

THE ANALYSIS OF SUPPLY CHAIN RISK ON READY TO DRINK (RTD) PRODUCT USING HOUSE OF RISK METHOD

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Abstract. PT SGB is one of the companies that produce Ready To Drink (RTD) beverage as its product and its demand have increased every each year. The company's supply chain process which starts from material ordering, materials storage management, production process, finished good storing, and delivering to customers. All those processes belong to company's supply chain stream and it is mapped as the element of Supply Chain Operation Reference (SCOR). From that complex processes, there were found supply chain risk as the problem. Risks that found in supply chain flow should be solved based on risk priority order. The method that used for analyzing the risk is House of Risk (HOR), consist of two phases. The objective of the first phase of HOR is knowing the risk priority that should be mitigated based on the Aggregate Risk Potential (ARP) score, and the second phase of HOR are generating some preventive strategies then choose the most effective strategy that suitable to be implemented. Meanwhile, the Pareto chart is used to determine the choosen priority risk to be mitigated. There are 63 identified risk events based on SCOR elements, 43 identified risk agents, and 15 recommended preventive strategies according to the most effective sequence of strategies that applied in the company.

Key words: House of Risk (HOR), SCOR, Supply Chain Risk Management, Pareto, Supply Chain Management

1. Introduction

Ready to drink (RTD) is term, which used to define a type of beverage in a special packaging that can be consumed directly without having to be processed. RTD is drink that includes in food and beverage group business as an industry that was not deterred by crisis. Even in 2008 when economy was weakening due to global crisis, food and beverage business was still survive and increased by 14.9%, according to data of food and beverage industry growth by Statistic Indonesia [1]. Moreover, RTD also experienced an increase in demand every year as shown at Figure 1.

PT Suntory Garuda Beverage (SGB) is one of companies that concerned in RTD, that packaging or RTD was divided into cup packaging and PET (Polyethylene Terephthalate) packaging. PT SGB ordered two categories of material, they were Raw Material (RM) and Packaging Material (PM).

When made an order of material, there was incompatibility as shown at Table 1.

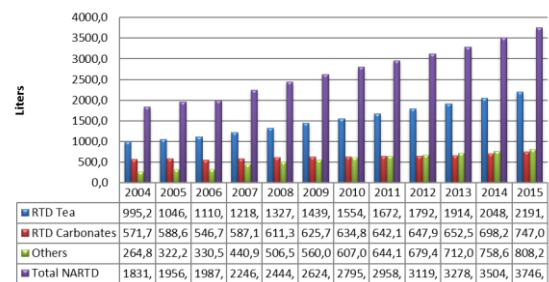


Figure 1. Assumption of RTD level growth

To fulfill its production need, PT SGB made schedule of supplier to send materials for production planning to run as expected, but not all suppliers come at the appointed time of purchase. This would certainly affect the production process and processing material into finished product. The material would be stored in material warehouse until production process would be done according to product variations. Incompatibility time-delivery (could be earlier or coming late) from supplier of PT SGB could be seen at Figure 2.

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Table 1. List of Material Returns to Supplier

No.	Type	Return Date	Item	Material Defective	Qty
1	PM	10/01/17	Cup JDO1 150 ML 3,3 gr	Lip cutting were not standard	250 pcs
2	PM	16/01/17	Roll JDO9 150ml 50µm Logo Garudafood New	Missprint	0,43 roll
3	PM	16/01/17	Roll MTB1 16L TRMS (New Design)	Stretchy	0,78 roll
4	PM	16/01/17	Roll JDO9 150ml 50µm Logo Garudafood New	Stretchy	1,9 roll
5	PM	16/01/17	Dus JDO3 150ml	Couldn't be formed perfectly in erector	1440 pcs
6	PM	16/01/17	Dus JDO7 150ml	Connection without glue	96 pcs
7	RM	30/01/17	VBC 04	Primary packaging was torn	25 kg

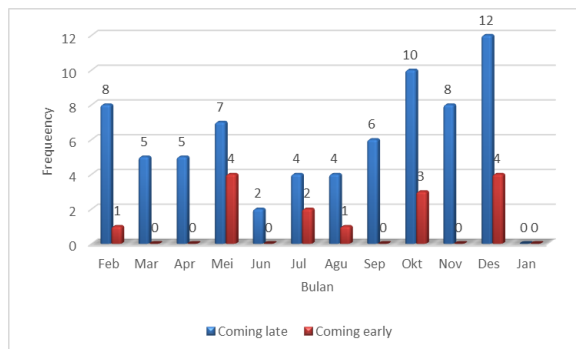


Figure 2. Incompatibility Time of Material Acceptance in PT SGB

Product of RTD beverage would be send according to customer demand by using a company fleet, shipping services, and also by using distributor company of Garuda, that was PT. Sinar Niaga Sejahtera (SNS). If there was return of RTD product because the product had damaged when shipping to customer, the company would re-send the product to customer at the following shipping schedule. Product return would cause harm to company and also affected the running of supply chain process. Product return of RTD product could be seen at Table 2. This risk management would be conducted at RTD product type of cup, because based on secondary data that obtained from Quality Control section of company, the number of defective product that produced by each RTD cup products were 1240 of cup and RTD PET were 548 of bottle as presented at

Figure 3.

