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# Risk Mitigation Strategy and Efficiency Improvement of PT Gasses Logistic Transportation using Six Sigma DMAIC Method

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**ABSTRACT:** PT Gasses Logistic is one of the companies that operates in the downstream oil and gas industry that focuses on providing logistic services and other support. From oil, gasses, to lubricant, together with their partnership, PT Gasses Logistic are responsible of transporting those goods to their consumers across Indonesia. Also, PT Gasses Logistic is the subsidiary/child company from one of the biggest state-owned enterprises in Indonesia. The core business of PT Gasses Logistic is transportation, that is why every type of problem in transportation needed to be solved quickly.

Through this research, it is identified 4 problems by using Pareto Chart. The problems are work & traffic accident, losses while loading & unloading operation, risk in damaging MESRAN MIN 40, and risk in damaging RORED EPA MIN 90. Those problems will be evaluated with risk management framework and analyse further using Six Sigma DMAIC method. Risk management framework will be used to identify the risk rating for each risk, which will be used when planning the mitigation strategies. Six Sigma DMAIC method will identified what is the problem, how it the performance regarding the process related to the problem, what is the root causes, how to improve it, and how to control it.

After using the risk management framework and Six Sigma DMAIC method, it is found that the root causes of the problems, which is identified by using fishbone diagram tools, is People and Machine. The author then provided the risk mitigation strategies solution of improvement, the implementation plan, and how to control it. With this research, the author hopes that it will help reducing/mitigating any losses received by PT Gasses Logistic incurred by those problems.

**KEYWORDS:** Fishbone Diagram, Quality Control, Risk Mitigation Strategies, Risk Management Framework, Six Sigma DMAIC, Transportation.

## INTRODUCTION

Oil and gas industry are one of the major industries in the world that play an influential role in the energy market and global economy as one of the world's most important fuel sources. The processes and system that involves procuring, producing, and distributing oil and gas to the customers in wide variety of types, container, and transportation are highly complex, require state-of-the-art technology, and especially high in capital cost. When talking about natural gas, it will be most likely that oil is linked to it because of the upstream side of the business. When procuring either oil or gas in the upstream side of the business, it is certain to obtain both oil and gas even though the goal of the upstream is to either procure oil or gas. Hence, it is named oil and gas industry.

The first commercialization of natural gas occurred in Britain in 1785. The British used natural gas produced from coal to light houses and streets. In 1816, Baltimore, Maryland used natural gas to become the first city in the United States to light its streets with gas. Natural gas was viewed as a nuisance as it is heavily disrupted the coal industry. Unlike coal, natural gas has a lower greenhouse gas emissions when combusted when comparing it to coal. Since then, natural gas has taken on a more prominent role in the world's energy supply, especially in the United States. The industry of oil and gas are divided into three segments, which is:

**Upstream industry**, the business of oil and gas exploration and production. The exploration activities include creating geological survey and obtaining land rights. While the production activities include onshore and offshore drilling to procure the oil and gas resources, which is mainly crude oil and natural gas.

**Midstream industry**, the business of oil and gas transportation and storage. Once the oil has been extracted and separated from natural gas, pipelines transport the products to another carrier or directly to a refinery.

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**Downstream industry**, the business of oil and gas refining and marketing. The crude oil and natural gas that were received are refined from its unusable natural state and transforming it into petroleum products used for a variety of purposes. The final products will be sold to businesses, industry, government, and public consumers.

PT Gasses Logistic was established in the year of 1996 with the name of PT Elnusa. PT Elnusa was established to manage the commercial area in Elnusa TB Simatupang Kav 1-B, Jakarta Selatan. Then, on 16 August 2005 PT Elnusa changed its name into PT Gasses Logistic, became independent and they become the subsidiary company of one of the biggest state-owned enterprises in Indonesia that operates in upstream & downstream oil and gas industry. Currently, the main focuses of PT Gasses Logistic is to operates in the downstream oil and gas industry that are concentrated on providing logistic service for fuel oil, gasses, lubricant, and heavy equipment & material. Other than that, PT Gasses Logistic also provides the solution for inventory management such as the management of Vendor Hold Stock (VHS), *Depot Pengisian Pesawat Udara* (DPPU) BBK, lubricants warehouses, and other materials warehouses. Not only that, PT Gasses Logistic can also provide helps in custom clearance such as the management of imported and exported goods documents and other logistic support.

There are a few risks that are currently being faced by PT Gasses Logistic, from the overdue account receivable to bribery. The issues stretch from financial problem, compliance & legal problem, and operation problem. As supply chain is too big of a problem to do a risk management, the risk management needs to be limited to a specific part of PT Gasses Logistic to produce a detail, intricate, and weighted analysis, and solution. Thus, the risk management will be conducted on PT Gasses Logistic transportation part only. The business issues in transportation are discovered by reading through the company historic data. There are few risks in transportation that are identified with company losses as the parameter. The data is gathered from the period of 2020. The risk in transportation with its quantified losses and percentage can be seen on Table 1 and the Pareto Chart on Figure 1.

