Supply Chain Risk Management during the COVID-19 Pandemic Using a Quantitative Approach (Case Study: PT Aksara Solopos Newspaper)

Aditya Mahendra, Anisa Nur Maya D.R.H.H, and Rizki Ananda P.N.R.
Industrial Engineering, Universitas Sebelas Maret,
mahendra.aditya10@student.uns.ac.id , anisadrhh@student.uns.ac.id ,
rizkianandapnr@gmail.com

Silvi Istiqomah
Industrial Engineering Department, Faculty of Engineering
Universitas Mahakarya Asia, DIY, Indonesia
silviistiqomah23@gmail.com

Wahyudi Sutopo[3], Yuniaristanto[4]
[3)] University Centre of Excellence for Electrical Energy Storage Technology
[4)] Research Group Industrial Engineering and Techno-Economic, Industrial Engineering Department, Faculty of Engineering
Universitas Sebelas Maret, Surakarta, Jl. Ir. Sutami, 36 A, Surakarta, Indonesia
wahyudisutopo@staff.uns.ac.id, yuniaristanto@ft.uns.ac.id

Abstract

In the current state of the COVID-19 pandemic, many industrial sectors are experiencing difficulties due to facing various kinds of problems, one of which is the newspaper industry. These problems are a risk that must be controlled by the company in order to minimize losses. The purpose of this study is to carry out supply chain risk management during the COVID-19 pandemic in newspaper companies. The method used is a quantitative approach using SCOR and SCRIS to calculate the expected cost of risk based on the magnitude of the impact and probability of a risk event. The results show that there are 5 risks with the biggest costs, namely machine damage, personnel absenteeism due to health problems, delays in gathering news content, natural disasters during delivery, and decreased paper quality when it arrives at the end customer. Of the 5 risks with the largest total cost, a possible mitigation strategy is proposed to overcome these risks.

Keywords
Risk Management, Supply Chain, SCOR, SCRIS, Newspaper Industry

1. Introduction

In the last 2 years, various industries have experienced difficulties due to the COVID-19 pandemic, one of which has been affected is the newspaper industry. The pandemic has put the newspaper industry in an unstable condition due to several obstacles, such as employee absenteeism due to health problems, delays in the raw material delivery, to delivery of products that are not in accordance with customer requests. In addition, the short product life cycle of newspapers and the pressure to present the latest news creates a conflict of goals between the newsroom and the production and distribution department (Sartika, V. et al., 2018). The above problems are a risks that arises in the supply chain run by the newspaper industry.

Quoted from Sutanto (2012), risk is a combination of the likelihood and severity of an event. The magnitude of the company's risk is determined by various factors during the production process, such as the amount of exposure,

location, consumers, quantity and vulnerability of the elements involved. Meanwhile, risk can also be interpreted as the chance of an event resulting in a loss if it occurs during a specific time period (Sherlywati, 2016). Risk can come from anywhere, both internal to the company and from external to the company. The nature of the uncertainty of a risk is certainly avoided in the industrial world, therefore it is necessary to carry out risk management as a control effort so that companies can minimize losses that may occur.

Risk management is a process that has a goal to assist companies in understanding, evaluating, and taking action on all risks in order to increase the chance of success and decrease the chances of failure (Slack et al., 2010). The steps that need to be taken in managing company risk are risk identification, risk assessment, and risk mitigation (Sherlywati, 2016). Risk management is used to respond to known risks, minimize risks that may occur in the future and an appropriate response plan can be developed to address these potential risks.

PT. Aksara Solopos is a company engaged in the newspaper industry located in Surakarta, Central Java. In its business process, PT. The Solopos script certainly involves various interrelated entities. The supply chain in the newspaper industry itself consists mostly of content editing production, manufacturing, and distribution. In general, the business processes can be seen in the following figure.

