providing transportation services, PT. KAI requires a continuous supply of fuel oil. In the operation of the fuel supply chain, PT. KAI has potential risks such as losses and several other risks that can harm the company. From these problems, this research tries to conduct a risk analysis by applying the ISO 31000 risk management framework to determine the effectiveness of PT. KAI in managing fuel supply chain risks. The distribution of subsidized fuel has been implemented before 2012 by PT KAI is the loco scheme, where a high level of potential risk is found outside the risk tolerance limit so that PT. KAI responds to this problem with risk transfer. Where is PT. KAI tries to take risks by using third-party services to provide and manage fuel for train operations' consumption needs.

Keywords: *Distribution of Fuel Oil, ISO 31000, Risk Management, Risk Transfer*

1. INTRODUCTION

1.1 Research Background

Land transportation is one of the technology sectors that is always experiencing development. The increase in the number and types of motorized vehicles and the flow of traffic that crowded the streets from day to day is proof that the development of this innovation is so massive. Innovation in this field goes on and on along with the human need for greater reach and cruising. But on the other hand, if not handled properly this technology can turn into a very dangerous killing machine. A common phenomenon that occurs in big cities in Indonesia, public vehicles are small but very large in number, not balanced with the number of users. Public transportation is more focused on business interests, without regard to other aspects, including the interests and safety of the community as consumers. On the one hand, granting a route permit is an opportunity for officials to get new income. However, as a result of the policy, it is as if the policy owner is considered to be underestimated in calculating the number of small vehicles that are so large that eventually they become the source of traffic congestion and density [1]. The consequence of this problem is the need to hold interventions on the public transport system and the urban transportation system. So in this case the train transportation mode is one of the solutions that has an important role in dealing with congestion. In addition to being mass transportation demand by consumer for timeliness, the train is also able to accommodate more passengers for once trip. The use of trains is predicted to continue to increase in the years to come because all traffic congestion problems as explained above can be overcome with more train operations. Improvement efforts have been carried out to provide better train services. The plan to add new locomotive facilities and increase the length of the railroad tracks will certainly increase the cost of using fuel to operate the locomotive and Diesel Rail Train.

Referring to the problem, PT. KAI faced a new problem, namely the availability of fuel to run its services. In its implementation before 2012, PT. KAI uses the loco scheme in which fuel is transported from Pertamina's fuel depots to PT. KAI's storage tanks, where PT. KAI has to hire more transportation services, manage availability and maintain the quality of fuel while distributing it to the railroad tanks by itself.

In applying with the loco supply chain scheme (before 2012), there are several potential risks / disturbances that have the potential to arise in the business operations of PT. KAI, including the following:

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1. Limitations of human resources, there is no task force which deal specifically fuel management.
2. There is overlapping work, which should be a worker working on the reliability and railroad facilities
3. There is a potential losses, when sending the fuel from Pertamina Depot to tanks PT.KAI.
4. There is a potential losses when fuel is stored and used due to the installation of fuel leaks tanks,evaporation, discrepancy accuracy of measuring instrument.
5. The difficulty of monitoring and controlling fuel usage, because it still uses manual methods without War Room.
6. Operational cost are not effective and efficient.
7. Environmental pollution

1.2 Research Purpose

1. Risks Identification That Affect the Achievement of Objectives In The Supply Chain Of Fuel At PT Kereta Api Indonesia (Persero).
2. Risk Management In The Form Of Risk Mitigation That Is Applied To The Supply Chain Of Fuel At PT Kereta Api Indonesia (Persero).

2. RESEARCH METHODOLOGY

2.1 Research flow

This research is a mixed research type. The purpose of this mixed research is to combine quantitative and qualitative research. Our quantitative research is based on the numbers from the data we get from the internal party of PT. KAI. Then we conducted qualitative interviews with employees of PT. KAI. Furthermore, we processed the data obtained based on SNI ISO 31000.