**Table** I. PT Gasses Logistic Current Risk in Transportation

| No | Risk in Transportation (2020) | Risk Parameter | |
|---|---|---|---|
| | | Losses (USD) | (%) |
| 1 | Work & Traffic accident | $174.707,97 | 36% |
| 2 | Losses in loading & unloading | $83.286,18 | 17% |
| 3 | Risk in damaging MESRAN MIN 40 | $60.811,24 | 13% |
| 4 | Risk in damaging RORED EPA MIN 140 | $49.369,53 | 10% |
| 5 | Risk in damaging MEDITRAN SX PLUS | $46.964,81 | 10% |
| 6 | Risk in damaging Turalik 52 MIN | $31.248,53 | 7% |
| 7 | Risk in damaging RORED EPA MIN 90 | $20.540,68 | 4% |
| 8 | Risk in evacuating post-traffic accident | $11.026,52 | 2% |
| 9 | Quantity and quality of goods does not match up | $1.772,21 | 0% |
| | **Total** | $479.727,67 | 100% |

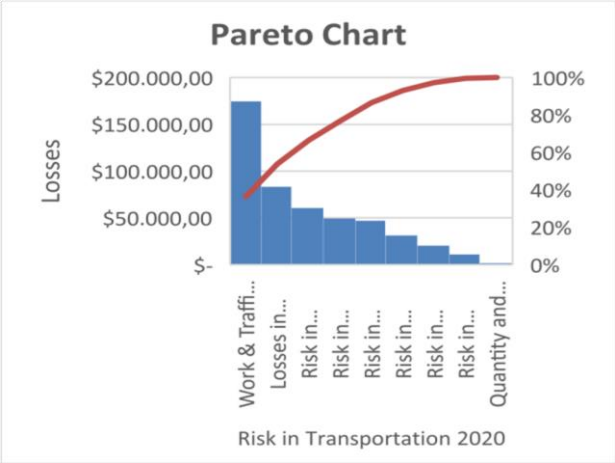


**Figure 1**. Pareto Chart of Risk in Transportation for the Period of 2020

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From the pareto chart on Figure 1, it can be identified the highest risk that which includes 80% of the problem. The 80% of the problem based on the pareto chart (1) work and traffic accident, (2) losses in loading & unloading, (3) risk in damaging MESRAN MIN 40, and (4) risk in damaging RORED EPA MIN 90. Hence, this research will concentrate on managing the risks listed above and providing a tangible solution for PT Gasses Logistic future references. The research was conducted with the following objectives:

To identify the risk mitigation strategies that PT Gasses Logistic currently uses.

To identify whether there's a similar root causes for work and traffic accident, losses in loading & unloading, risk in damaging MESRAN MIN 40, and risk in damaging RORED EPA MIN 90.

To propose the solution to address the current risk management problems related to transportation in PT Gasses Logistic supply chain.

## REVIEW OF LITERATURE

According to Srinivas (2019), risk is defined in terms of uncertain events which may have positive or negative effect on the project objectives. Risks include circumstances or situations, the existence or occurrence of which, in all reasonable foresight, result in an adverse impact on any aspect of the implementation of the project. To address those risks, risk management is needed.

Risk management is a planned and a structured process aimed at helping the project team make the right decision at the right time to identify, classify, quantify the risk and then to manage and control them (Srinivas, 2019). The aim is to ensure the best value for the project in term of cost, time, and quality by balancing the input to manage the risks with the benefits from such act. Although risk management is a continuous process that are implemented from the start to finish, it is better to implement risk management from the earliest stage of a project to realise its full potential. According to Ehsan (2012), risk management is a project involves the identification of influencing factors which would have negative impact on the cost, schedule, and quality objectives of the project and quantification of impact of potential risk and implementation of mitigation measures to minimize the potential impact of risk. The nature of these types of risks lends them to a three-step risk management process that can be applied to situations where disruptions are possible (Jacobs & Chase, 2018). The three streps are as follows:

1. Identify the sources of potential disruptions
2. Assess the potential impact of the risk
3. Develop plans to mitigate the risk

Risk mapping involves assessment of the probability of relative frequency of an event against the aggregate severity of the loss (Jacobs & Chase, 2018). Depending on the result, some risks is acceptable related to the normal cost of doing business. In some cases, the company accept the losses, while there might be other cases that the potential loss is so great that avoiding the risk is the priority. The risk mapping usually uses risk assessment matrix to identify the urgency of a risk. According to Graves (2000), a risk matrix consists of a 5 x 5 array of elements, each element representing a different set of impact and probability values. Graves also state that there is no particular significance to the use of a five-level scale, and other scales can be used such as 3 x 3 or 4 x 4. However, a 5 x 5 risk matrix is the most common type being used and according to EHS professionals, the 5 x 5 format allow a more detail and clarity risk assessments.

In the 1980s, Six Sigma was introduced by American engineer Bill Smith while working at Motorola. With the implementation of Six Sigma, Motorola began to produce products with fewer defects while their factory maintained the same workforce, machinery, and design work. It became clear that Six Sigma was the secret for Motorola success. Since then, Six Sigma has been widely uses by many different types of industry and organizations. The effectiveness of Six Sigma is supported by anecdotal evidence, that most Fortune 500 companies have adopted Six Sigma (Goh, 2002). Motorola, the pioneer of using Six Sigma, reported US$16 billion benefits from Six Sigma for the period of 1986-2001 (Eckes, 2001; Hendricks and Kelbaugh, 1998).