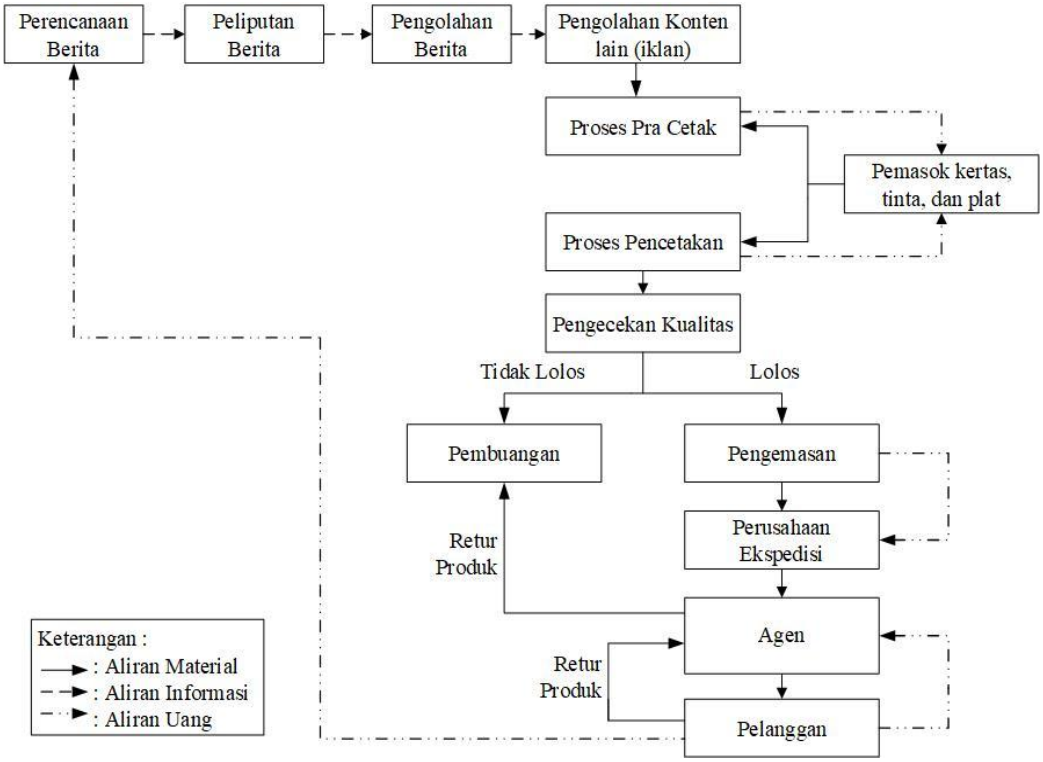

Figure 1. Newspaper Industry Supply Chain Business Process

Research related to risk management has been widely carried out in the last few years using a qualitative approach as expressed by qualitative values and impacts such as unique, neutral, mild impact, etc. (Okay, A. and Gopalakrishnan, M., 2009). Furthermore, research is mostly carried out with a quantitative approach by determining the impact using quantitative values such as cost, time, bodily injury, etc. (Gisslen, L. and Horndahl, A., 2016). A quantitative approach to supply chain risk management will assist management in taking action or deciding on a risk mitigation strategy based on the impact of risk. Several earlier studies have used a quantitative approach to supply chain risk management. Li, Y., et al. (2013) assessed supply chain disruptions using the Newsvendor model that considers opportunity costs and disruption costs. Furthermore, by Kähkönen, AK, et al. (2018) which shows the results that the Risk management is influenced by the strategic status of supply management, supply capabilities, expenses before and after acquisition, and project duration. Then by Melly, S., et al (2019) which was carried out in the agroindustry with the supply of raw materials and processing processes that were still traditional using ANP (Analytical Network Process) analysis and determined OKP (Operational Key Process) which became the main priority. Furthermore, by Ratnasari, S., et al.

(2018) used the House of Risk method and the results showed that there were 24 risks and 20 risk-causing agents with two risks in the red area and six risks in the orange area, so corrections were needed. Then by Sartika, V., et al. (2018) uses a quantitative approach to newspaper supply chain management by calculating the expected cost of risk.

This research was conducted by reviewing risk identification and proposed strategies that can be applied to mitigate the possibility of emerging risks in the supply chain of the newspaper industry during the COVID-19 pandemic using a quantitative approach. A quantitative approach is used to determine the probability of occurrence and impact on the company which is expressed quantitatively, so that the impact of each risk can be compared and ranked and the cost of the risk is calculated. There is a risk in every supply chain entity of the newspaper industry for an activity carried out in its business activities. The risks that existed previously were also added to the risks that emerged due to the COVID-19 pandemic.

2. Methods

The newspaper industry currently has a short time frame for producing newspapers to be sold, this makes every company required to have the right strategy so that the company can survive in the existing business competition. With the company's production activities being so short, it is vulnerable to risks that arise in the company's supply chain activities. The emergence of risks in supply chain activities should be assessed and mitigated so as not to interfere with the company's goals (Kurniawan DC, 2018). Supply chain risk management is needed by companies to reduce and deal with risks that will occur. (Juttner, 2013).

Seeing this, it has become a duty and obligation for the management of PT. Aksara Solopos as a company involved in increasing the value of the company. The value of the company itself can increase if events that are detrimental to the company and the environment can be controlled and minimized. One way to manage this risk is to create and implement a risk management (Farhan, M., 2020). Risk management is the process of detecting, measuring, mapping, establishing alternative risk management, monitoring, and controlling risks in a structured and methodical manner (Djohanputro, 2008). The goal of supply chain risk management is to control the risks that develop during supply chain activities in order to achieve optimal supply chain performance and avoid disruption.