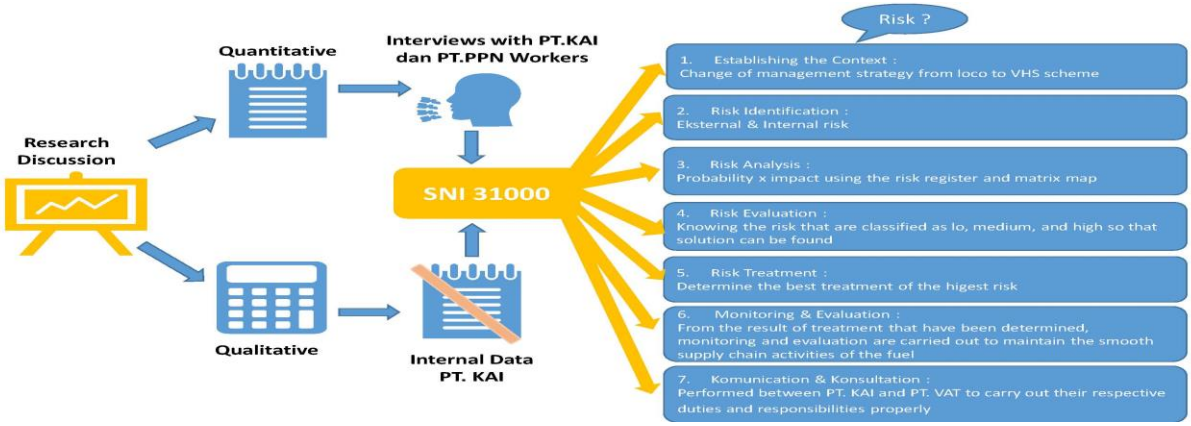


Figure 1 : Process Flow Approach

In the figure 1 above describes the flow of the process in this research.

2.2 Risk Management Principle

According to [2-10] an organization's risk management can be effective if it adheres to the following principles:

1. Risk management protects and creates added value.
2. Risk management is an integral part of organizational processes.
3. Risk management is part of the decision-making process.
4. Risk management specifically addresses the uncertainty aspect.
5. Risk management is systematic, structured, and timely.
6. Risk management based on the best available information.
7. Risk management is unique to its users (tailored).
8. Risk management considers human and cultural factors.
9. Risk management should be transparent and inclusive.
10. Risk management is dynamic, iterative, and responsive to change
11. Risk management should facilitate continuous improvement and improvement of the organization.

2.3 Supply Chain Management

Supply Chain Management (SCM) is an integration of raw material suppliers, producers, distributors, resellers to consumers [10], [11]. SCM is a relationship between suppliers of raw materials, production processes, transportation, planning and controlling systems, distribution systems including financial problems and information flow of a product. Supply Chain Management is an integrated application that provides information systems support to management in the procurement of goods and services for the company while managing relationships among partners to maintain the level of product and service availability needed by the company optimally. SCM integrates order delivery and its processes, procurement of raw goods, order tracking, information dissemination, collaborative planning, performance measurement, after sales service, and new product development.

According [12] supply chain management is the integration of procurement activities of materials and services, changing the form into semi-finished goods and finished product, as well as the delivery of goods to customers. All of these activities include purchasing and outsourcing activities, as well as other functions that are important to the relationship between suppliers and distributors. The purpose of SCM is to make effectiveness and efficiency starting from suppliers, manufacturers, warehouses and stores [13].

2.4 Supply Chain Risk Management

Supply chain risk management is a coordinated activity among all supply chain actors and concerns the risk of potential deviations that occur in the entire set of production processes and mitigation management such as supply management, demand management, production management, information management and safety management [14]. Unidentified risks can lead to misdirection in the supply chain risk management process (such as making risk mitigation plans), giving rise to incorrect or inappropriate strategies to control these risks and this can lead to greater losses [15]

2.5 ISO 31000

The ISO 31000 international standard issued by The International Organization for Standardization can be used by all types of organizations in dealing with various risks inherent in organizational activities. ISO 31000 provides risk management principles, frameworks, and processes that can be used as risk management architecture in an effort to ensure the effective application of risk management.