Table 2. Return Data of RTD Product

	Item Code	Accepted (box)	Refused (box)
Depo: Surabaya	JDO1	24	2
	JBC4	42	3
	JBC3	20	3
Sent date: 20/01/17	JDO9	28	6
	JDO5	85	10
	JDO2	38	11
	JBC8	26	2
	JBC4	46	5
	JDO7	28	4
	JDO4	42	2

Final defects that produced could be caused of un-specification material in production, then defect during production process, and defective product when transfer time of goods to finished product warehouse.

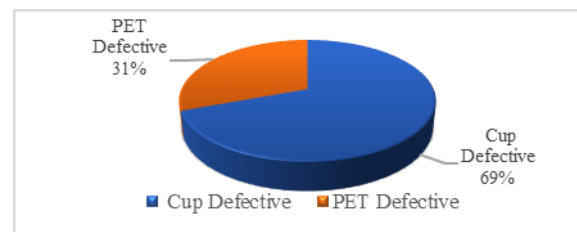


Figure 3. Comparison Chart of RTD defective Number in January 2017

Supply chain management is method or integrative approach that used to manage the flow of product, flow of information and flow of money intregatedly. The flows involved the parties from upstream to downstream that consisting of supplier, factory, distribution network and logistics services [2]. In a process, there was always risk arised, so were risks along the flow of supply chain activity in PT SGB. Risk was probability of loss and its implication that affect to individual and organization [3]. To handle existing risk, required a clear structure of Supply Chain Risk Management (SCRM), start from identifying risk on each activity according to Supply Chain Operation Reference (SCOR) which consisted of 5 elements, they were plan, source, make, deliver, and return. Arising risk from such activity would be triggered by the risk agent, then would be designed mitigation strategy in order to manage the risk well and fixed business system of PT SGB.

This research used House of Risk (HOR) method that was developed from Failure

Site this Article As

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Mode and Effect Analysis (FMEA) and House of Quality (HOQ) methods to develop a framework for risk management. HOQ method in product designing changed function into tool in strategi designing of risk mitigation that known as HOR [4]. HOR consisted of two phases, they were HOR phase 1 dan HOR phase 2. This research aimed to identify risk, cause of risk, and strategy to handle risk that accordance with the condition of company.

2. Research Methods

Type of research that used in this study was descriptive research. Final result of this study could be used as input and consideration matter for the management to handle the risk in supply chain management of company and affected to fluency of supply chain flow of company.

2.1 Research Steps

Steps in conducting research were Study of Literature, Preliminary Survey, Identification and Determine of Research Problem, Determination of Research Goal, Data Collection, and Conclusion and Suggestion. It starts with study of literature that conducted to learn about theory and knowledge, which relate to problem that match with object under study.

Secondly, preliminary survey that aimed to obtain as much as possible that relate to research topic and identify the problem in company. Steps that had to be conducted after preliminary survey were identification and determined of research problem against activity in supply chain flow of RTD product in PT SGB and defined any problems that might arise. After determining of research goal, then determining framework that used in processing and analyzing data. Data that used in this research was primary data and secondary data.

Primary data in this research was obtained from observation, interview, discussion, and questionnaire. The observation/survey method collected data about the implementation of *supply chain* in PT SGB through complete assessment of real condition company. The interview method conducted to obtain data and information about implementation of Supply Chain Risk Management in PT SGB. The discussion method conducted to help identifying risk factors and determining cause of risk, Site this Article As

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determining correlation value between HOR 1 and HOR 2, and also assessment of difficulty level of implementing handling strategy in company, and questionnaire method conducted when giving assessment of severity value and occurrence against supply chain risk of company.

Secondary data that used was a brief history and profile of PT SGB, vision and mission, and also organization structure of PT SGB, variation of RTD product that produced, returned data RM and PM from and to supplier, and incompatibility data of delivery schedule of RM and PM, and also finished product inspection.

The following step after data collection was data processing and discussion in this research explained as mapping activity of company supply chain, this stage was stage that describing activity by identifying parties that involved in supply chain activity in PT SGB. Followed by Risk identification and Cause of Risk, this stage identifying the risk that would be handled by using element from supply chain, that was SCOR consisted of plan, source, make, delivery, and return. After identifying the risk, then identifying the cause of risk. The next step is Analysis and Risk Evaluation. In this stage identified the score of severity and occurrence of risk, correlation between the risk event and risk agent. Risk evaluation conducted to determine the risk that required handling by using House of Risk (HOR) method phase 1. Input for HOR phase 1 were risk event, risk agent, severity value, occurrence, and correlation. Then, from HOR phase 1 would obtain the value of Aggregate Risk Potential (ARP) from each risk agent. To determine risk agent which had to be immediately mitigated, used Pareto diagram to know the highest cause of risk on each occurrence [5].