Especially now that the world is in the midst of the COVID-19 pandemic. The impact of this pandemic has an impact on various fields, such as the economy, tourism, transportation, mass media and others (Ispriadi, BD S (2020). One of the affected mass media is print media. At this time there are not a few print media who cannot survive in the middle of the road competition. The COVID-19 pandemic has become an obstacle that has resulted in a negative impact on the print media industry. Due to the COVID-19 pandemic, the demand for newspaper print media is very volatile so there are often delays in the delivery of raw materials from suppliers who resulting in changes in production planning and out of stock of raw materials.

One of the methods used to manage risk is the supply chain operation reference (SCOR) method. Supply chain management using the SCOR method is divided into several parts of the supply chain, namely planning (plan), procurement (source), manufacture (make), delivery (deliver), and return (return).

1. Planning (Plan)
   This section describes the production activities associated with developing a plan to operate the supply chain.
2. Procurement (Source)
   This section describes product ordering, production scheduling, delivery and receipt of goods to service.
3. Making (Make)
   Describes activities related to the conversion of materials or the creation of supply chain content or products.
4. Delivery (Deliver)
   Describe the process of fulfilling the demand for goods or services from the supply chain
5. Return (Return)
   Describe activities related to the return of goods or the return of goods or products for various reasons

The SCOR model method occurs in all interaction activities between raw material suppliers and consumers. The interaction starts from the process of ordering goods to the issuance of payment invoices, the process of transferring ownership of the product from the supplier to the final consumer, all market interactions that greatly affect this method, even to the return process (Anggraeni & Hermana, 2009). SCOR is believed to be the best model for evaluating supply chain performance, because it allows describing the actual conditions (Apriyani, D., et al., 2018). The model also

emphasizes ineffective processes to help improve towards a better direction where operations, performance, and control can be improved (Supply Chain Council, 2008). The SCOR model focuses on the unity of supply chain activities, work together without impeding the continuity of activities in other areas. If there is a gap or gap, the SCOR model will reveal it and lead to a better condition (Delipinar and Kocaoglu, 2016). The SCOR model is able to maximize supply chain visibility including efficiency, measurement, and actionable results when the supply chain visibility strategy aligns with SCOR (Ntabe et al., 2015).

If there is a gap in the supply chain, identification is carried out using the SCRIS (Supply Chain Risk Identification System) method. The SCRIS method identifies risks in a supply chain systematically and identifies their causes, consequences, safeguards, and mitigation actions.

3. Data Collection

This research is a problem development from the research that have been conducted by Sartika et al. (2018) with an addition of the risks that can emerge from newspaper supply chain and consideration of inflation that happened in the last 3 years. This problem caused by COVID – 19 pandemic that has an impact to newspaper industry e.g. disruption in the delivery process and personnel absence due to health issue.

3.1. Company Business Processes

The entities that involved in newspaper supply chain network are shown in the table below.

Table 1. The Entities Involved in Newspaper Supply Chain

Entity	Code
Supplier	EN1
Newspaper Co.	EN2
Printing Co.	EN3
Expedition Co.	EN4
Agent	EN5
End Cust.	EN6

This is the activities that has been doing by each entities that involved. All activites divided with the SCOR elements. The SCOR elements are Plan (P), Source (S), Make (M), Deliver (D), Agent (A), dan Return (R).

Table 2. Supplier Activities

Process	Activities
P	Raw materials (paper, ink, etc.) supply planning Financial planning
S	Raw materials procurement
M	-
D	Raw materials delivery to printing company
A	Raw materials extraction at printing company warehouse
R	Raw materials return management Substitute materials delivery

Table 3. Newspaper Company Activities

Process	Activities
P	*Plan Source* Fulfill the demand, purchase the raw materials, supplier selection *Plan Deliver* Expedition company selection, make the delivery plan *Return Plan* Make the service plan and agency claims plan
S	Supplier selection Raw materials procurement Make a contract with suppliers Payment authorization Asked for printing to check the quantity and quality of raw materials Booking newspaper printing
M	Content creation and content delivery to the printing
D	Delivery schedule management Deliver the newspaper to agent Shipping document management Newspaper quality checking Keeping a relation with agent
R	Claim (for a error of quantity, quality, etc.) management Refund management

Table 4. Printing Company Activities

Process	Activities
P	*Plan Source* Raw materials procurement, supplier selection, plan the inventory inspection *Plan Makeup* Plan the human resource, production process, maintenance of the engine, and management of the waste *Plan Deliver* Plan the quality standard paper *Return Plan* Raw material return planning
S	Supplier selection Raw materials procurement Make a contract with suppliers Payment authorization Raw materials delivery process Raw materials inspection process (quantity, quality, document completion, etc.)
M	Production process (pre – press, printing, post – press) Inspection during production process Production scheduling Inspection of newspaper quality Packaging of newspaper Production Waste collection and management
D	-
R	Identification of damaged raw materials Return of raw materials