One thing that distinguishes ISO 31000 from other risk management standards is that the ISO 31000 perspective is broader and more conceptual compared to the others. This is indicated by the existence of a risk management framework which is an implementation of quality management principles and is known as " Plan-Do-Check-Action ". In the risk management framework, this is stated by planning the risk management framework, implementing risk management, monitoring and review, and continuous improvement. The following figure 2 is a framework from ISO 31000:

Figure 2: Management Risk Process According to ISO 31000

1. Establishing the context, determining the risk management context is closely related to establishing the objectives, strategies, scope and other parameters related to the risk management process of a company. This process shows the relationship or relationship between the issues that will be managed risk with the company environment (external & internal), the risk management process, and the size or risk criteria that would be standardized.
2. Risk identification, risk assessment includes phases of risk identification is to identify risks that may affect the achievement of corporate goals. Based on the risks that have been identified can be compiled a list of risks to then be measured risk to see the level of risk.

3. Risk analysis, risk measurement in the form of risk analysis that aims to analyze the likelihood and impact of identified risks. The measurement results are in the form of a risk status that shows the size of the risk level and a risk map which is a picture of the distribution of risks in a map. Another stage in risk assessment is risk evaluation which is intended to compare the results of risk analysis with risk criteria that have been determined to be used as a basis for implementing risk management.
4. Risk evaluation, risk management in the form of planning for mitigating risks to obtain alternative solutions so that risk management can be applied effectively and efficiently. Several alternative risk management that can be taken are aimed at avoiding risks, mitigating risks to reduce the likelihood or impact, transferring risk to third parties (risk sharing) and accepting risk (risk acceptance).
5. Risk Treatment, including the selection of one or more options for managing risk, and implementing those options. Once implemented, treatment provides or modifies controls. Risk treatment involves the process of assessing risk treatment, deciding whether the level of residual risk can be tolerated, if it cannot be tolerated then create a new risk treatment and assess the effectiveness of the treatment.
6. Communication & consultation, with internal and external stakeholders must be carried out at all stages of the risk management process. A communication and consultation plan must be developed at an early stage. Communication must include issues related to the risk itself, its causes, its consequences (if known), and the steps taken to deal with it. Effective external and internal communication and consultation must take place to ensure that they are responsible for carrying out the risk management process and stakeholders understand the basis of how decisions are made, and the reasons why certain actions are needed.
7. Monitoring and review must be part of the risk management process plan and involve inspection and supervision. This can be done periodically or *ad hoc*. Responsibilities for monitoring and review must be clearly defined. The progress of implementing risk treatment produces a performance measure. Results can be incorporated into management performance, measurement and reporting of external and internal activities. The results of monitoring and review must be recorded and reported externally and internally, and must also be used as input from a review of the risk management framework.

3. RESULT AND DISCUSSION

The process of supply chain risk management of fuel oil at PT. Indonesian Railways according to ISO 31000:

3.1 Establishing the Context

In 2012, PT. Kereta Api Indonesia (Persero) has changed its fuel supply chain management strategy by conducting a joint operation with PT. Pertamina Patra Niaga where PT. KAI will pay for fuel oil owned by PT. Pertamina if the fuel has been entered in tank (Locomotive, Genset and Diesel Rail Train) owned by PT. KAI , this is called the project *Vendor Held Stock* (VHS). In the process of distributing fuel starting from PT. Pertamina then goes to PT. Pertamina Patra Niaga to enter PT. KAI is done by forecasting the need for fuel by the work unit which is then sent to the main work unit at the regional operations office and then forwarded to PT. Pertamina (Persero) which will be forwarded to PT. P ertamina Patra Niaga as an executor from PT. Pertamina (Persero), of course, after obtaining the quota approval from the BPH Migas.

3.2 Risk Identification

Based on the results of risk and hazards identification [16], and data compiled from interviews of several employees of the Jatinegara Locomotive Dipo and the Tanah Abang Locomotive Dipo about the fuel supply chain by PT. KAI before 2012 found several risks as follows:

1. Limitations of human resources, there is no task force which deal specifically fuel management.
2. There is overlapping work, which should be a worker working on the reliability and railroad facilities.
3. There is a potential losses, when sending the fuel from Pertamina Depot to tanks PT.KAI.
4. There is a potential losses when fuel is stored and used due to the installation of fuel leaks tanks, evaporation, discrepancy accuracy of measuring instrument.
5. The difficulty of monitoring and controlling fuel usage, because it still uses manual methods without War Room.
6. Operational cost are not effective and efficient.
7. Environmental pollution.