The following step after was Risk management that used to designing strategy which need to repair immediately. ARP value in HOR phase 1 would be input to make HOR phase 2. After that, would be determined correlation between strategy and selected risk agent. Then, total effectiveness was calculated and determined degree of difficulty from every preventive action to see how effective and difficult that action to do, then calculated ETD, that was ratio of effectiveness to difficulty and

ranked to each preventive action. Ranking would be given based on the highest ETD value.

The last stage consisted of conclusion that obtained from analysis result and suggestion in statement for company in order to do systematic action to minimize risk on supply chain flow of RTD product.

3. Result and Discussion

In this section would be explained the result and discussion of research.

3.1 Mapping of Supply Chain Activity

Mapping of supply chain activity was conducted based on five elements in Supply Chain Operation Reference (SCOR) they were Plan, Source, Make, Deliver and Return, and summarized in Table 3.

Table 3. Mapping of Supply Chain Activity of RTD Product based on SCOR element

Element	No	Activity
Plan	1.	Making schedule of weekly production plan
	2.	Forecasting demand
	3.	Material inventory planning
	4.	Procurement planning of material needs
Source	1.	Acceptance of RM and PM from supplier
	2.	Checking RM and PM that accepted from supplier
	3.	Storing RM and PM in material warehouse
	4.	Management stock of RM and PM in material warehouse
	5.	Distribution of RM and PM to production section
Make	1.	Processing production of RTD (cup line)
	2.	Controlling against production process
Deliver	1.	Storing finished product until distributed
	2.	Inspection against RTD product
	3.	Distributing RTD to customer
	a.	Company fleet
	b.	PT SNS (Sinar Niaga Sejahtera)
Return	c.	Expedition
	1.	Material return (RM/PM) from supplier
	2.	Return of defect RTD product from customer
	3.	Re-send RTD product to customer

3.2 The 1st Phase of House of Risk

HOR phase 1 was started by identifying risk event and severity assessment. Followed by identifying risk agent and occurrence assessment, and also identifying of correlation between risk event and risk agent. The following were identification result of risk event and risk agent in supply chain flow based on SCOR element as shown in Appendix 1.

Based on identification result, there was found 63 risk events and 43 risk agents. After knowing risk event and risk agent, assessed severity and occurrence by company parties and continued with discussion to determine correlation between risk event and risk agent of supply chain. Correlation assessment based on

scoring scale 0 (had no correlation), 1 (weak correlation), 3 (medium correlation), 9 (strong correlation). Table of HOR 1 could be seen at Appendix 2.

The following step is calculating Aggregate Risk Potential (ARP) value, used as reference and input to determine priority of risk agent which need to be handled first that given preventive action against risk agent. After calculating all of ARP value, then ARP value sorted descending (from the biggest value into smallest value). The following is ARP value ranking that presented in Table 4.

Based on ARP ranking, the highest ARP value in risk agent "human error" is 1521,952 and the lowest ARP value in risk agent "limited of RTD product safety stock that available" that is 4,762. Then, ARP ranking would be analyzed by using Pareto Chart. Pareto Chart aimed to determine the priority risk agent to be handled for the occurrence of the risk caused. Based on Pareto chart, selected risk agent is 80:20. 20% from total number of risk agent that contributed almost 80% against total ARP value caused by nine risk agents. The following is Pareto Chart of ARP ranking that shown in Figure 4.

3.3 The 2nd Phase of House of Risk

The next stage was determining several actions that considered effective for reducing probability of cause of risk. Steps in working on HOR phase 2 were cause of risk election, management strategy determination, proposal of management strategy, correlation between management strategy and cause of risk,

Table 4. Ranking of ARP

Rank	Code	Cause of Risk	ARP
Pr1	ARP10	Human error	1521,951
Pr2	ARP22	Incompability material quality (un-specification quality of material)	1012,574
Pr3	ARP33	No checking in final delivery	789,198
Pr4	ARP11	Un-specified work instruction and retrieval of material	413,517
Pr5	ARP19	Planning of machine maintenance was not done routinely	370,483
Pr6	ARP12	Lack of control over supplier	358,241
Pr7	ARP1	Sudden production machine was damaged	339,228
Pr8	ARP17	Environmental condition of material storage was uncondusive	293,028
Pr9	ARP20	Repairment of production machine was not optimal yet	247,042
Pr10	ARP5	Lack of coordination between parts	243,000
Pr11	ARP25	Product was knocked during transfer process	212,555
Pr12	ARP6	Unevenly information distribution between part	209,411
Pr13	ARP42	Lack of company fleet	168,948
Pr14	ARP13	Fleet didn't pay attention to environmental condition of vehicle	162,857