Table 5. Expedition Company Activities

Process	Activities
P	Make a delivery plan to different regions

Process	Activities
S	-
M	-
D	Newspaper loading into the fleet Conduct delivery process to the agents in various regions (choosen by newspaper company) Product verification to agents
R	Deliver the replacement to the agents who deliver a claim

Table 6. Agent Activities

Process	Activities
P	Plan the newspaper demand in his/her region
S	Newspaper booking
M	-
D	Sales invoice management
R	Customer claim management and customer claim report
R	

Table 7. Final Customer Activities

Process	Activities
P	-
S	Purchase the newspaper via the agent
M	-
D	-
R	Make a claim if there is any defective product
R	

3.2. Newspaper Industry Supply Chain Risk

Newspaper industry supply chain risk is obtained from the research that has been conducted by Sartika et al. (2018) with an addition of 5 new risks caused by COVID – 19 pandemic such as sudden changes in production planning, delay in raw material delivery from supplier, unable to ship product according to the number of request, out of raw materials, and personnel absence due to health issue.

Table 8. The Supply Chain Risk

Risk	Code
Newspaper demand miscalculation	P1
Daily demand notification delay	P2
Error logging shipping	P3
Raw materials quality decline	S1
Expired raw material	S2
Raw materials damaged in the delivery by the suppliers	S3
Bad quality of news	S4
A false amount of paper has been produced	M1
News content provision delay	M2
Broken machine	M3
Damaged plate	M4
Missprint	M5
Error in the setup process	M6

Risk	Code
Natural disasters during transportation process	D1
Car damage during transportation process	D2
Delivery delay to final customer	D3
Newspaper got to the false agent	D4
Reduced paper quality to the final customer	D5
Natural disasters during return process	R1
Car damage during return process	R2
Sudden changes in production planning	P4
Delay in raw material delivery from supplier	D6
Unable to ship product according to the number of request	D7
Out of raw materials	S5
Personnel absence due to the health issue	S6

3.3. Impact of Supply Chain Risk

The impacts of supply chain risk is obtained from the research that has been conducted by Sartika et al. (2018).

Table 9. Impacts of Supply Chain Risk

Impact	Code
Newspaper return 6%	T1
Waste	T2
Retransmission to the agent	T3
Newspaper demannd declinig	T4
Raw materials return	T5
Repairing/upgrading cost	T6

4. Results and Discussion

4.1. Supply Chain Risk Identification System (SCRIS)

Supply Chain Risk Identification System (SCRIS) is a system that shows the relationship between the risks, the impacts, and the risk carriers from each risk agents.