Probability and impact are used to measure the level of risk. The level of risk is the multiplication of probability scores and impact scores obtained from respondents.

To measure risk using a formula like the following.

Risk Identification = probability x effect potential

Furthermore, these risks can be grouped in the probability and impact matrix to find out which risks are likely to occur large and have a major impact on the supply chain fuel activities at PT. KAI. From the data in Table 1, it is found that there are many risks that need to be analyzed and evaluated and treatment is determined.

Table 1: Supply Chain Fuel Risk Identification at PT. Kereta Api Indonesia (Persero)

No	Risk Identification	Information
1	Limitations of human resources, there is no task force which deal specifically fuel management	In the organizational structure in the Locomotive Depot, there are no human resources specifically handling fuel management
2	There is overlapping work, which should be a worker working on the reliability and railway facilities	Worker in the Locomotive Depot, whose main duty is to maintain the reliability of the railway facilities by 10 people, 4 of whom work on fuel management work
3	There is a potential losses, when sending the fuel from Pertamina Depot to tanks PT. KAI	Loses occur approximately as much as 3000liters every month
4	There is a potential losses, when fuel is stored and used due to the installation of fuel leaks tanks, evaporation, discrepancy accuracy of measuring instrument	The storage tank capacity is 16.000 liters, and loses occur approximately 1.200 liters per month
5	The difficulty of monitoring and controlling fuel usage, because it still uses manual methods without war room	There is no system that controls the fuel supply chain process, and at the time of the loco system the recording process is still manual
6	Operational cost are not effective and efficient	The budget spent on managing BBM is Rp. 2 billion every year
7	Environment pollution	Environmental damage often occurs due to tank leakage, causing the surrounding plants to die

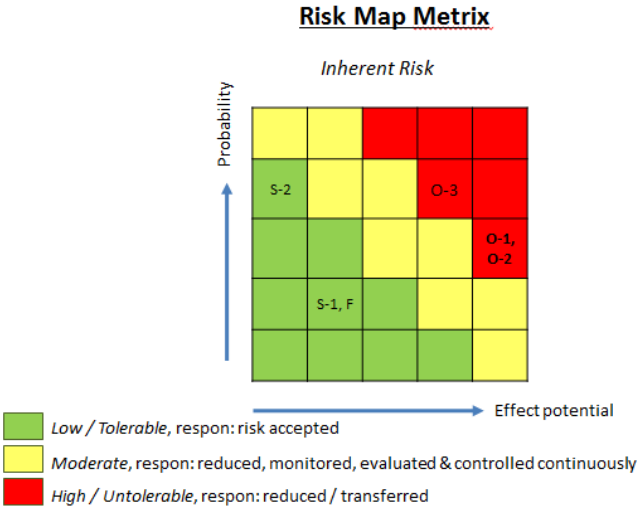
3. 3 Risk Analysis

From the results of the identification of risks above, then analyzed is the result of the potential risks to the effectiveness of fuel supply chain activities at PT. KAI as Table 2. From the risk table above, the risk of activities that affect the fuel supply chain is determined by the probability scale and its impact, by grouping them using codes so that they are easier to enter into the matrix ratio table, then the potential risks are searched. After the probability scale, impact and risk importance are known, the next step is to map the value into the matrix. The risk assessment matrix can be seen in Figure 3.

Table 2. Supply Chain Fuel Risk Analysis at PT. Kereta Api Indonesia (Persero)

Risk Management Matrix (Risk Register)					
No	**Risk Event & Description**	**Probability**	**Impact**	**Code / ID Category**	**Early Risk Indicator**
1	Limited human resources, there is no unit that specifically handles fuel management	2	2	***HR-1***	Unprofessional handling so that work effectiveness is lacking.