Site this Article As

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Paper Published : August, 11th 2017

Rank	Code	Cause of Risk	ARP
Pr15	ARP41	Limited fleet capacity	135,000
Pr16	ARP23	Production machine worked un-optimally	129,765
Pr17	ARP24	Cup-sealing process was not perfect	116,275
Pr18	ARP31	Inappropriate pallet using (reverse)	109,381
Pr19	ARP28	Labelling machine (IIP) worked un-optimally	108,000
Pr20	ARP8	Un-stable traffic condition	94,065
Pr21	ARP4	Sudden demand changed from central company	91,559
Pr22	ARP27	Asroll was not rolled properly on machine	83,549
Pr23	ARP29	Production plan didn't run cording to schedule	62,471
Pr24	ARP16	Location of material storage in warehouse was ineffective	54,775
Pr25	ARP2	Lack of RM to process production	52,034
Pr26	ARP3	Lack of PM to process production	45,456
Pr27	ARP9	Lack of coordination with supplier	45,357
Pr28	ARP36	No checking in delivering finished product by company fleet	33,877
Pr29	ARP43	RTD returned product was broken	33,156
Pr30	ARP35	There was fault storage in transport fleet	32,469
Pr31	ARP34	Finished product in FG warehouse was not effective	31,061
Pr32	ARP30	There was expanding inspection, indeed overall inspection	30,826
Pr33	ARP18	Expired Date label was not seen clearly	29,595
Pr34	ARP21	Overloading in using of production machine	27,896
Pr35	ARP32	Un-optimally inspection process of material	25,960
Pr36	ARP7	Parameter in determining the purchase of material was inappropriate	22,679
Pr37	ARP15	The division of human resource was uneven	22,386
Pr38	ARP26	Contamination of iron from production machine	21,604
Pr39	ARP14	Weather problem	19,049
Pr40	ARP37	Fleet damage	12,000
Pr41	ARP39	Expedition transportation of fleet was damage	11,761
Pr42	ARP38	Lack of coordination with supplier	9,906
Pr43	ARP40	Limited safety stock of RTD product that available	4,762

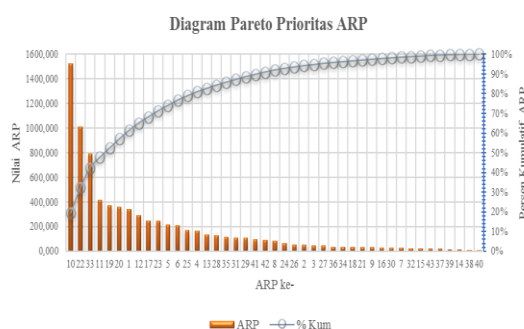


Figure 4. Pareto Chart of ARP

calculation of Total Effectiveness (TE_k) value from each strategies by considering risk agent of ARP value and management strategy, and calculation of Effectiveness To Difficulty (ETD) value by considering Degree of Difficulty value [6].

Management strategy considered according to Pareto principle that selected 9 risks and handled by 15 management strategies. Management strategy that recommended could reduce occurrence in supply chain of company as presented in Table 5-6.

Table 5. Management Strategy of Risk Agent

No.	Risk Agent	Management Strategy	Code
1.	Human error	Training periodically	PA1
		Applying reward system as work	PA2
		Briefing routinely every day at the beginning and the end of working hours	PA3
2.	Incompibility of material quality with the specifications desired by company	Supplier election had to be conducted more selectively	PA4
		Reviewing contract with supplier	PA5
3	No checking in final delivery	Adding the task of BOF section that aimed to check product before distributed	PA6
4.	Un-specified working instruction and retrieval of material	Updating the "work instruction" of storage and retrieval material and supervising its implementation	PA7
		Making mandatory sign board in material warehouse	PA8
5.	Planning of machine maintenance was not conducted routinely	Making maintenance report	PA9
		Scheduling preventive maintenance of production machine	PA10
6.	Lack of control over supplier	Reviewing performance of supplier	PA11
		Making contract with supplier	PA12
7.	Sudden production machine was damaged	Preparing emergency maintenance action	PA13
8.	Environmental condition of material storage was uncondusive	Determining criteria of environmental for material storage to keep quality of material	PA14
9.	Repairment of production machine was not optimal yet	Conducting corrective maintenance of production machine	PA15

After making management strategy of supply chain risk in PT SGB that discussed in previous point, the next stage was making assessment of correlation between recommended management strategy and each potentially risk agents. Correlation assessment conducted as correlation on HOR phase 1.