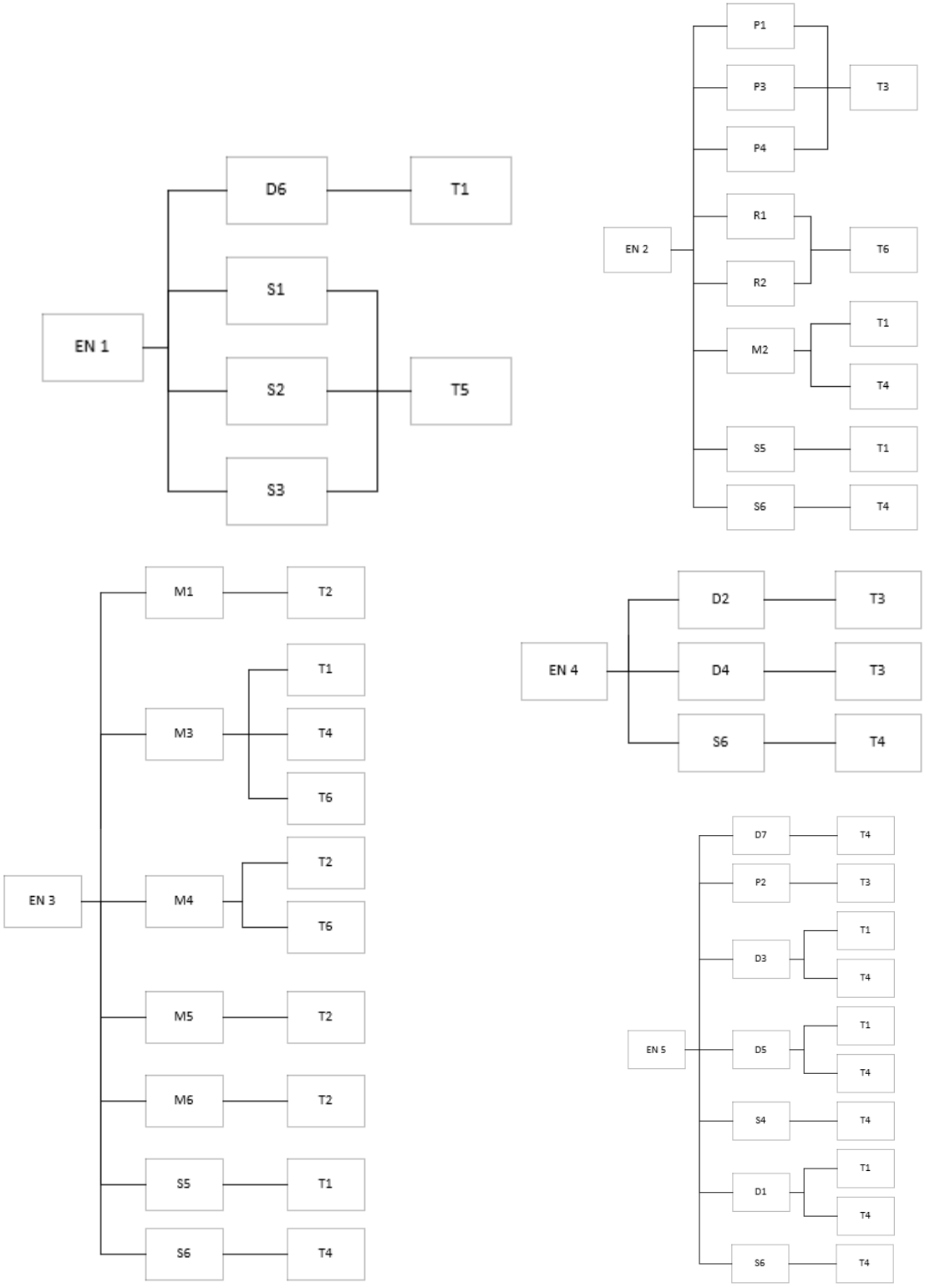

Figure 2. *Supply Chain Risk Identification System* (SCRIS)

4.2. Risk Cost Calculation Result

The risk cost calculation is adjusted with the 5% inflation and the addition of new risks that caused by COVID – 19 pandemic. In this research, the newspaper return is assumpted by 6% (C1). In the contract between newspaper company and the agents, the maximum amount of newspaper that can be returned without any payment is 6%. The return is caused by the newspaper that cannot be sold.

$$C_{C1} = P_{Newspaper} \cdot Q_{Newspaper} \cdot 6\%$$

Where C_{C1} is an impact cost from C1, $P_{newspaper}$ is a newspaper price, and $Q_{newspaper}$ is a newspaper sales in t period.

$$C_{C2} = P_{paper} \cdot Q_{kertas} + P_{ink} \cdot Q_{newspaper} + P_{plate} \cdot Q_{plate}$$

Where C_{C2} is an impact cost from C2, P_{paper} is a paper price, Q_{paper} is a quantity of paper that will become waste, P_{ink} is a ink price, Q_{ink} is a quantity of ink that will become waste, P_{plate} is a plate price, and Q_{plate} quantity of plate that will become waste.

$$C_{C3} = P_{gas} \cdot km$$

C_{C3} is an impact cost from C3, P_{gas} is a gas and km is a distance in kilometres.

$$C_{C4} = P_{newspaper} \cdot St$$

C_{C4} is an impact cost from C4, $P_{newspaper}$ newspaper price to the agent, dan St is a reduction of daily demand.

$$C_{C5} = 0$$

C_{C5} is an impact cost from C5. This cost is borne by the supplier.

C_{C6} is an impact cost from C6 (depends on which facilites need to be upgraded).

The result of the calculation is shown in the table 10.

Table 10. Total Cost Calculation Result

Risk	Probability	Impact Cost (IDR)		Risk Cost (IDR)		Total Cost (IDR)
		Before Inflation	After Inflation	Before Inflation	After Inflation	
Newspaper demand miscalculation	0.0092	5000.00	5250.00	505.00	530.25	5780.25
Daily demand notification delay	0.0367	5000.00	5250.00	2018.00	2118.90	7368.90
Error logging shipping	0.0092	5000.00	5250.00	505.00	530.25	5780.25
Raw materials quality decline	0.0917	0.00	0.00	0.00	0.00	0.00
Expired raw material	0.0367	0.00	0.00	0.00	0.00	0.00
Raw materials damaged in the delivery by the suppliers	0.0367	0.00	0.00	0.00	0.00	0.00
Bad quality of news	0.0550	330000.00	346500.00	18165.00	19073.25	365573.25
A false amount of paper has been produced	0.0367	123000.00	129150.00	4514.00	4739.70	133889.70
News content provision delay	0.0183	1650000.00	1732500.00	30275.00	31788.75	1764288.75
Broken machine	0.0367	1650000.00	1732500.00	60550.00	63577.50	1796077.50
Damaged plate	0.1835	123000.00	129150.00	2716.00	2851.80	132001.80
Missprint	0.1835	23000.00	24150.00	2569.00	2697.45	26847.45
Error in the setup process	0.0917	123000.00	129150.00	11284.00	11848.20	140998.20
Natural disasters during transportation process	0.0092	1650000.00	1732500.00	15138.00	15894.90	1748394.90
Car damage during transportation process	0.0183	55000.00	57750.00	1009.00	1059.45	58809.45
Delivery delay to final customer	0.0550	1650000.00	1732500.00	90826.00	95367.30	1827867.30