Six Sigma is a set of quality management system that are a highly effective tool that focuses on repairing and fixing business process to ensure the company achieve their goals. According to Przekop (2006), The Six Sigma measurement focuses on customer satisfaction, data-driven management, and improvement of the business process. The main essence of Six Sigma is to reduce defects of a product or services by improving products or services and processes. The cornerstone performance of Six Sigma is producing only 3,4 defects per million (DPMO) opportunities for a business process (Kankariya, 2017). With the defect reach only 3,4 units, the company are producing products or services in customer's satisfaction level of 99,9997% which would leverage to company's

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profit. According to Crosby (1979), defects cause waste, rework, or scrap and eventually lead to customer dissatisfaction. If a processes, whether a product or service can achieve Six Sigma quality level, it will literally produce no defective product. Not only it will reduce waste and cost, but ultimately it will also improve customer satisfaction.

Many tools and techniques have been developed over time to help firms improve their process to achieve Six Sigma level quality. DMAIC (Define, Measure, Analyze, Improve, and Control) has been used as tools and techniques to achieve an overarching structured improvement (Mitra, A., 2008). DMAIC is a structured problem-solving method, it has five stages with each letter in the acronym stands for one. Many professionals and consultants often use DMAIC as it is well known that many consider it a synonym to Six Sigma. Although DMAIC is the core tool used to implement Six Sigma core projects, but DMAIC is not exclusive to Six Sigma and can be used as a framework for other improvement applications. The explanation of DMAIC process can be seen below:

1. Define, define is the phase where the user identifies the problem precisely.
2. Measure, in order to make an accurate decision making, the facts and data must be valid and reliable.
3. Analyze, the main activity of the analyze phase is to identify the potential root causes of the problem to reach the actual root causes.
4. Improve, the goal of this stage is to determine the correct solution according to the problems in the first three phases.
5. Control, the main focuses of control phase are to ensure that the action implemented through Improve phase is well implemented and maintained.

## RESERACH METHODOLOGY

This research will be the combination of both qualitative and quantitative research, which more inclined to the qualitative method. The primary data which is qualitative method will be obtained through direct observation by interviewing and questionnaire to several respondents that are involved closely with PT Gasses Logistic transportation process. The interview and questionnaire will be conducted to 5 people with 5 different jobs, with each of those questionnaires consists of 10-17 questions related to the topic. While the secondary data which is quantitative method will be obtained from the company historical data that will be used to support the primary data. The method of processing the data is Risk Management Framework and Six Sigma: DMAIC method.

## RESULT AND DISCUSSION

The result for risk management framework can be seen on the following Table II and Figure 2.

**Table II**. Risk Assessment Form

| No | Risk | Likelihood | Impact | Risk Rating |
|---|---|---|---|---|
| 1 | Work & Traffic Accident | 3 | 5 | 15 |
| 2 | Losses while Loading & Unloading Operation | 3 | 4 | 12 |
| 3 | Risk in Damaging MESRAN MIN 40 | 4 | 3 | 12 |
| 4 | Risk in Damaging RORED EPA MIN 90 | 4 | 3 | 12 |

Table II explains that the risk rating for each of the risk in this research is quite high, especially work & traffic accident that have a risk rating of 15 (extreme)


**Figure 2**. Risk Assessment Matrix

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The level of risk for each of the risks can be seen on Figure 2. Work & traffic accident level of risk is extreme, while the other 3 level of risk is high.

Continuing with Six Sigma DMAIC Method, the first phase will be the define phase. The define phase will show the risk matrix from PT Gasses Logistic and SIPOC diagram to understand the process of transportation in PT Gasses Logistic. The risk matrix and SIPOC diagram can be seen on Figure 3 and Figure 4 respectively.

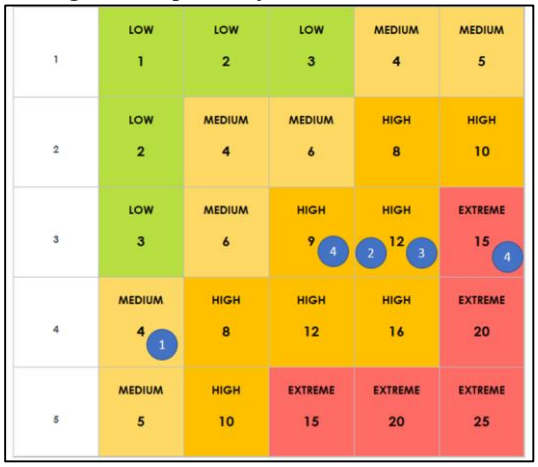


**Figure 3**. PT Gasses Logistic Risk Assessment Matrix
(**Source:** PT Gasses Logistic)

| **SIPOC Diagram** | | | | |
|---|---|---|---|---|
| **Supplier** | **Input** | **Process** | **Output** | **Customer** |
| Warehouse Operator<br>Cargo Owners | Drum container goods<br>Cardboard container goods | Drivers fit to drive check | Drum container goods Cardboard container goods | Oil and gas companies<br>Companies that needs oil and/or gas for their business operation |
| Shipping Lines Partner<br>Transport Companies | Bill of Lading<br>Trucks<br>Drivers | 1 st checklist maintenance | Trucks | PLN |
| | | 2 nd checklist maintenance | | |
| | | Administrative processing | | |
| | | Loading & unloading | | |
| | | Administrative processing | | |

**Figure 4**. PT Gasses Logistic SIPOC Diagram

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Continue with the measure phase, the first is to measure the performance of work & traffic accident. Work & traffic accident can be measured by finding out the frequencies of work & traffic accident in recent years and how many losses incurred by it. The losses of work & traffic accident can be seen on Table III.