After making assessment of correlation, the next stage was calculating *Total Effectiveness* (TE_k) value and making assessment of *Degree of Difficulty* (D_k) from each proposal management strategy. Assessment of *Degree of Difficulty* (D_k) that conducted with difficulty scale where value on the scale was presenting consideration of cost, time, and resource in its implementation. Assessment of degree of difficulty conducted

Site this Article As

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Paper Published : August, 11th 2017

by company according to scale in Table 7.

Table 7. Scoring Scale of Degree of Difficulty

Level	Degree of Difficulty (D_k)	Explanation
3	Low	Easy to apply
4	Medium	Rather difficult to apply
5	High	Difficult to apply

After calculating Total Effectiveness (TEK) and assessment of Degree of Difficulty (D_k), then calculating ratio of Effectiveness to Difficulty (ETD) from management strategy that had been proposed. Calculation of ETD aimed to determine ranking and priority of each management strategy. Then, ETD value was sorted descending as presented in Table 8.

Table 8. Ranking of ETD Value

No. PA	Management Strategy	ETD Value
PA 3	Briefing routinely every day at the beginning and the end of working hours	4565,852
PA 1	Training periodically	3763,896
PA 2	Applying reward system as work motivation to all workers	3424,389
PA 4	Supplier election had to be conducted more selectively	3395,963
PA 6	Making team that aimed to check product before distributed	2044,375
PA 7	Updating WI of storage and retrieval material and supervising its implementation	1240,552
PA 9	Planning machine maintenance periodically	1088,007
PA 10	Preventive maintenance of machine	1088,007
PA 11	Doing evaluation of supplier performance	1074,723
PA 12	Making contracts with supplier	1074,723
PA 5	Reviewing contract with supplier	1012,574
PA 14	Determining criteria of environmental for material storage to keep quality of material	912,457
PA 13	Preparing emergency maintenance action	610,611
PA 15	Conducting corrective maintenance to production machine	512,520
PA 8	Making mandatory sign board in material warehouse	511,193

Preventive action by periodical training (PA1) could be conducted to handle human error risk agent. Training Needs Analysis (TNA) was needed to know training need in each particular job in company.

Preventive action by applying reward system as motivation to all workers (PA2) was strategy that offered to reduce the occurrence of human error. Giving reward as motivation to all workers increased spirit, motivation and

reduced inaccuracy and mistake during doing their job.

Briefing routinely every day at the beginning and the end of working hours (PA3) was preventive action to handle human error risk agent. Briefing was conducted by team leader of each section as expert of the field. During conducting briefing, there should be report as documentation and daily journal that could be used as activity control.

Preventive action by electing supplier selectively (PA4) used for handling material quality was not appropriate with specification desired by company risk agent. Method that used for determining the best supplier was using scoring for some criteria that wanted by company. Supplier scoring was using Analytical Hierarchy Process (AHP) method.

Reviewing contract with supplier (PA5) was preventive action that conducted in order to decrease risk of material quality that was appropriate with specification desired by company. Resulted output from reviewing contract was evaluation of supplier if there was something that inappropriate with contract.

Preventive action by task adding of Back off Factory (BOF) that aimed to check product before distributed (PA6) was decreasing risk because there was no final checking before delivering product. Checking and controlling product during loading and transferring to expedition was conducted by BOF team leader and staff.

Preventive action by updating work instruction (WI) of storing and retrieving of material and supervising in implementation (PA7) was handling strategy that recommended to decrease the risk agent because of WI. It was related with risk event of retrieval of material that was not accordance with FIFO principle for PM and FEFO for RM, and evaluation of supplier in material arrival.

Preventive action by making mandatory sign board that put on the door of warehouse (PA8) could be conducted by company to reduce risk of how to retrieve material by using FIFO or FEFO principles. Mandatory sign board made in three kinds, related how to retrieve material by FIFO for packaging material and FEFO for raw material. Related with how to put separated reacted material, and also made report for head of warehouse division

Site this Article As

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Paper Published : August, 11th 2017

about retrieval of material.

Preventive action for planning of machine maintenance was not done routinely by making report of maintenance (PA9). Maintenance was not conducted according to schedule, so that should be needed of control for machine to make sure that it was already maintained.

Preventive action for planning of machine maintenance was not done routinely was scheduling of preventive maintenance for production machine (PA10). Preventive Maintenance was an observe sistematically that accompanied with technical-economical analysis to ensure functioning of production equipment. Preventive maintenance aimed for achieveing a level of production equipment maintenance in order to get product quality optimally.

Preventive action by reviewing supplier performance (PA11) was strategy to handle of lack of supplier control. Evaluation of supplier performance aimed to increase supplier performance and can be used in considering alternative supplier. This system would increase supplier performance.