Risk	Probability	Impact Cost (IDR)		Risk Cost (IDR)		Total Cost (IDR)
		Before Inflation	After Inflation	Before Inflation	After Inflation	
Newspaper got to the false agent	0.0550	55000.00	57750.00	3028.00	3179.40	60929.40
Reduced paper quality to the final customer	0.0092	650000.00	682500.00	15138.00	15894.90	698394.90
Natural disasters during return process	0.0092	300000.00	315000.00	2752.00	2889.60	317889.60
Car damage during return process	0.0183	50000.00	52500.00	917.00	962.85	53462.85
Sudden changes in production planning	0.0092	5000.00	5250.00	505.00	530.25	5780.25
Delay in raw material delivery from supplier	0.0183	0.00	0.00	0.00	0.00	0.00
Unable to ship product according to the number of request	0.0550	5000.00	5250.00	505.00	530.25	5780.25
Out of raw materials	0.0183	5000.00	5250.00	505.00	530.25	5780.25
Personnel absence due to the health issue	0.1835	1650000.00	1732500.00	60550.00	63577.50	1796077.50

After that, the total cost is sorted from the largest to the smallest.

Table 11. Sorted Total Cost Calculation Result

Risk	Probability	Impact Cost (IDR)		Risk Cost (IDR)		Total Cost (IDR)
		Before Inflation	After Inflation	Before Inflation	After Inflation	
Delivery delay to final customer	0.0550	1650000.00	1732500.00	90826.00	95367.30	1827867.30
Broken machine	0.0367	1650000.00	1732500.00	60550.00	63577.50	1796077.50
Personnel absence due to the health issue	0.1835	1650000.00	1732500.00	60550.00	63577.50	1796077.50
News content provision delay	0.0183	1650000.00	1732500.00	30275.00	31788.75	1764288.75
Natural disasters during transportation process	0.0092	1650000.00	1732500.00	15138.00	15894.90	1748394.90
Reduced paper quality to the final customer	0.0092	650000.00	682500.00	15138.00	15894.90	698394.90
Bad quality of news	0.0550	330000.00	346500.00	18165.00	19073.25	365573.25
Natural disasters during return process	0.0092	300000.00	315000.00	2752.00	2889.60	317889.60
Error in the setup process	0.0917	123000.00	129150.00	11284.00	11848.20	140998.20
A false amount of paper has been produced	0.0367	123000.00	129150.00	4514.00	4739.70	133889.70
Damaged plate	0.1835	123000.00	129150.00	2716.00	2851.80	132001.80
Newspaper got to the false agent	0.0550	55000.00	57750.00	3028.00	3179.40	60929.40

Risk	Probability	Impact Cost (IDR)		Risk Cost (IDR)		Total Cost (IDR)
		Before Inflation	After Inflation	Before Inflation	After Inflation	
Car damage during transportation process	0.0183	55000.00	57750.00	1009.00	1059.45	58809.45
Car damage during return process	0.0183	50000.00	52500.00	917.00	962.85	53462.85
Missprint	0.1835	23000.00	24150.00	2569.00	2697.45	26847.45
Daily demand notification delay	0.0367	5000.00	5250.00	2018.00	2118.90	7368.90
Newspaper demand miscalculation	0.0092	5000.00	5250.00	505.00	530.25	5780.25
Error logging shipping	0.0092	5000.00	5250.00	505.00	530.25	5780.25
Sudden changes in production planning	0.0092	5000.00	5250.00	505.00	530.25	5780.25
Unable to ship product according to the number of request	0.0550	5000.00	5250.00	505.00	530.25	5780.25
Out of raw materials	0.0183	5000.00	5250.00	505.00	530.25	5780.25
Raw materials quality decline	0.0917	0.00	0.00	0.00	0.00	0.00
Expired raw material	0.0367	0.00	0.00	0.00	0.00	0.00
Raw materials damaged in the delivery by the suppliers	0.0367	0.00	0.00	0.00	0.00	0.00
Delay in raw material delivery from supplier	0.0183	0.00	0.00	0.00	0.00	0.00

From the table, we can conclude 5 risks with the largest cost and have a significant impact to the company through the large amount of loss. Those risks and the risk carriers are broken machine that caused by printing company, while delay in the provision of news content that caused by newspaper company. Whereas, the agent brings 2 risks i.e. natural disasters that occurred during transportation and delivery delay to the final customer. Furthermore, personnel absence due to the health issue is caused by newspaper company, printing company, expedition company, and agent. If all of those 5 risks happened, the total loss is IDR 8,932,705.95.