2	Overlaping the work of HR, whose function is to maintain the reliability of railway facilities	4	1	***HR-2***	Employee productivity and quality of work is not good
3	There is potential Losses when shipping fuel from Pertamina Depot to PT. KAI Stockpile	3	5	***Operational1 (O-1)***	Potential transport fraud
4	The potential Losses when fuel is stored and used due to leaks in fuel installations, evaporation, inaccura-cies	3	5	***Operational2 (O-2)***	Potential theft or sabotage of BBM
5	Uncontrolled and monitored process	4	4	***Operational3 (O-3)***	Monitoring and control is difficult
6	Budget waste	2	2	***Finansial (F)***	High fuel budget costs
7	Environmental pollution	1	4	***Environment (E)***	The existence of installation leaks that make the environment polluted



Figue 3 : Supply Chain Fuel Risk Matrix Map at PT. Kereta Api Indonesia (Persero)

3.4 Risk Evaluation

Based on the results of the risk analysis by determining the probability value multiplied by the impact and setting the code and indicators on the supply chain fuel at PT Kereta Api Indonesia (Persero) prior to the application of the VHS scheme, are as follows:

1. Limitations of human resources, there is no task force which deal specifically fuel management. The probability is 2 and the impact is 2 with the SDM-1 (S-1) code, where the indicator is unprofessional handling so work effectiveness is reduced. Previous risk profile 4 to 1
2. There is overlapping work, which should be a worker working on the reliability and railroad facilities. The probability is 4 and the impact is 1 with the HR-2 (S-2) code, where the indicators are employee productivity and quality is not good. Previous risk profile 4 to 1
3. There is a potential losses, when sending the fuel from Pertamina Depot to PT.KAI's tank. The probability is 3 and the impact is 5 with the code Operational -1 (O1), where the indicator is the potential for transport fraud. Previous risk profile 15 to 4.
4. There is a potential losses when fuel is stored and used due to the installation of fuel leaks tanks, evaporation, discrepancy accuracy of measuring instrument. The probability is 3 and the impact is 5 with the Operational-2 (O-2) code, where the indicator is the presence of fuel theft and sabotage. Previous risk profile 15 to 4.

5. The difficulty of monitoring and controlling fuel usage, because it still uses manual methods without War Room. The probability is 4 and the impact is 4 with the Operational-3 (O-3) code, where the indicators are that monitoring and control are difficult. Previous risk profile 16 to 2.
6. Operational cost are not effective and efficient. The probability is 2 and the impact is 2 with the Financial (F) code, where the indicator is high fuel budget costs. Previous risk profile 4 to 2.
7. Environmental pollution. The probability is 1 and the impact is 4 with the Environment code (L), where the indicator is the existence of leaky installations that make the environment polluted. Previous risk profile 4 remained 4. As stated in the following table 3:

Table 3 : Supply Chain Fuel Risk Evaluation Risk at PT. Kereta Api Indonesia (Persero)

Risk Management Matrix (Risk Register)								
No	*Risk Event & Description*	**Probability**	**Impact**	**Code / ID Category**	*Early Risk Indicator*	*Suggested Risk Response*	**Probability**	**Impact**
1	Limited human resources, there is no unit that specifically handles fuel management	2	2	HR-1	Unprofessional handling so that work effectiveness is lacking.	Hire human resources who will master the management of fuel	1	1
2	Overlaping the work of HR, whose function is to maintain the reliability of railway facilities	4	1	HR-2	Employee productivity and quality of work is not good	Hire human resources who will master the management of fuel	1	1
3	There is potential Losses when shipping fuel from Pertamina Depot to PT. KAI Stockpile	3	5	Operational-1 (O-1)	Potential transport fraud	Implement a COD system in the procurement process	2	2
4	The potential Losses when fuel is stored and used due to leaks in fuel installations, evaporation, inaccuracies	3	5	Operational-2 (O-2)	Potential theft or sabotage of BBM	Hire experienced handling services	2	2
5	Uncontrolled and monitored process	4	4	Operational-3 (O-3)	Monitoring and control is difficult	Rent a Warroom for monitoring	1	2
6	Budget waste	2	2	Finansial (F)	High fuel budget costs	make fuel use efficient	1	2
7	Environmental pollution	1	4	Environment (E)	The existence of installation leaks that make the environment polluted	Hire experienced handling services	1	4

