Risk Management in Selecting Supplier Process using ISO 31000 Guidelines and International Aerospace Quality Group (IAQG) Quality Procurement & Source Control Departement PT. Dirgantara Indonesia

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Abstract - In case of delay the availability of material provided supplier [1] is currently make risk management structured need to be applied in order to suit on the acting related decision making in choosing suppliers.Conformity risk management methods in the supplier selection required in minimize risk of the delay in order to the achievement of the purpose(timely production). Risk management methods in the supplier selection has stages of determining the context of using the stakeholders analysis. Risk identification using theRisk Breakdown Structure and Turtle diagrammethod.Risk analysis using the semi quantitative.Risk evaluation using the semi qualitative due to consider the impact and the possibility that is done through assessment and weighting the expert judgment, but add up the points risk factors using quantitative methods. The process supplier selection according to record performance 26 sample quality aspects have 3,5% risk impact, completeness of documents have 3,08% risk impact, and delays have 69,67% risk impact. The identification risk company can use the method Risk Breakdown Structure and sort of risk adjusted to the responsibility and the authority on the organizational structure of the company.

Keywords: Risk Management, Risk Breakdown Structure, Turtle Diagram.

I. PREFACE

Failure in achieving the target can be analyzed using a systematic risk management. All members of the organization must be aware of the potential causes of failure to achieve targets [2]. That applies to the procurement process material at a good company to a function taking a decision to be selected supplier is used for risk analysis conducted in accordance of the company. No exception PT. Dirgantara Indonesia, which produces aircraft, PT. Dirgantara Indonesia has global market coverage, then everything that supports the course of production must be ensured certification, timeliness and quality of international standard and zero deffect.

Unfortunately of some news, PT. Dirgantara Indonesia is still have a constraint in the timeliness of production. The risk of the delay the production process strengthened in the presence of some news about the fines or penalty to be paid PT. Dirgantara Indonesia on the customer [1]. Constraints in the suitability of production time aircraft of which comes from the risk of the delay booking and the arrival of material or spare parts were booked on the supplier [3]. The case is one example of the possible risks can occur and impact on the next process, even at the final result of the purpose a project. Possible risk that can occur, included in the supplier selection based on the costs, certification, timeliness and completeness of any documents, in order to the risk that may occur can be minimized if done risk management.

exact method will help determine the possibility of the risk of the actual to select suppliers in order to the risk can be minimized without a rule out one of the standard risk management. ISO 31000 and ISO 9001 the standard guide in the risk management, as well as IAQG and AS9100C the standard guide in the risk management especially the aircraft industry in fact can run by side and complementary (harmonization).[2] Research Objectives:

1. Describe the process as the risk management methods used the company when the study carried out.
2. Identify potential causes of emerging risks in the process select and use (cooperation) suppliers.
3. Identify methods can be used to the process of risk identification and risk evaluation, so obtained method according to the objectives and business processes of the company.

II. MODEL APPROACH AND METHODS

Model approach used in the from of approach semi quantitative which means formulation of value on aspects on the possibility is not the probability value but prediction based on experience and knowledge [2]. Approach semi quantitative research is a combination of probability value according to the existing data (experience) and value weighting based (knowledge) for certain risk.

This study based on the framework modeling determine the context of risk, risk identification, risk analysis and risk evaluation in selecting and using supplier for material procurement aircraft produced by PT. Dirgantara Indonesia. In process modeling of risk management made hierarchical model which aims to determine the risk factors dominant on each level of the procurement process materials imported from suppliers. Risk factors obtained from literature studies and interviews of which has authority as well as having knowledge and risk management experience in PT. Dirgantara Indonesia.

The results of the process determination the context the next will be identified using the Risk Breakdown structure and the turtle diagram in order to the process of grouping risks in a composition logical hierarchy of organizational risk as well, systematic, and structural, as natural in accordance with the organizational structure of the company [2]. Based on the basic principle of the risk management business processes that is; (1) Understanding the target objective of business processes, (2) Identification of the constraint the achievement of the purpose, (3) Control & plan what to do, so that the risk can be eliminated or reduced, then the results of risk identification by the method of Risk Breakdown Structure will be the input for the turtle diagram.