Preventive action by making contract with supplier (PA12) was recommended to reduce the risk that caused by lack of supplier control. Lack of control would be influenced against problems that arised. Cooperation contract would make company had a right to hold accountable from supplier if there was something inappropriate in contract.

Preventive action for sudden production machine was damaged risk agent was by preparing emergency maintenance. Emergency maintenance included in unplanned maintenance. That method was repairing tools that damaged.

Preventive action PA14 was for handling un-conductive condition of material storage environmental that affected to quality of material. Several factors that caused damage or lose were chemical reaction, microorganism, insect, rats, and used of un-properly container. Bad condition of material that caused by environmental influence and human error.

Corrective maintenance of machine strategy (PA15) was strategy that handle risk agent of un-optimally machine repaired. Corrective maintenance was maintenance that

conducted by identifying cause of damage and followed by repairing machine or production equipment.

Ranking above was strategy that appropriate to apply by company which had been assessed by level ratio of effectiveness by considering its difficulty if that strategy was applied in company. That strategy was strategy that could reduce the value of the highest risk of company and could increase fluency of supply chain flow in company. Table of HOR phase 2 could be seen at Appendix 3.

4. Conclusion

Conclusion from research about risk analysis of supply chain flow in Ready To Drink (RTD) product, that conducted in PT SGB which focused on supply chain flow of RTD product in cup packaging, obtained these following conclusions.

1. Risk arising from supply chain flow of RTD product in cup packaging of di PT Suntory Beverage, was identified according to Supply Chain Operations Reference (SCOR) element that consisted of *Plan* that were 4 risk events, *Source* that were 18 risk events, *Make* that was 15 risk events, *Deliver* that were 19 risk event, *Return* that were 7 risk events. So, the number of risk events identified in supply chain flow were 63 risk events.
2. Every risk event triggered by risk agent. Risk agent identified from occurrence of risk event in supply chain flow of RTD product in cup packaging were 43 risk agents.
3. Priority of risk showed ranking of preferred risk based on Aggregate Risk Potential (ARP) value. Based on Pareto diagram, that 9 risk agents had the highest ARP value contributed to the high total ARP value. 9 risk agents that prioritized were human error, incompatibility of material quality with the specifications desired by company, no total checking, no checking in final delivery, un-specified working instruction and retrieval of material, planning of machine maintenance was not conducted routinely, lack of control over supplier, sudden production machine was damaged, environmental

Site this Article As

Paper Accepted : June, 9th 2017

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condition of material storage was uncondusive, repairment of production machine was not optimal yet.

4. Repairments that given to 9 risk agents were 15 preventive action. Ranking of management strategy based on the highest ETD value until the lowest values were routinely briefing every day at the beginning and the end of working hours, training periodically, applying reward system as work motivation to all workers, supplier election had to be conducted more selectively, making team that aimed to check product before distributed, updating the "work instruction" of storage and retrieval material and supervising its implementation, planning machine maintenance periodically, preventive maintenance of machine, doing evaluation of supplier performance, making contracts with supplier, reviewing contract with supplier, determining criteria of environmental for material storage to keep quality of material, preparing emergency maintenance action, conducting corrective maintenance to production machine, making mandatory sign board in material warehouse.

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Appendix 1. Identification of Risk Agent from Each Risk Event