Table 12. The Risks with the Largest Total Cost

Code	Risk	Risk Carrier
D3	Delivery delay to final customer	EN5
M3	Broken machine	EN3
S6	Personnel absence due to the health issue	EN2, EN3, EN4, EN5
M2	News content provision delay	EN2
D1	Natural disasters during transportation process	EN5

4.3. Mitigation Strategy Design

From the 5 risks with the largest total cost, some mitigation strategies are proposed in order to handle the risks. Each of those mitigation strategies has a advantages and disadvantages that can be considered during the implementation.

Table 13. Mitigation Stragies for Each Risks

Code	Risk	Risk Carrier	Mitigation Strategy	Advantages	Disadvantages
D3	Delivery delay to final customer	EN5	Increase the communication to the newspaper company Making a contract between agent and delivery man	Newspaper company will know the problem in the delivery	-
M3	Broken machine	EN3	Change the machine Change the printing vendor Divide the printing process to another vendor	Machine rejuvenation Vendor production load reduction	Cost for new machine
S6	Personnel absence due to the health issue	EN2, EN3, EN4, EN5	Apply the health protocol in work environment Apply the shift work hour Reduce the production quantity Change the printing vendor Divide the printing process to another vendor Change the expedition vendor Change the delivery in certain region to another agent	Labor health guaranty Production load reduction Work load reduction	There is a need for adaption to health protocol
M2	News content provision delay	EN2	Improve the communication between printing company and newspaper company Improve the performance of the content creator	News content production acceleration	-
D1	Natural disasters during transportation process	EN5	Change the delivery route Change the delivery in certain region to another agent	Newspaper demand in the region that blocked by the natural disasters still can be fulfilled	Cost for route changing

5. Conclusion

According to business processes analysis in each entity using SCOR element (plan, source, make, deliver, return) we can conlude that there are 25 risks with 3 risks from plan element, 6 risks from sources element, 6 risks from make element, 7 risks from deliver element, and 2 risks from return element. From the total risk cost analysis, we can conlude 5 risks with the largest total cost i.e. delivery delay to the final customer, broken machine, personnel absence due to the health issue, the delay in the provision of news content, and natural disasters occur during transportation. If If all of those 5 risks happened, the total loss is Rp IDR 8,932,705.95. To handle those 5 risks, the mitigation strategies is proposed with an advantages and disadvantages that can be considered during the implementation.

References

Apriyani, D., Nurmalina, R., & Burhanuddin, B. Evaluasi Kinerja Rantai Pasok Sayuran Organik Dengan Pendekatan Supply Chain Operation Reference (SCOR). *MIX: Jurnal Ilmiah Manajemen*, *8*(2), 312-335. 2018.

Ispriadi, B. D. S., Putri, D. A., & Dewani, P. K. Eksistensi Media Cetak Pada Masa Pandemi COVID-19. *JISIP: Jurnal Ilmu Sosial dan Ilmu Politik*, *9*(2), 127-134. 2020.

Farhan, M. Analisa Manajemen Risiko Rantai Pasok Dengan Menggunakan Metode *House of Risk* (HOR). 2020.

Gisslen, linus dan Horndahl, Andreas. *A Quantitative Approach to Risk and Cost Assessment in Supply Chain Management*. 2016 European Intelligence and Security Informatics Conference. 2016.

Kähkönen, A. K., Lintukangas, K., Hallikas, J., & Ojala, M. The impact of total costs and strategic supply on risk management in project business, *International Journal of Procurement Management*, *Inderscience Enterprises Ltd,* vol. 11(2), pages 153-171. 2018.

Kurniawan, D. C. Analisis dan Mitigasi Risiko Proses *Make, Deliver, Return* dengan Pendekatan Model *Green Supply Chain Operation Reference* (*Green* SCOR) dan Metode *House of Risk* (HOR) pada PT. Globalindo Intimates. 2018.

Li, Y., Chen, X., & Lu, J. Supply chain disruption assessment based on the newsvendor model. *Journal of Industrial Engineering and Management* (JIEM, 2013 – 6(1):188-199. 2013.