After identification of advanced carried out the next stage is the risk analysis by measuring the incidence rate, the possibility of the impact, as well as possible solutions to eliminate these risks. Risk analysis will result in the information will then be carried out further analysis to help the decision making process. Cost, time and quality in a project have an impact in decision making. The method qualitative analysis (specify the weight of each element of risk) and quantitative methods (multiplying the weight with a value of risk rating/ probability of risk) will determine priorities related risks. The steps research illustrated in Figure 2.1.

III. DISCUSSION

A. Specifies the Context

In the determination of the context the entire risk factors that allows occur are summarized in the table taxonomy of risk is divided into the external context (outside the part under study) and the context of internal (part under study). Examples of risk taxonomy can be seen in Table 3.1 and Table 3.2. The following:

Table 3. 1. Risk Taxonomy in External Context

No	macro	Risk Groups	Type Risk
1	Economic	1 Government policy	a fiscal policy
			b Monetary policy
		2 Macroeconomics	a Inflation rate
			b Unemployment
			c Interest rate
			d Currency exchange rates
			e Level of gross domestic
		3 Microeconomics	a Per capita income
			b Agregat demand
2	Political	1 Political macro	a Bureaucratic
			b Corruption levels of high
			c Terrorism
			d Nationalization of industry
			e War
		2 Political micro	a Policy special rate
			b Quota policy
			c Addition/ reduction of import duties for certain

Flowchart of research:

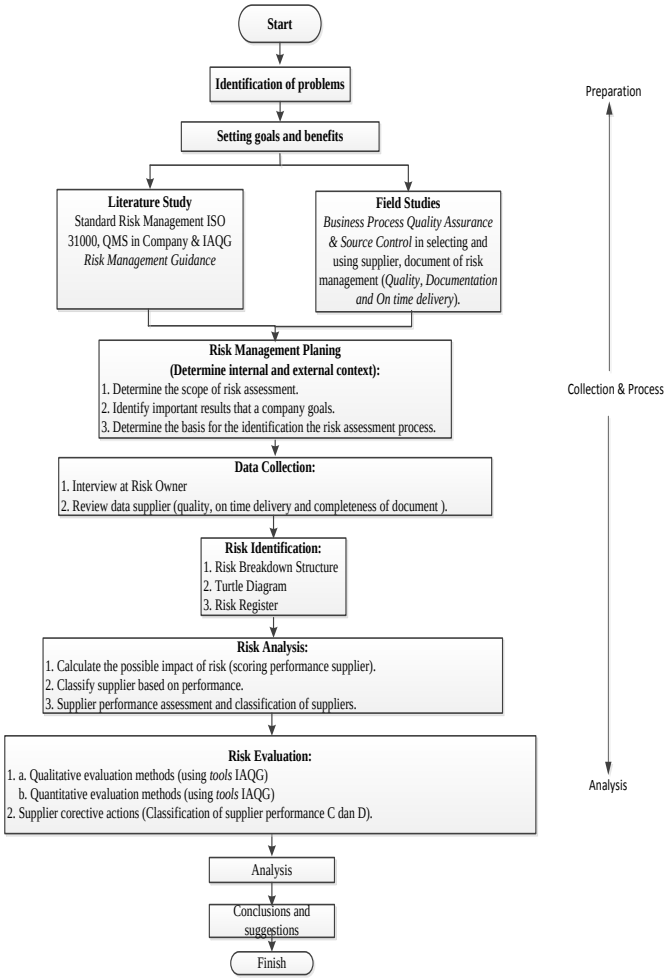


Figure 2.1. Flowchart of research

Internal Environment Impact –Mikro (Quality Assurance & Source Control)			
No	**Mikro Factor**	**Risk Group**	**Risk Classification**
1	Selecting Supplier	Supplier status	a. Survey cualification
			b. Audit planning & scheduling
			c. Survey supplier via site/ direct to supplier
			d. Identify cualification of material ordered
			e. Identify potential supplier MPSR
			f. Evaluation MPSR
			g. Unbonafit supplier
			h. Untusted supplier
			i. Non-compliance supplier with QMS
			j. Supplier certification (ISO/AS, Atority (CA), NADCAP)
2	Using Supplier	Approval Prosess	a. Survey result SQPER (no later than 30 days)
			b. Delays in the return of the quetionnaire on the keypad and the QP & SC for 7 days after recipt supplier or late response or no response from supplier
			c. Supplier without the purchase for 36 months
			d. Questionnaires or supplier data is incomplete
			e. The submission process supplier who approve or certificate of approval
			f. Corrective Action/ poor supplier performance (CA made into form SCAR & delivered on the QP & SC in 7 days after audit)
			g. Evaluation & Supplier Performance not in accordance with the guidance document supplier performance
			h. Maintain Supplier Status (ASL)
3	Documentation	Supplier Performance	a. Quality of material received do not match
			b. On time delivery is not same with plan and order (late/ erlier)
			c. Completeness of documents delivered goods less or not in accordance
4	Cost	Cost Evaluation/ material prices	a. Exceed the budget plan purchase of raw materials
			b. There are potential supplier that offer more in line with the company's condition
			c. Cost overruns as a result of bureaucratic administration or delivery

B. Risk Identification

After the context of the specified will be identified risk factors that may occur in each part, next step is focused risk identification in order to be minimized by collecting data and plan remedial actions or prevention of the impact of the risk. Basically RBS similar to the taxonomy of risk, only prepared to resemble the organizational structure. Therefore arranged Risk Breakdown structure such as Figure 3. 1. Here is a Risk Breakdown structure:

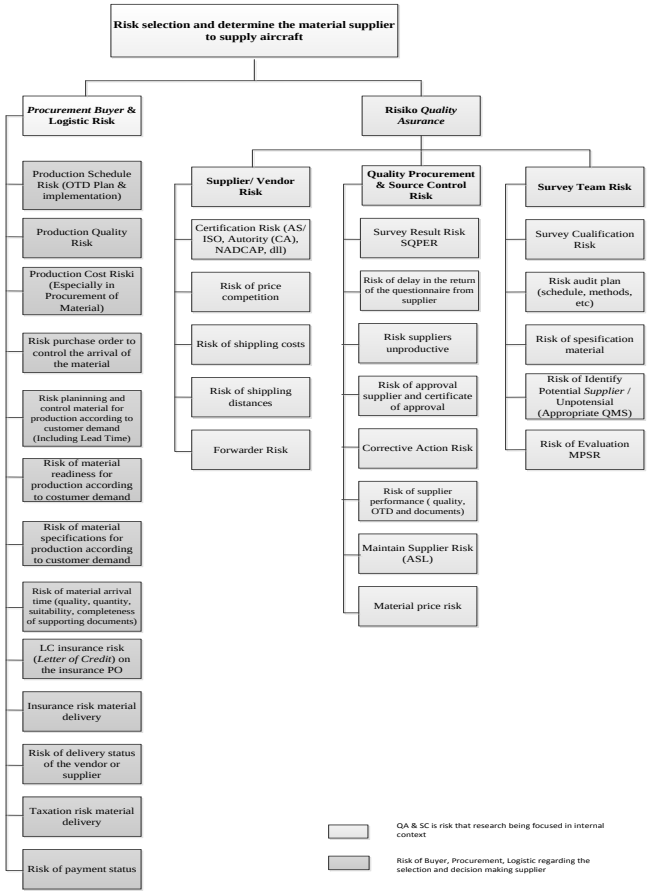
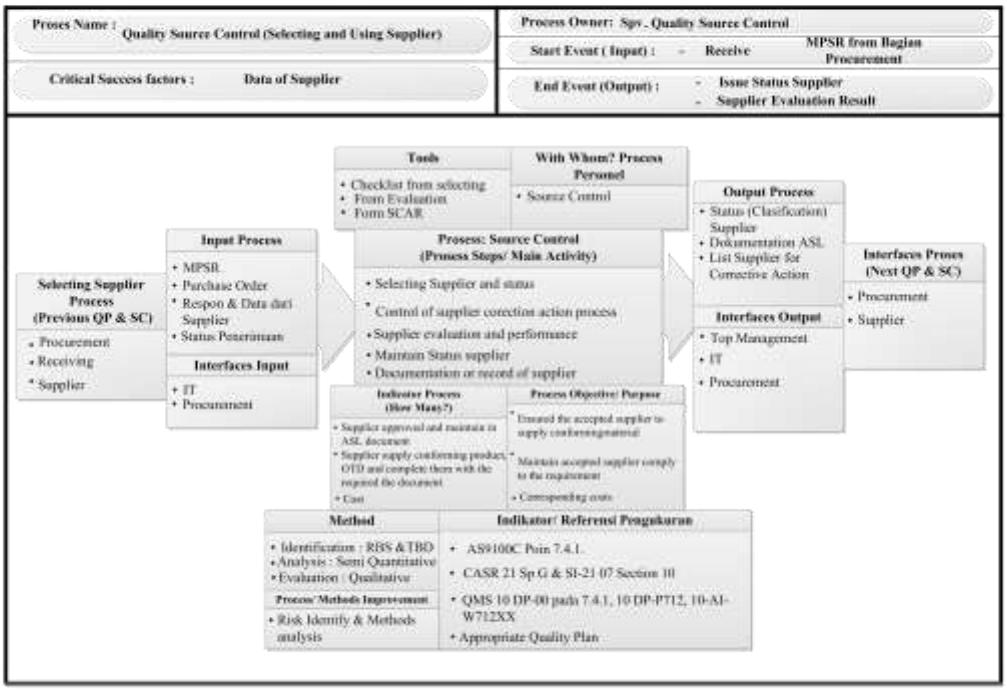