**Table III**. Work & Traffic Accident Losses

| Year | Frequency of Work and Traffic Accident | Losses ($US) |
|---|---|---|
| 2018 | 1 | $ 37.113,48 |
| 2019 | 0 | - |
| 2020 | 5 | $ 174.707,97 |

Other than losses, work & traffic accident can be measured in a different aspect. For example, with the drivers and maintenance performance. The reason why drivers and maintenance performance it is the probable reason for work & traffic accident according to hazard identification in Table IV.

**Table IV**. Hazard Identification, Risk Assessment, and Determining Control (HIRADC) (Source: PT Gasses Logistic)

| HAZARD IDENTIFICATION | | | | RISK ASSESSMENT | | | |
|---|---|---|---|---|---|---|---|
| (1a) | (1b) | (1c) | (1d) | (2a) | (2b) | (2c) | (2d) |
| **No** | **Activities** | **Hazard** | **Possible Accident** | **Existing Risk Control** | **S** | **L** | **R** |
| | | | | | | | |
| 1 | Transportation | Driver Fatigue | Work and Traffic Accident | | 5 | 2 | High |
| | | Vehicle is not in good condition | Work and Traffic Accident | | 5 | 3 | High |
| | | Overspeed | Work and Traffic Accident | | 5 | 1 | High |
| | | Overload | Work and Traffic Accident | | 5 | 1 | High |
| | | Incompetence driver | Work and Traffic Accident | | 5 | 3 | High |
| | | Does not understand the planned route condition | Work and Traffic Accident | | 5 | 2 | High |
| | | Safety belt is not used | Fatality, Major Injuries | | 5 | 3 | High |
| | | Safety belt is broken | Fatality, Major Injuries | | 5 | 3 | High |

6 out of 8 hazard is caused by drivers, while the rest of it is related to maintenance. Hence, that is why this research will also measure drivers and maintenance performance in PT Gasses Logistic. The measurement for drivers can be seen on Table V.

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**Table V**. PT Gasses Logistic Driver's Training Program (Source: PT Gasses Logistic)

| **Upskilling *Pekerja*** | ***Jenis Pelaksanaan*** | ***Tanggal Pelaksanaan*** |
|---|---|---|
| Basic HSSE | *Sharing session/KOMET Wujudkan SDM yang Unggul dan Berbudaya HSSE untuk mendukung Business Sustainabillity* | 08 Februari 2021 |
| Fire Fighting | POLS<br>Fire Fighting at Home | 18 Februari 2021 |
| First aid | - | - |
| Defensive Driving Training | *Diselenggarakan oleh JDC* | 13 November 2021 |
| Behavior Based Safety Training | - | - |
| Training Keahlian Personil HSSE | - | - |

The measurement for drivers used the training program that are provided by PT Gasses Logistic. Only 3 out of 6 training programs has been executed this year, which means that the qualifications of drivers in PT Gasses Logistic is still not enough. Lack in qualification would affect the performance during transportation process. On the other hand, the measurement for maintenance procedure can be seen on Table VI.

**Table VI**. Example of Maintenance Activities of a Truck in PT Gasses Logistic (Source: PT Gasses Logistic)

| **No** | **Unit Name** | **Asset Number** | **Maintenance Activities** | **Serial Number** | **Plan** | |
|---|---|---|---|---|---|---|
| | | | | | **Maintenance Date** | **Maintenance Duration** |
| 1 | Wingbox Truck | B 9148 TEZ | Change tire | 2294 | 05-Jan-21 | 1,5 hours |
| 2 | Wingbox Truck | B 9148 TEZ | Change tire | 7969 | 05-Jan-21 | 1,5 hours |
| 3 | Wingbox Truck | B 9148 TEZ | Change tire | 2664 | 26-Jan-21 | 1,5 hours |
| 4 | Wingbox Truck | B 9148 TEZ | Change tire | 1257 | 26-Jan-21 | 1,5 hours |
| 5 | Wingbox Truck | B 9148 TEZ | Change tire | 0521 | 04-Mar-21 | 1,5 hours |
| 6 | Wingbox Truck | B 9148 TEZ | Change tire | 4658 | 04-Mar-21 | 1,5 hours |
| 7 | Wingbox Truck | B 9148 TEZ | Hydraulic hose change | | 03-Jan-21 | 1,5 hours |
| 8 | Wingbox Truck | B 9148 TEZ | Battery change 2 pcs | | 27-Jan-21 | 1,5 hours |
| 9 | Wingbox Truck | B 9148 TEZ | Periodic service | | | 1,5 hours |

It can be seen from Table VI that the maintenance procedure in PT Gasses Logistic is quite complete. There are other maintenance activities that are not listed above. The maintenance activities for each truck unit are different depends on what part needed repair or changes except periodic service that are conducted once per week. Even in an occasion that a truck does not have any maintenance activities, the periodic service will still be conducted to monitor and control the condition of truck, which would make monitoring and control of any potential problem easier.