	<i>Risk Event</i>	<i>Risk Agent</i>
E1	Sudden changes in production plan	<ul style="list-style-type: none"> • Sudden production machine was damaged • Lack of RM for processing production • Lack of PM for processing production • Sudden changed in demand from central company
E2	There was mistake in determining number of demand	<ul style="list-style-type: none"> • Sudden changed in demand from central company
E3	Planning in determining safety stock was inappropriate	<ul style="list-style-type: none"> • Lack of coordination between parts • Unevenly information distribution between part
E4	Material warehouse capacity planning was inappropriate	<ul style="list-style-type: none"> • Parameters in determining purchase of material was • Lack of coordination between parts • Unevenly information distribution between part
E5	Material delivery from supplier was delay	<ul style="list-style-type: none"> • Un-stable traffic condition
E6	The arrival of material delivery come earlier than scheduled	<ul style="list-style-type: none"> • Lack of coordination with supplier
E7	Evaluation of supplier performance was not conducted for environmental assessment when receiveing material	<ul style="list-style-type: none"> • Human error • Un-specified work instruction and retrieval of material
E8	Inappropriate quantity of RM that received	<ul style="list-style-type: none"> • Human error • Lack of control over supplier
E9	Inappropriate quantity of PM that received	<ul style="list-style-type: none"> • Human error • Lack of control over supplier
E10	Inappropriate type of RM received with the ordered one	<ul style="list-style-type: none"> • Human error • Lack of control over supplier
E11	Inappropriate type of PM received with the ordered one	<ul style="list-style-type: none"> • Human error • Lack of control over supplier
E12	Inappropriate specification of RM received with the ordered one	<ul style="list-style-type: none"> • Human error • Lack of control over supplier • Fleet didn't pay attention to the environmental condition of vehicle
E13	Inappropriate specification of PM received with the ordered one	<ul style="list-style-type: none"> • Human error • Lack of control over supplier • Fleet didn't pay attention to the environmental condition of vehicle
E14	Contaminated material during delivering process	<ul style="list-style-type: none"> • Fleet didn't pay attention to the environmental condition of vehicle • Weather problem
E15	Limited QC number for inspecting material	<ul style="list-style-type: none"> • The division of human resource was uneven
E16	RM was expired in warehouse	<ul style="list-style-type: none"> • Lack of coordination between parts • The division of human resource was uneven
E17	A fire occurred because RM reacted with chemical element	<ul style="list-style-type: none"> • Location of material storage in warehouse was ineffective • Human error • Un-specified work instruction and retrieval of material
E18	PM was damaged because of environmental problem in storage	<ul style="list-style-type: none"> • Uncondusive condition of environmental storage
E19	Differences in RM number that recorded with RM stock in warehouse	<ul style="list-style-type: none"> • Lack of coordination between parts • Unevenly information distribution between part
E20	Differences in PM number that recorded with PM stock in warehouse	<ul style="list-style-type: none"> • Un-specified work instruction and retrieval of material • Human error
E21	Retrieval of RM was not according to FEFO principle	<ul style="list-style-type: none"> • Expired Date label was not seen clearly
E22	Retrieval of PM was not according to FIFO principle	<ul style="list-style-type: none"> • Un-specified work instruction and retrieval of material • Human error • Location of maerial storage in warehose was ineffective
E23	Stop of production process in certain production line	<ul style="list-style-type: none"> • Sudden production machine was damaged
E24	High production machine downtime	<ul style="list-style-type: none"> • Planning of machine maintenance was not done routinely • Un-optimally maintenance of production machine • Un-optimally inspection process of material
E25	Carton cup couldn't open during production process	<ul style="list-style-type: none"> • Material quality was not appropriate with specification desired by company • Production machine worked un-optimally • Un-condusive condition of material storage environmental
E26	Leakage on packaging of RTD product	<ul style="list-style-type: none"> • Cup-saealing process wasn't perfect
		<ul style="list-style-type: none"> • Product was knocked during transfer process • Production machine worked un-optimally • Condition of environmental storage was un-condusive
E27	Missed in entering straw into carton cup	<ul style="list-style-type: none"> • Human error
E28	Damage of packaging box of RTD product	<ul style="list-style-type: none"> • Human error • Material quality was not appropriate with specification desired by company • Cup-saealing process wasn't perfect • Product was knocked during transfer process • Condition of environmental storage was un-condusive
E29	Decreasing quality of RTD product during production process	<ul style="list-style-type: none"> • Sudden production machine was damaged • Contamination of iron from production machine • Production machine worked un-optimally • Human error
E30	Lip cup of product was cut	<ul style="list-style-type: none"> • Production machine worked un-optimally • Planning of machine maintenance was not done routinely • Un-optimally maintenance of production machine • Material quality was not appropriate with specification desired by company
E31	Cup of RTD product was dent	<ul style="list-style-type: none"> • Product was knocked during transfer process

Site this Article As

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Paper Published : August, 11th 2017