Figure 3.1. Risk Breakdown Structure

So that risk calculations can be expressed in scale that made the description of the indicator tool, process, planning, purposes as well as the methods,input and output of the entire process. In summarized description into a diagram called aturtle diagram like figure 3.2. below:



Gambar 3.2. *Turtle Diagram*

C. Risk Analysis

After identification of the data should be collected and calculated on stage of risk analysis can be known. Based on the risk that may occur in the Risk Breakdown structure and of the input, the process, the output it can be concluded that there is aspects of quality, completeness of documents and timeliness of that can be calculated using quantitative methods. As for the cost factor, political, social, economic, the process of handling, administration, customs clearance for each supplier different then will be carried out further analysis method qualitative after calculating performance of suppliers based on 3 aspects (quality, completeness of documents and timeliness/OTD) to minimize risk. With the formula specified company based on the weighting in accordance with the priority& Company Quality Management System, then carried out the collection of historical data on 3 aspects and suppliers are then calculated by multiplying the Risk of (impact x weighting) each aspect after that made the classification of its performance as below:

Table 4. 21. Examples of the classification table Performance supplier

No	Supplier	Total P/N Delivery	Nilai per Part Number/ Mat			Total Nilai	Kategori Peringkat Supplier				explanation
			Point of Quality (45%)	Point of Document (20%)	Point of On Time Delivery (35%)		A (90-100)	B (80-89)	C (60-79)	D (<60)	
1	AXX HXX PXX	41	45	20	0	65			X		(Marginal Supplier)
2	AXX AXX DXX PXX	96	45	20	7	72			X		(Marginal Supplier)
3	AXX TXX TXX	97	43	20	3	66			X		(Marginal Supplier)
4	IXX AXX SXX	28	35	20	10	65			X		(Marginal Supplier)
5	AXX NXX	11	45	18	20	83		X			Satisfy
6	.....	....	....	....	....	....	..	..	..	..	.....
26	IXX IXX SXX TXX	27	45	11	0	56				X	Unsatisfactory