The next to be measured is losses while loading & unloading operation. The losses can be seen on Table VII.

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**Table VII.** Total Losses in Loading & Unloading Operation (Source: PT Gasses Logistic)

| Year | Loss (*Ribu* IDR) | Loss (US) |
|---|---|---|
| 2018 | Rp 704.487.394,00 | $ 49.320,90 |
| 2019 | Rp 1.699.500.620,00 | $ 118.981,40 |
| 2020 | Rp 1.189.638.526,00 | $ 83.286,15 |

Continue to the measurement of risk in damaging MESRAN MIN 40 and RORED EPA MIN 90, the measurement can be seen on Table VIII and Table IX.

**Table VIII**. Defect for MESRAN MIN 40 Product in 2020 (Source: PT Gasses Logistic)

| No | *Jenis Produk* | *BPP* | *Diterima* | *Keterangan* |
|---|---|---|---|---|
| 1 | MESRAN MIN 40 | 250 | 248+14 *Botol* | *Tidak Layak Jual* |
| 2 | MESRAN MIN 40 | 261 | 261 *Botol* | 198 *Tidak Layak Jual* |
| 3 | MESRAN MIN 40 | 230 | 230+10 *Botol* | *Tidak Layak Jual* |

**Table IX**. Defect for RORED EPA MIN 90 Product in 2020 (Source: PT Gasses Logistic)

| No | *Jenis Produk* | *BPP* | *Diterima* | *Keterangan* | | |
|---|---|---|---|---|---|---|
| | | | | *Bocor & Penyok* | *Bocor* | *Kesimpulan* |
| 1 | RORED EPA MIN 90 | 19 | 19 | 1 | 18 | *Tidak Layak Jual* |
| 2 | RORED EPA MIN 90 | 21 | 21 | 9 | 12 | *Tidak Layak Jual* |
| 3 | RORED EPA MIN 90 | 19 | 19 | 3 | 16 | *Tidak Layak Jual* |

After measurement phase, the next phase is Analyze. The analyze phase will use Fishbone Diagram as its tool to identify the root cause. There will be 3 fishbone diagrams, where risk in damaging MESRAN and risk in damaging RORED is combined because of the similarity. The fishbone diagram for work and traffic accident can be seen on Figure 4.

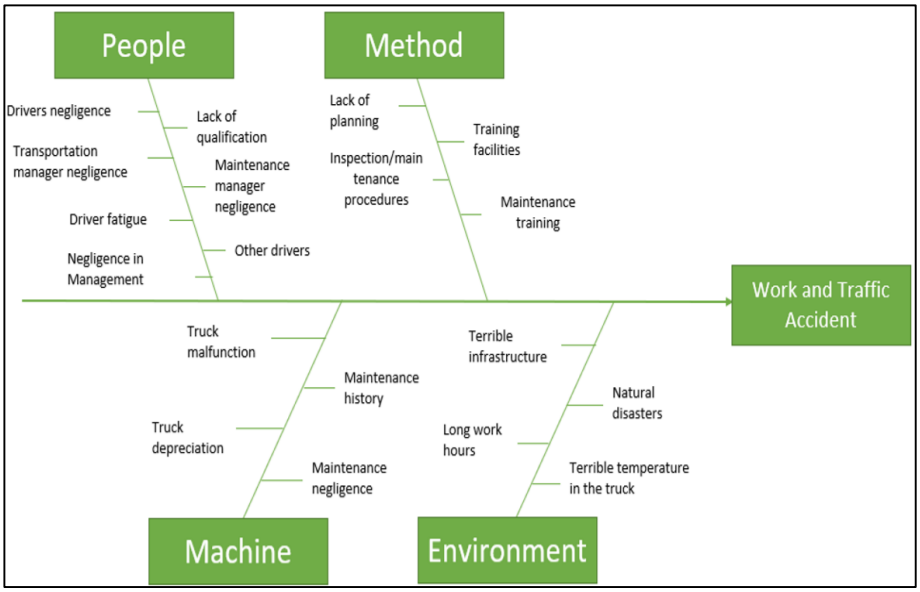


**Figure 4** . Work & Traffic Accident Fishbone Diagram

The root cause for work & traffic accident is People, with driver negligence and driver fatigue as the probable sub causes.