Melly, S., Hadiguna, R.A., Santosa, & Nofialdi. Manajemen Risiko Rantai Pasok Agroindustri *Industria: Jurnal Teknologi dan Manajemen Agroindustri* Vol. 8 No. 2: 133-144. 2019.

Oke, A., & Gopalakrishnan M. Managing Disruption in Supply Chains: A Case Study of A Retail Supply Chain. *IJPE 118* No. 1, pp 1-11. 2009.

Ratnasari, S., Hisjam, M., & Sutopo, W. Supply chain risk management in newspaper company: House of risk approach. *In AIP Conference Proceedings* (Vol. 1931, No. 1, p. 030016). 2018.

Rozudin, M. & Mahbubah, N.A. Implementasi Metode *House of Risk* Pada Pengelolaan Risiko Rantai Pasokan Hijau Produk Bogie S2HD9C (Studi Kasus: PT Barata Indonesia). *JISI: Jurnal Integrasi Sistem Industri* Vol. 8 No.1. 2021.

Sartika, V., Hisjam, M., & Sutopo, W. Supply chain risk management of newspaper industry: A quantitative study. *In AIP Conference Proceedings* (Vol. 1931, No. 1, p. 030018). 2018.

Yuliani. Analisis Pemilihan Supplier Bahan Baku Paper dengan Metode Analytical Hierarchy Process Menuju E-Supply Chain Management PT Papertech Indonesia di Unit II Skripsi. Teknik Industri, Universitas Muhammadiyah Magelang. Magelang. 2019.

Saputra, I. W., Sutopo, W., & Hisjam, M. Optimization of distribution channel vehicle routing problem with time windows using differential evolution algorithm a case study in newspaper industry. *Asia-Pacific Management and Business Application*, 10, 1-10. 2017.

Aqidawati, E.F., Sutopo, W., & Hisjam, M. The Integration of Production-Distribution on Newspapers Supply Chain for Cost Minimization using Analytic Models: Case Study. *IOP Conf. Series : Materials Science and Engineering*, 319. 2018.

Sutopo, W., Erliza, A., & Heryansyah, A. Optimizing Supply Chain Collaboration Based on Agreement Buyer-Supplier Relationship with Network Design Problem. *Makara Journal of Technology*, 20(3), 2. 2016.

Biographies

Aditya Mahendra is an undergraduate student of the Industrial Engineering Department of Universitas Sebelas Maret, Surakarta, Indonesia. Her research interests are in the supply chain, logistics, business, techno economy, and sustainability.

Anisa Nur Maya D.R.H.H is an undergraduate student of the Industrial Engineering Department of Universitas Sebelas Maret, Surakarta, Indonesia. Her research interests are in the supply chain, logistics, business, techno economy, and sustainability.

Rizki Ananda P.N.R is an undergraduate student of the Industrial Engineering Department of Universitas Sebelas Maret, Surakarta, Indonesia. Her research interests are in the supply chain, logistics, business, techno economy, and sustainability.

Silvi Istiqomah a lecturer of Industrial Engineering Department, Universitas Mahakarya Asia. She has graduated in Undergraduate and Master Program of Industrial Engineering Department, Universitas Sebelas Maret, Surakarta, Indonesia. Research interests are related to techno-economics, logistics, commercialization technology, electric vehicle, and charging station. She has published some research optimization and supply chain management.

Wahyudi Sutopo is a professor in industrial engineering and coordinator for the research group of industrial engineering and techno-economy (RG-RITE) of Faculty Engineering, Universitas Sebelas Maret (UNS), Indonesia. He earned his Ph.D. in Industrial Engineering & Management from Institut Teknologi Bandung in 2011. He is also a researcher for the university center of excellence for electrical energy storage technology (UCE-EEST). He has done projects with Indonesia endowment fund for education (LPDP), sustainable higher education research alliances (SHERA), MIT-Indonesia research alliance (MIRA), PT Pertamina (Persero), PT Toyota Motor Manufacturing Indonesia, and various other companies. His research interests include logistics & supply chain management, engineering economy, cost analysis & estimation, and technology commercialization. He is a member of the board of industrial engineering chapter - the institute of Indonesian engineers (BKTI-PII), Indonesian Supply Chain & Logistics Institute (ISLI), Society of Industrial Engineering, and Operations Management (IEOM), and Institute of Industrial & Systems Engineers (IISE).

Yuniaristanto is a lecturer of Department of Industrial Engineering, Universitas Sebelas Maret (UNS). He obtained his Master of Engineering from Institut Teknologi Bandung and Bachelor of Engineering in Industrial Engineering from Institut Teknologi Sepuluh November. He is part of the Industrial Engineering and Techno -Economy (RITE) Research Group. His research interests are Logistics & Supply Chain Management, and Production/Operations Management.