Kategori Supplier	Nilai	Keterangan
A = Highly Satisfactory	90 – 100	outstanding performance, keep
B = Satisfactory	80 – 89	Standard satisfactory work, it can be further enhanced
C = Self	60 – 79	Increased performance required may soon
D = Unsatisfactory	50 – 59	unsatisfactory performance, Evaluation back your performance, and action is required as soon as possible

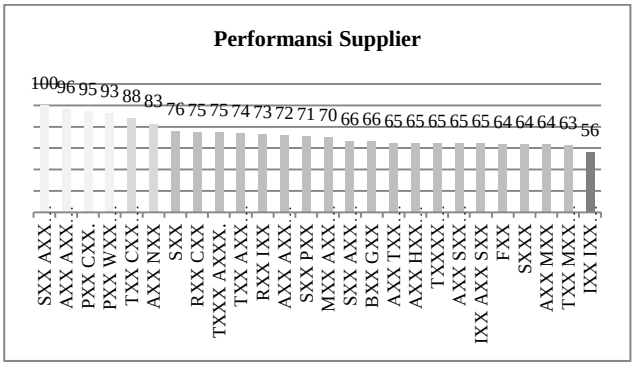


Figure 3. 3. Classification Performance Supplier

Performance of a bad or not satisfactory will give rise to risk appetite a low (the company will avoid this risk). Further analysis for risk factors that can not be calculated using quantitative methods will using qualitative methods by providing an assessment of the risk level and do weighting. The formula risk (Risiko = Impact x Possible) or (Risiko= Impact x Weighting (Possible)).

Judging from the image 3.3. supplier who have the performance of good will be selected to provide the inverter. Supplier of which provides an inverter is the supplier AXX AXX UXX and PXX CXX the two suppliers will be compared using the table IAQG as below:

Table 3. 3. Comparison Supplier Selected(1)

Supplier : AXX AXX UXX
Supplier Addresses : [redacted] U.S.A.
Price of Material : USD 27.495,72

Product/ Material: Inverter		Risk Level							No.1
Risk Assessment (PRA)		1	2	3	4	Weighting	Result Risk Assessment (PRA	Max Possibility Result	Daftar Risiko Yes / No
No	Classification Risk								
1	Distance				4	1	4	4	Yes
2	Cost/ Price		2			2	4	8	Yes
3	Forwarder			3		1	3	4	Yes
4	Handling Process			3		0,5	1,5	2	Yes
5	Administration Process		2			0,2	0,4	0,8	Yes
6	Tax/ Customs Process	1				0,3	0,3	1,2	Yes
	Total risk					5	13,2	20	← M
					R	5	13,2	20	

$$(PRAS) = \frac{R}{M} \times 20 = \frac{13,2 \times 20}{20} = 13,2$$

D	C	B	A
Very High 15<R≤20	High 11<R≤15	Marginal 7<R≤11	Low 5<R≤7

Person in charge		
Representatif:	Signature:	Date:

Table 3.4. Perbandingan Supplier Terpilih (2)

Supplier : PXX CXX
Supplier Addresses : [redacted] London UK
Price of Material : USD 32.994,86

Product/ Material: Inverter		Risk Level							No.1
Risk Assessment (PRA)		1	2	3	4	Weighting	Result	Max Possibility Result	Daftar Risiko Yes / No
No	Classification Risk								
1	Distance			3		1	3	4	Yes
2	Cost/ Price			3		2	6	8	Yes
3	Forwarder			3		1	3	4	Yes
4	Handling Process			3		0,5	1,5	2	Yes
5	Administration Process			3		0,2	0,6	0,8	Yes
6	Tax/ Customs Process	1				0,3	0,3	1,2	Yes
	Total risk					5	14,4	20	← M
					R	5	14,4	20	

$$(PRAS) = \frac{R}{M} \times 20 = \frac{14,4 \times 20}{20} = 14,4$$

D	C	B	A
Very High 15<R≤20	High 11<R≤15	Marginal 7<R≤11	Low 5<R≤7

Person in charge		
Representatif:	Signature:	Date:

The following is the analysis assessment and weighting risk factors listed in the table 3. 5.