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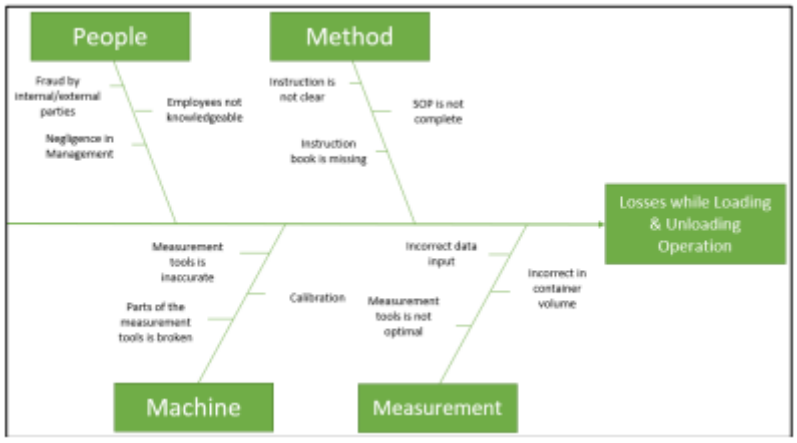


**Figure 5.** Losses while Loading & Unloading Operation Fishbone Diagram

The root cause for losses while loading & unloading operation is Machine, with measurement tool is inaccurate as the probable sub cause.

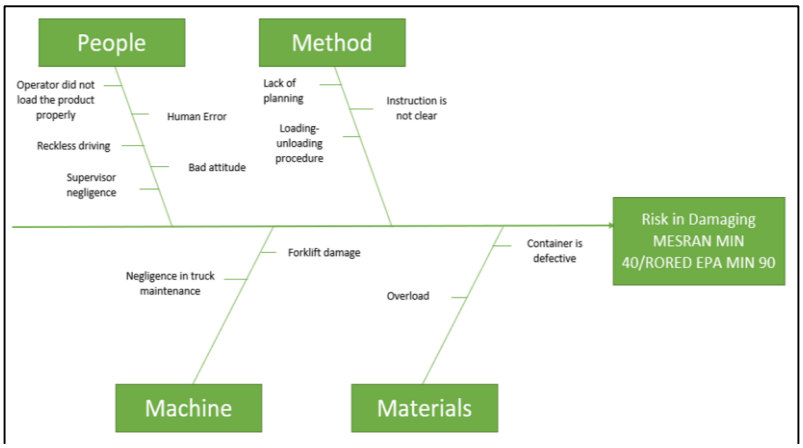


**Figure 6**. Risk in Damaging MESRAN MIN 40/RORED EPA MIN 90 Fishbone Diagram

The root cause for risk in damaging MESRAN MIN 40/RORED EPA MIN 90 is People, with operator did not load the product properly and human error as the probable sub causes.

After the analyze phase, the next phase will be the improvement and control phase. The improve phase will be in the form of risk mitigation strategies. It will be separated to each of the risk. The risk mitigation strategies for work & traffic accident, losses while loading & unloading operation, and risk in damaging MESRAN MIN 40/RORED EPA MIN 90 can be seen on Table X, Table XI, and Table XII respectively.

**Table X**. Risk Mitigation Strategy for Work & Traffic Accident

| Risk | Risk Rating | Mitigation Strategies |
|---|---|---|
| Work & Traffic Accident | 13 | Reworking the hiring process |
| | | Management improvement |
| | | Implement maximum work hours system to reduce fatigue |
| | | Improve route scheduling for drivers' convenience |
| | | Upskilling workers skill and proper qualifications |
| | | Identifying, evaluating, and hazard control during transportation operation |
| | | Employee's health monitoring and screening |

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The risk mitigation strategies for work & traffic accident revolves around People because of People as root cause that was identified with Six Sigma DMAIC. The idea of risk mitigation strategies is obtained from interview with logistic manager and various of sources from internet as reference.

**Table XI**. Risk Mitigation Strategies for Losses while Loading & Unloading Operation

| Risk | Risk Rating | Mitigation Strategies |
|---|---|---|
| Losses While Loading & Unloading Operation | 11 | Periodic calibration with third parties |
| | | Quality and quantity monitoring |
| | | Use the same brand of measurement tools |
| | | Upskilling workers skill and proper qualifications |
| | | Complete the SOP and instruction |

The risk mitigation strategies for losses while loading & unloading operation revolves around People and Machine.
Although the root cause is only Machine, but the implementation of few risk mitigation strategies outside of Machine is needed to fully implement the mitigation strategies seen on Table XI

**Table XII**. Risk Mitigation Strategies for Risk in Damaging MESRAN MIN 40 and RORED EPA MIN 90

| Risk | Risk Rating | Mitigation Strategies |
|---|---|---|
| Risk in damaging MESRAN MIN 40 and RORED EPA MIN 90 | 10 | Upskilling workers skill and proper qualifications |
| | | Complete the SOP and instruction |
| | | Periodic site visit |
| | | Asset Management |
| | | Proper vendor/supplier selection and monitoring |

The risk mitigation strategies for risk in damaging MESRAN MIN 40 and RORED EPA MIN 90 revolves around People. The same as previous risk mitigation strategies, the idea of risk mitigation strategies is obtained from interview with logistic manager and various of sources from internet as reference.

After improvement phase, the last phase in Six Sigma DMAIC is Control Phase. In this phase, all the changes done from the previous phases is maintained. No matter how good a solution and implementation are, without maintaining the valuable changes for a long-term success, all the work done previously would be wasted. The tools being used for this research will be standard documentation. The process of improvement is only known for the current employees, and they may not be around in the coming years. Thus, it is important to document the process as detailed as possible, step-by-step guide to doing the process correctly to kept on maintaining the improvement in the future.
Furthermore, the team responsible for the project should create a full report on the challenges, how they discover the problems to how they overcame them. In this case, the 3 main goals in the control phase are:

**Monitor and control plan**. After the implementation, measuring the performance is needed to compare it with previous performance. This is important to ensure that the organization execute the improvement correctly and do not slip back into the old way of doing things.