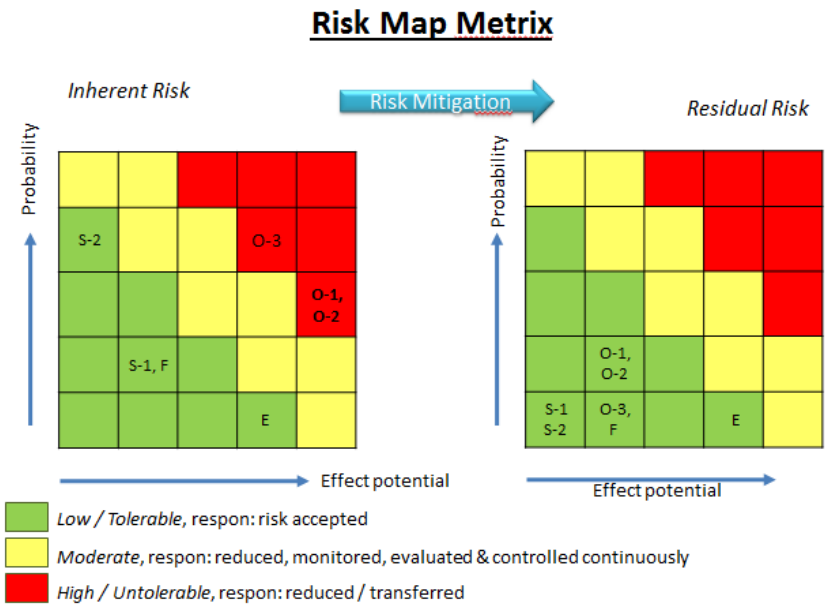


Figure 4: Supply Chain Fuel Risk Mapping Result at PT. Kereta Api Indonesia (Persero)

From the results of risk mapping in Figure 4, shows that the risks are included in the high category is the potential for loses caused by the delivery of fuel from Depot Pertamina to the PT.KAI's tank, where profile previous risk 15 to 4 and potencial losses when fuel is stored as a result of leakage on the installation of fuel, evaporation. With this mapping, as known where the greatest risk and can be reduced to be low risk by way of giving a solution of the risks that are arising in the activities of the fuel supply chain at PT. Kereta Api Indonesia (Persero)

3.5 Risk Treatment

After evaluating the risks arising from the supply chain fuel activities at PT. KAI, then risk treatment can be taken by managing fuel with the *Vendor Held Stock* (VHS) scheme, namely the management of fuel is carried out by a third right, namely PT. Pertamina Patra Niaga full responsible on fuel management starts from the transaction fuel on Depot Pertamina starts from transportation, maintaining quality in PT. KAI, handling channeling to the railroad facilities tank. So, PT. KAI only monitors the supply chain process.

The impact felt by PT. KAI is quite significant. One indicator of its success is a decrease in fuel consumption because it uses the VHS system. The following data is the use of fuel between before and after the use of VHS scheme. From the table 4 above shows that fuel usage before using the VHS scheme amounted to 1,47 ltr/km (in 2011), while after wearing VHS scheme, consecutive fuel consumption is 1.19 ltr/km, 0.88 ltr/km 0.92 ltr/km in 2012, 2013 and 2014. With this scheme PT. KAI pursuing a strategy of risk sharing where the earlier loco scheme PT. KAI is fully responsible for managing fuel as a VHS scheme. Can be described in the loco scheme of fuel supply chain of PT. KAI.