Table 3. 5. Analysis Assessment Risk Factors Supplier

No	Description Risk	Supplier		Description Point	
		AXX AXX UXX	PXX CXX	AXX AXX UXX	PXX CXX
		Point	Point		
1	Distance	4	3	Located in the U.S.(United)	Located in the United Kingdom(Europe)
2	Cost (Finance)	2	3	USD 27.495,72	USD 32.994,86
3	Forwarder	3	3	Service suppliers(CIF) Close Insurance Freight or supplier send goods to the clearance(Airport). if exercised by suppliers there is the risk of the form of the delay flight, delay pick up caused by the forwarder.	Service suppliers(CIF) Close Insurance Freight or supplier send goods to the clearance(Airport). if exercised by suppliers there is the risk of the form of the delay flight, delay pick up caused by the forwarder.
4	Process Handling	3	3	of Goods/ material is not great and harmless so that can be sent through flights and not costly and a long time.	of Goods/ material is not great and harmless so that can be sent through flights and not costly and a long time.

5	administrative process	2	3	Purchase registrasion 15 days, purchase order 2 months, payment 15 days, receipt of goods imported 15 days. Each supplier has lead time different depending on the needs of production so on the RFQ(Request for Quatiaton) need to be considered. Vendor suppliers have a linkage view of PT IN so that in the process of administration can be easier.	Purchase registrasion 15 days, purchase order 2 months, payment 15 days, receipt of goods imported 15 days. Each supplier has lead time different depending on the needs of production so on the RFQ(Request for Quatiaton) need to be considered.
6	The process of Customs	1	1	Airport: Clearance(B. C. 1. 1.) Customs. Traffic: PT IN B. C. 2. 3.(The process does not require a long time).	Airport: Clearance(B. C. 1. 1.) Customs. Traffic: PT IN B. C. 2. 3.(The process does not require a long time).

The following is the analysis of the weighting of risk factors distance suppliers, the process of handling, forwarder, administrative processes, the process of customs and procurement costs material (material prices). Weighting for the second supplier is the same with a total points weighting 5.

Table 3. 6. Analysis Weighting Factors Risk Supplier

No	Description Risk	Weighting	description of Weighting
1	Jarak	1	distance factor affecting the delivery time, shipping costs, date of validity period of material or raw materials(if taken into account), Material safety and other important factors so that the value of weighting factors distance large enough or 1
2	Cost(Finance)	2	Finance in a company can affect stability of production, therefore cost effective in accordance with the state of the company will be a priority. Especially regarding the problem late payment, PT IN should try to minimize costs taking into account the risk costs, one of which set the weighting for high cost factor.
3	Forwarder	1	goods or materials were booked must be in accordance with the classification of booking, including conditions of goods must have good quality. Quality of goods can be damaged when shipping way is not good or forwarder late do delivery. such a thing can inhibit production so that the weighted risk factors forwarder large enough(1 one) points.
4	Process Handling	0,5	Goods/ great material usually have a special way to the process of handling, the greater and expensive goods or material is the higher risk. For the material form of the inverter process of handling carried out not as complex material other large, because the volume of the inverter is not great. Therefore weighted risk for the process of handling 0 5 points because it is still take into account the price is expensive.
5	administrative processes	0,2	administrative process usually has been compiled in such a way on the agreement and programs Directive, so that the delay on administrative process usually can be handled.
6	The process of Customs	0,3	The process of the examination and ratification at the Customs and Traffic does not require a long time. This process in the form of the examination, taxes and validation and reporting with the document Bs. C. 1. 1. for customs Airport and B. B. 2. 3. at the Traffic.

D. Risk Evaluation

Risk evaluation made to the supplier category C (marginal) and D (Unsatisfactory) in order to do corective actions for each supplier. The following details of corective actions for suppliers category C (marginal) and D (Unsatisfactory).