**Create a response plan**. Response for various of issues because of the implementation should be prepared. It is inevitable that things might go wrong when executing a new process.

**Develop a continual improvement plan**. This plan ensures that improvements does not stop. Competitors would not sit idly, that's why an improvement plan should be continually developed.

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## CONCLUSSION

To conclude, this research finds out that in the transportation division of PT Gasses Logistic, there is few risks that are needed to be solved. Ranging from very high-risk level to low risk level, this research chose 4 risks with the very high-risk level chosen by Pareto Chart with the parameter of losses in USD. Not only that, but this research also reassesses the risk level of each risk with a simple risk management framework and find out that those 4 risks do indeed have a minimal risk level of high. Before planning the risk mitigation strategies, this research will conduct a Six Sigma DMAIC studies with the focus to find out the root causes for each risk and how to improve it. To conclude, the answer for the research question is:

PT Gasses Logistic already have few risks mitigation strategies, which is (1) calibrate the measurement tools periodically, (2) quality and quantity monitoring, (3) complete the SOP and instructions for every process related to transportation, (4) upskilling employees, especially drivers, and (5) proper vendor/suppliers' selection and monitoring.

Each of the risk have its own root cause and sub root causes. However, the main root cause of the risks originated from People and Machine. Work & traffic accident have People as its root cause with driver's negligence and fatigue as its sub causes, losses while loading & unloading have Machine as its root cause with measurement tools inaccuracy as its sub cause, and risk in damaging MESRAN MIN 40 and RORED EPA MIN 90 have People as its root cause with human error as its sub cause.

The improvement solution plan will be separated to each of the risk, there are 7 risk mitigation strategy for work & traffic accident, 5 risk mitigation strategy for losses while loading & unloading, and 5 risk mitigation strategy for risk in damaging MESRAN MIN 40/RORED EPA MIN 90.

## REFERENCES

1. Andersen, E. (2012). The Most Important Reason People Fail in a New Job. https://www.forbes.com/sites/erikaandersen/2012/04/25/the-most-important-reason-people-fail-in-a newjob/?sh=1ce31910bd2c
2. Antadiredja, Z. Q. I. (2018). *Defect Product and Waste Reduction for Elhijab Using Six Sigma Method.* [Master Dissertation,
3. Institut Teknologi Bandung]. Institut Teknologi Bandung Repository. https://fpjkt.sbm.itb.ac.id/pdf/viewer.php?code=uhXjbywh_wc
4. Akintoye, A. (2015). *Developing Theoretical and Conceptual Frameworks*. Retrieved from jedm.oauife.edu.ng>uploads
5. Bailey, T. & Barriball, E. (2010). *McKinsey Global Survey: A Practical Approach to Supply-chain Risk Management*.
6. https://www.mckinsey.com/business-functions/operations/our-insights/a-practical-approach-to-supply-chain-riskmanagement
7. Brumby, N. (2017). *61% of Hiring Managers Report a Failure on the Part of Recruiters*. https://www.mightyrecruiter.com/blog/61-of-hiring-managers-report-a-failure-on-the-part-of-recruiters/
8. Camp, W.G. (2001) *Formulating and Evaluating Theoretical Frameworks for Career and Technical Education Research*. Journal of Vocational Education Research, 26, 1-17. doi:10.5328/JVER26.1.4
9. Crosby, P. B. (1979). *Quality if Free: The Art of Making Quality Certain.* New York: New American Library.
10. Dupuis, E. (2014). *Oil and Gas Custody Transfer*. Africa. Petroleum Africa Magazine Inc.
11. Eckes, G. (2001). *The Six Sigma Revolution, How General Electric and Others Turned Process Into Profits*. John Wiley & Sons, Inc.
12. Ehsan, N., et. al. (2012). Risk Management in Construction Industry.
13. Eia.gov. (n.d.). *U.S. Field Production of Crude Oil.* https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=mcrfpus2&f=a
14. Eia.gov. (n.d.). *Natural Gas Explained, Where our Natural Gas Comes From.* https://www.eia.gov/energyexplained/naturalgas/where-our-natural-gas-comes-from.php
15. Eia.gov. (2021). *Indonesia*. https://www.eia.gov/international/overview/country/IDN
16. Eia.gov. (n.d.) *Total Energy Production 2018*. https://www.eia.gov/international/rankings/world?pa=12&u=0&f=A&v=none&y=01%2F01%2F2018

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IJCSRR @ 2021
www.ijcsrr.org