Table 4: Comparison of Fuel Usage with KM Trip

YEARS	AMOUNT OF TRAINS	USE OF FUEL (LITER)	TOTAL OF KM TRIP (KM)	AVERAGE USE OF BBM/KM
2011	621	153.524.081	104.693.544	1,47
2012	672	153.066.141	128.186.685	1,19
2013	717	162.961.132	185.943.537	0,88
2014	783	188.239.717	203.854.437	0,92

Source: Annual Report PT. KAI

3.6 Communication & Consultation

In the process of communication and consultation between PT. KAI and PT. PPN is carried out to ensure that every work is carried out in accordance with their respective duties and responsibilities. The technical process in the application in the field in accordance with the fuel originating from the tank is checked and put into a pile of work units of PT. KAI, the operator is PT. KAI sends a memorandum of request for railways needs (Locomotive, Diesel Rail Train and train generator set) which is ready for operation in a train travel service containing chit fuel to PT. PPN then the officers will serve fuel filling and provide proof of filling consisting of a memorandum called fuel ticket after filling is completed which will be signed together, after each party signs and feels there is a difference in data then there are a number of recapitulation of the total distribution of fuel containing the reconciliation journal news daily expenses event given to the logistics administration unit. . From the analysis in determining the improvement of product quality and added value is expected to be known to the different conditions [17-20] to reduce risk [21].

3.7 Monitoring dan Review

Monitoring and review as a part of the risk management process plan and involves inspection and supervision. This can be done periodically or ad hoc. To avoid misuse of fuel and unwanted losses, PT. KAI together with PT. Pertamina Patra Niaga conducts periodic monitoring and evaluation both manually by looking at the remaining tank quota, fuel quality, monthly, quarterly, semester, annual reports and by using an application**.** So the expected results after implementing the VHS scheme can minimize the existing risks.

Many companies work with the wrong steps, many of which are incorrectly called key performance indicators (KPIs). Very few organizations actually monitor their actual KPIs. The reason is that it is very several organizations, business leaders, writers, accountants, and consultants have explored what KPIs really are[22].

KPIs are defined as strategic and measurable measurements that reflect critical business success factors [23].

- Analyze the identified risks in the fuel supply chain at PT Kereta Api Indonesia (Persero).
- Evaluating fuel supply chain risk management conducted by PT. KAI (Persero).
- Understand risk management in the form of planning for risk mitigation to obtain alternative solutions whether the risk must be mitigated, avoided, transferred or accepted so that risk management can be implemented effectively and efficiently.

4. CONCLUSION

After the identification of the risks involved in the fuel supply chain fuel at PT. Kereta Api Indonesia (Persero) before the application of the VHS scheme, there are risk as follows:

a. Limitations of human resources, there is no task force, which deal specifically fuel management.
b. There is overlapping work, which should be a worker working on the reliability and railroad facilties
c. There is a potential loss, when sending the fuel from Pertamina Depot to tanks PT.KAI.
d. There is a potential loss when fuel is stored and used due to the installation of fuel leaks tanks, evaporation, discrepancy accuracy of measuring instrument.
e. The difficulty of monitoring and controlling fuel usage, because it still uses manual methods without War Room.
f. Operational cost are not effective and efficient.
g. Environmental pollution

A risk assessment by using the table risk and then do an evaluation matrix map of the risk results obtained as follows:

a. Limitations of human resources, there is no task force, which deal specifically fuel management. Previous risk profile 4 to 1.
b. There is overlapping work, which should be a worker working on the reliability and railroad facilities. Previous risk profile 4 to 1.
c. There is a potential loss, when sending the fuel from Pertamina Depot to tanks PT.KAI. Previous risk profile 15 to 4.
d. There is a potential loss when fuel is stored and used due to the installation of fuel leaks tanks, evaporation, discrepancy accuracy of measuring instrument. Previous risk profile 15 to 4.

e. The difficulty of monitoring and controlling fuel usage, because it still uses manual methods without War Room. Previous risk profile 16 to 2.
f. Operational cost are not effective and efficient. Previous risk profile 4 to 2.
g. Environmental pollution. Previous risk profile 4 remained 4

From the results of the evaluation, risk treatment is carried out on the fuel supply chain by transferring the risk to PT. Pertamina Patra Niaga as an expert on fuel handling services, in other words by using the Vendor Held Stock (VHS) scheme, where the benefits are:

a. Zero stock, so that potential losses can be eliminated, other than that there is no more company money that settles due to fuel storage (cash flow is more liquid).
b. Good monitoring fuel management system
c. If used fuel utilization ratio of the total mileage KM per year, with an increase in the number of trains will be visible trends down by using a VHS scheme.

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