		<ul style="list-style-type: none"> Human error Material quality was not appropriate with specification desired by company
E32	RTD product was contaminated with strange things	<ul style="list-style-type: none"> Human error Contamination of iron from production machine Asroll was not rolled properly on machine
E33	Decreasing of machine performancy	<ul style="list-style-type: none"> Planning of machine maintenance was not done routinely Un-optimally maintenance of production machine
E34	Found some un-labelled “expired” in cup packaging	<ul style="list-style-type: none"> Labelling (IJP) machine worked un-optimally Planning of machine maintenance was not done routinely
E35	Delay in production process	<ul style="list-style-type: none"> Production planning wasn’t run as had been scheduled Lack of RM for production process Lack of PM for production process Sudden changed in demand from central company Human error
E36	Decreasing number of production	<ul style="list-style-type: none"> Sudden production machine was damaged Human error There was expanding inspection, indeed overall inspection
		<ul style="list-style-type: none"> Material quality was not appropriate with specification desired by company
E37	Lack of machine maintenance and production tool	<ul style="list-style-type: none"> Planning of machine maintenance was not done routinely Un-optimally maintenance of production machine
E38	RTD product was broken when arranging in the rack	<ul style="list-style-type: none"> Inappropriate in using pallet Human error
E39	Satack of boxes were not perfectly arranged on pallet	<ul style="list-style-type: none"> Material quality was not appropriate with specification desired by company
E40	Un-availability of pallet when product ready to be stored	<ul style="list-style-type: none"> Production planning wasn’t run as had been scheduled Lack of coordination between parts Unevenly information distribution between part
E41	Found of defect in RTD product before being distributed	<ul style="list-style-type: none"> Un-optimally inspection process Human error Material quality was not appropriate with specification desired by company
E42	Limited QC number for inspecting finished produc	<ul style="list-style-type: none"> The division of human resource was uneven
E43	There was mistake in delivery for product number to customer	<ul style="list-style-type: none"> Human error No checking in final delivery
E44	There was mistake in delivery for type of product to customer	<ul style="list-style-type: none"> Location of material storage in warehouse was ineffective There was mistake in storing product in transportation (fleet)
E45	There was mistake in delivery for specification of product to customer through fleet	<ul style="list-style-type: none">
E46	Product delivery didn’t match to the specified address	<ul style="list-style-type: none"> Human error
E47	Package damage during shiiping	<ul style="list-style-type: none"> There was mistake in storing product in transportation (fleet) Human error Material quality was not appropriate with specification desired by company No checking in final delivery of finished product
E48	Delay in delivery product to customer	<ul style="list-style-type: none"> There was expanding inspection, indeed overall inspection Damage fleet Condition of traffic was un-stable
E49	There was mistake in delivery for number of product to customer through PT SNS	<ul style="list-style-type: none"> Human error No checking in final delivery of finished product
E50	There was mistake in delivery for type of product to customer through PT SNS	<ul style="list-style-type: none"> Finished product in FG warehouse was not effective There was mistake in storing product in transportation (fleet)
E51	There was mistake in delivery for specification of product to customer through PT SNS	
E52	Delay in distribution product to PT SNS	<ul style="list-style-type: none"> There was expanding inspection, indeed overall inspection
E52	Delay in distribution product to PT SNS	<ul style="list-style-type: none"> Production planning wasn’t run as had been scheduled
E53	There was mistake in delivery for number of product to customer through expedition	<ul style="list-style-type: none"> Human error No checking in final delivery
E54	There was mistake in delivery for type of product to customer through expedition	<ul style="list-style-type: none"> Location of material storage in warehouse was ineffective There was mistake in storing product in transportation (fleet)
E55	There was mistake in delivery for specification of product to customer through expedition	
E56	Delay of expedition in delivering product to customer	<ul style="list-style-type: none"> Condition of traffic was un-stable Damage transportation of expedition Production planning wasn’t run as had been scheduled
E57	Returned inappropriate specification of RM to supplier	<ul style="list-style-type: none"> Material quality was not appropriate with specification desired by company
E58	Returned inappropriate specification of PM to supplier	<ul style="list-style-type: none"> Lack of coordination with supplier
E59	Returned inappropriate type of RM to supplier	<ul style="list-style-type: none"> Lack of control over supplier
E60	Returned inappropriate type of PM to supplier	<ul style="list-style-type: none"> Fleet didn’t pay attention to environmental condition of vehicle
E61	Delayed in handling product returned to customer	<ul style="list-style-type: none"> Limited safety stock of RTD product that available Production planning wasn’t run as had been scheduled Damage transportation (fleet) Condition of traffic was un-stable
E62	Lack of fleet number to re-send substitution product to customer	<ul style="list-style-type: none"> Limited of fleet capacity Lack of fleet number in company
E63	Returned product couldn’t be re-used	<ul style="list-style-type: none"> RTD drink had blocked

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Appendix 2. 1st Phase of HOR

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Appendix 3. 2nd Phase of HOR

Risk Agent	Preventive Action															
	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	PA 7	PA 8	PA 9	PA 10	PA 11	PA 12	PA 13	PA 14	PA 15	ARP
A1	9	9	9													1521,951
A2				9	3									1		1012,574
A3						9										789,198
A4	1						9	3								413,517
A5									9	9						370,483
A6	1			3		3					9	9				358,241
A7	1								3	3			9		1	339,228
A8								1						9		293,028
A9	1														9	247,042
Total Effectiveness (TEk)	15055,585	13697,557	13697,557	10187,888	3037,722	8177,501	3721,655	1533,580	4352,030	4352,030	3224,168	3224,168	3053,055	3649,829	2562,602	
Degree of Difficulty (Dk)	4	4	3	3	3	4	3	3	4	4	3	3	5	4	5	
Effectiveness to Difficulty (ETD)	3763,896	3424,389	4565,852	3395,963	1012,574	2044,375	1240,552	511,193	1088,007	1088,007	1074,723	1074,723	610,611	912,457	512,520	
Rank of Priority	Rank 2	Rank 3	Rank 1	Rank 4	Rank 11	Rank 5	Rank 6	Rank 15	Rank 7	Rank 8	Rank 9	Rank 10	Rank 13	Rank 12	Rank 14	

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