17. Fluid Component International LLC. (2013). Flow Meter Performance, Validation and Compliance to 40 CFR Part 98, Subpart HH. LMOP Conference. Baltimore:MD. 16. Forceintellect.com (2018). *Supply Chain and It's Impact on Profit and Growth in Today's Business*. https://forceintellect.com/2018/05/14/importance-of-supply-chain-management/
18. FMCSA Regulation, Summary of Hours of Service Regulations/20
19. Ginting, B. B. (2020). *Evaluation of The Quality of News Program Production Process of INEWSTV Medan to Get Better Audience Share Using DMAIC Rules of Six Sigma.* [Master Dissertation, Institut Teknologi Bandung]. Institut Teknologi Bandung Repository. https://fp-jkt.sbm.itb.ac.id/pdf/viewer.php?code=PgayWjt2JKI
20. Goh, T.N. (2002). *A Strategic Assessment of Six Sigma*. Quality and Reliability Engineering International, 18, 403-410. doi:10.1002/qre.491
21. Grant, C. & Osanloo, A. (2014). *Understanding, Selecting, and Integrating a Theoritical Framework in Dissertation*
22. *Reseach: Creating the Blueprint for Your "House".* Journal of Administrative Issues, Connecting Education, Practice, and Research, v4 n2, 12-26. doi:10.5929/2014.4.2.9
23. Graves, R. (2000). *Qualitative Risk Assessment*. *PM Network, 14*(10), 61–66.
24. Hendricks, C.A. & Kelbaugh, R. (1998), *Implementing Six Sigma at GE.* The Journal of Quality and Participation, Vol. 21 No. 4, 48-53
25. Hessing, T. (n.d.). *Define Phase (DMAIC)*. https://sixsigmastudyguide.com/define-phase-dmaic/
26. Hessing, T. (n.d.). *Measure Phase (DMAIC)*. https://sixsigmastudyguide.com/measure-phase-dmaic/
27. Hugos, M. H. (2011). *Essentials of Supply Chain Management, Third Edition*. United States of America: John Wiley & Sons Inc.
28. Jacobs, F. R. & Chase, R. B. (2018). Operation and Supply Chain Management, Fifteenth Edition. New York: McGraw-Hill Education
29. Kankariya, P. & Keshav, V. (2017). *Performance Improvement in Garment Industries by Reducing Defects Using Six Sigma Methodologies*. International Journal of Scientific Research Engineering & Technology. Vol.6, No.3. 228-236.
30. Manggala, D. (2005). *Mengenal Six Sigma Secara Sederhana*. Jakarta: Salemba Empat.
31. Mitra, A. (2008). *Fundamentals of Quality Controls and Improvement Third Edition*. Hoboken, New Jersey: John Wiley & Sons, Inc.
32. Pacheco, D. (2021). Drowsy Driving vs Drunk Driving: How Similar Are They? https://www.sleepfoundation.org/drowsydriving/drowsy-driving-vs-drunk-driving
33. Palsaitis, R. & Petraska, A. (2012). *Heavyweight and Oversized Cargo Transportation Risk Management*. Transport and Telecommunication, 13, 51-56. http://dx.doi.org/10.2478/v10244-012-0005-9
34. Pareto, V. (1986). Cours d'Economie Politique. The Annals of the American Academy of Political and Social Science. Vol. I. Pp. 430. I896. Vol. II. Pp. 426. doi:10.1177/000271629700900314
35. Peshkin, A. (1993). *The Goodness of Qualitative Research*. Educational Researcher, *22*(2), 23–29. https://doi.org/10.2307/1176170
36. Pradipta, W. N. (2018). *Production Process Optimization By Six Sigma DMAIC Method at Black Belt Cold Brew Coffee* [Master Dissertation, Institut Teknologi Bandung]. Institut Teknologi Bandung Repository. https://fpjkt.sbm.itb.ac.id/pdf/viewer.php?code=3rByR0--4ok
37. Przekop, P. (2006). *Six Sigma for Business Excellence.* New York: McGraw-Hill.
38. Rahmaini, D. (2014). *Applying Six Sigma DMAIC Methodology for the Process of Handling ATM & Debit Card Complaint at PT Bank BNI Syariah* [Master Dissertation, Institut Teknologi Bandung]. Institut Teknologi Bandung Repository.
39. https://fp-jkt.sbm.itb.ac.id/pdf/viewer.php?code=eSNzUw81un0
40. Riza, H. & Dwianto, G. (2021). *Outlook Energi Indonesia 2021*. Tangerang: Pusat Pengkajian Industry Proses dan Energi.
41. Sadiya, I. (2021). *Designing the Effective BRT Services by Evaluating Impact of Pandemic Using Six Sigma at PT Transportasi Jakarta* [Master Dissertation, Institut Teknologi Bandung]. Institut Teknologi Bandung Repository. https://fpjkt.sbm.itb.ac.id/pdf/viewer.php?code=L8_g-bQbuc8
42. Smith, M.J. and Liehr, P. (1999). *Attentively Embracing Story: A Middle-Range Theory with Practice and Research Implications*. Scholarly Inquiry for Nursing Practice, 13, 187-204, Discussion 5-10.

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IJCSRR @ 2021
www.ijcsrr.org

43. Sonnichsen, N. (2021). *Oil and Gas Industry Revenue in the United States from 2010 to 2020*.
44. https://www.statista.com/statistics/294614/revenue-of-the-gas-and-oil-industry-in-the-us/
45. Srinivas, K. (2019). Process of Risk Management. doi: 10.5772/intechopen.80804.
46. Terry, K. (n.d.). *What is DMAIC?*. https://www.isixsigma.com/new-to-six-sigma/dmaic/what-dmaic/

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