No	Supplier	Point			Total Poinnt	classification	company' s actions	recommendation for supplier
		Quality	Documentation	On Time Delivery				
1	RXX CXX	44	20	11	75	C	Check the cause of the delay, follow up the quality of the products proposed corrective actions / give tolerance to the supplier if the fault of the company	Perform corrective actions in particular aspects of timeliness
2	SXX	44	19	13	76	C	Check the cause of the delay, follow up the incompleteness of the document and the product quality propose corrective actions / give tolerance to the supplier if the fault of the company	Perform corrective action on all aspects of performance
3	TXXX AXXX.	33	20	22	75	C	Check the cause of the delay, follow up the quality of the products proposed corrective actions / give tolerance to the supplier if the fault of the company	Perform corrective actions on the aspects of timeliness and quality
4	TXX AXX SXX CXX	45	20	9	74	C	Check the cause of the delay, propose corrective action / give tolerance to the supplier if the fault of the company	Perform corrective actions in particular aspects of timeliness

5	RXX IXX	44	20	9	73	C	Check the cause of the delay, follow up the quality of the products proposed corrective actions / give tolerance to the supplier if the fault of the company	Perform corrective actions on the aspects of timeliness and quality
6	AXX AXX DXX PXX	45	20	7	72	C	Check the cause delays, proposed remedial actions/ give tolerance on the supplier if the error of the company	should take corrective in particular aspects of timeliness

IV. CONCLUSION

The conclusion based analysis and the results of data processing tailored to the research purposes on the introductory chapter. Conclusion of data processing and analysis is as follows:

1. The state current company research done has implemented quality management system in accordance with ISO and the AS., risk management also have been implemented with appropriate procedures ISO 31000 generically with consideration of using tools IAQG in accordance conditions of the company. The process run the company to supplier selection is as follows:
    1. Receive and evaluate MPSR.
    2. Doing the initial process and supervision of the survey.
    3. Recommend supplier with the status in approve.
    4. Determine and maintain the ASL by doing the calculation of three aspects (quality, completeness of documents and timeliness/ OTD) with qualitative methods (weighting in each aspect in accordance with the QMS companies) and the calculation of the impact with the document review. Furthermore the weight of each aspect multiplied by the record the impact of the risks contained in the document.
    5. Determine the performance of suppliers based analysis and reports.
    6. Control and monitor the corrective action.
    7. Asking recommendations supplier who do not in approve.
    8. Perform analysis and continued evaluation to select suppliers based on the ordered goods, the distance, the cost, the process of handling, forwarder, administrative processes, the process of customs and risk of other external which can not be carried out the calculation is sure to each suppliers because it has a risk factors typical and vary.

2. Aspects of quality in general has no material risk to order/ drawing / document, the old stock, defective, damaged or need to be improved on the material. Aspects of documents in general have no risk of the presence of material documents the test results, results reporting and document data mismatch. Aspects of punctuality at risk of payment delays resulting from PT DI and the delay in delivery of materials by suppliers. As for the factor of external risk management cost factor remains a major obstacle for PT DI and is the focus of risk management PT DI, thus weighting for considerable cost factor. The distance factor is also still a consideration because it can affect the time and cost of production.

3. The method is right for the application of the process select and use (cooperation) supplier based on the risk that may occur on each stage of risk management different. In the stages of determining the context of the method of stakeholders analysis can be used to determine the picture of risk identification form of the description or table taxonomy of risk. Phase risk identification can be done through search risk of each part in charge of the electoral process and the determination of suppliers will be selected to work. Therefore this process can use the method Risk Breakdown structure in order to the risk of each part identified in detail and then carried out the identification process continued using the turtle diagram in order to input, the process and output can be identified. The process of risk analysis can use the method of semi quantitative because there are weighting based on the priorities and tolerance company of the risk factors that can be calculated, and then carried out the process of calculation of weighting and the provision of points performance of suppliers. Furthermore, is the evaluation process, using semi qualitative due to consider the impact and the possibility that is done through assessment and weighting the expert judgment, but add up the points risk factors using quantitative methods. The sum done in order to consideration supplier selection. The accumulation of the risks likely and its impact will have a risk appetite a low, so that the supplier is not selected to work.

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