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# Mapping of Supply Chain Risk  in Industrial Furniture Base on House of Risk Framework

Titik Kusmantini      Adi Djoko Guritno      Heru Cahya Rustamaji

**Abstract**
Business success in unpredictable market conditions and volatility, business competition is no longer dependent on the ability of the company's business operations individual but based supply chain. Therefore, the effectiveness of the supply chain requires the synchronization of all entities involved in the supply chain of products or services. Strategy to build a strong supply chain needed to reduce market uncertainty. This study aims to map the risk agents and events risks that may arise as a result of the risks identified agent. Analysis of risk mapping is done by using the framework of the House of Risk (HOR). Data collection techniques using triangulation method that combines in-depth interview technique with a numbers of successful exporters and distributing questionnaires to 84 SMEs in the DIY furniture. The results of in-depth interviews to identify as many as 23 agents and 43 incidence risk of supply chain risk. To mitigate the risk is focused on a number of agents who have a value of the index  Priorities  Risk Agent (PRA) which has an index value of more than 400 and there are 5 top PRA index that must be considered is the lack of supervision or PRA 13; Production schedule changes or PRA 12; Often unpredictable requests or PRA 11; Needs of large and volatile materials or PRA 8 And technology is not compatible or PRA 9. Recommendations future studies need to use to control the operating life of the company and use the framework as a tool HOR 2 to develop supply chain risk mitigation strategies.
**Keywords:** Synchronization; HoR Framework; Risk Mapping; Priority of Risk Agent (PRA); Rrisk mitigation

## A. Introduction
Nearly two decades, practitioners or academics have believed that the supply chain management (Supply Chain Management or SCM) as one important thing to improve the effectiveness (Womack and Jones, 2005) and as something of value in supporting the creation of competitive advantage (Li et al, 2006). Since the early 90s levels increasingly intense business competition encourages companies to improve the efficiency of the various aspects of their business. Vanany et al, 2009 stated that the level of competition increasingly competitive business trigger uncertainty, and the consequence is that every company will need more resources to anticipate uncertainty: demand, supply, or in internal processes.

Globalization creates higher risks and uncertainties, some facts about vulnerability supply chain or supply chain vulnerability as vulnerable to interference noise or an unexpected disaster. For example, a fire incident at one of the factories suppliers Ericsson who was in Mexico in 2000 have resulted in a loss of 4,000 million euros to be borne by the company Ericsson. Ineffectiveness process at Land Rover suppliers also have an impact on the Company Land Rover, because the company must  be termination or lay off employees 14,000 employees. The tragedy of the terrorist attacks on the WTC (World Trade Center) on 11 September 2001 has also caused problems in the supply chain of several world-class companies (Norrman and Jonsson, 2004; Paulsson, 2004; Tang, 2006). The fact of risk and uncertainty in the supply chain can appear in the scope of the company's internal, upstream or downstream so that the current supply chain risk management topics as research issues relevant and interesting to support sustainable supply chain process.

Tang, 2005, emphasizes the importance of a strategy to build a robust supply chain that is a condition of the supply chain that is able to survive when faced with various kinds of interference (noise) or an unexpected disaster. According to Tang, 2005 when a disturbance arises, companies that implement a proactive strategy is certainly a company that has developed plans to mitigate interference or risk arising and can disrupt the supply chain. While Manuj and Mentzer 2008 identifies that noise or disruption in the supply chain may adversely affect the sustainability of the business and many companies are not able to recover after the appearance of the disorder.

Some researchers like Juttner et al, 2003; Christopher and Peck, 2004; Norrman and Jansson, 2004 states that the types of supply chain risks are distinguished into three types: operational accidents, catastrophes operational and strategic uncertainty and opportunities for the emergence of risk will be influenced by the type of industry. Some researchers focus on the type of innovative industries, ie industries that produce shorter product life cycle and require more rapid technological development capability. Generally on innovative industry will have an increased risk of supply chain more complex, and one of the sources of risk that often arises is the demand risk (Christopher and Hang, 2004). One example of a risk that the current demand is a trend in overseas markets is the change in customer requirements of eco-labeling. The issue of eco-labeling significan impact on supply chain management companies, one of which is industrial furniture and handicraft forest products. Because the overseas buyer demands a firm guarantee that the furniture products obtained from sustainably

managed forests, then the manufacturer's assessment of the extent to which the capability and related business entities doing Chain of Custody (CoC) Ability tracking system reflects the ability of a higher quality supply chain management, so CoC as administrative requirements to obtain certification from the FSC (Forest Stewardship Council).

Specific reason researchers conducted a study of supply chain risk mapping in SMEs in the furniture industry DIY is an attempt to provide carrying capacity strengthening potential of the furniture industry as a superior product DIY considering the contribution of the export value of the furniture industry in the GDP (gross income areas) than most other industries. The industry also has: (1). Prospects LN products on the market more than 70%; (2) Focus on the use of local raw materials; (3) The orientation of local employment, so that the performance improvement efforts need to be improved.

The earthquake of 2006 in the province have great impact on the capability of SMEs in DIY and various disorders such as inflation and changes in regulations also affect the ability of SMEs in managing a supply chain risk due to the bankruptcy of the supplier, the weakening rupiah, uncertainty demands and many more risks arising and affect the effectiveness of supply chain management SMEs in DIY furniture. For the purpose of this research is to identify the source or agent of any risks that may impede the process of supply chain furniture products and what are the consequences of events supply chain risks to be faced by SMEs in the DIY furniture.

## B. Study of Literature

### 1. The concept of Supply Chain Management

Supply chain management as a key strategic factor for improving organizational effectiveness and realization corporate objectives, such as the achievement of competence capabilities, better customer service and improve profitability (Gunasekaran, 1997). Supply Chain Council or SCC 2009 defines the SCOR model or the Supply Chain Operations Reference as a process reference model that incorporates the concepts that have been known in the business process reengineering, benchmarking and measurement processes in a cross-functional framework (www.supply-chain.org ). SCOR model is very effective as a frame of reference to identify supply chain performance metrics in five important activity in supply chain management, 5 key activities include: (1). Plan; (2). source; (3) Make; (4) Deliver and (5) Return (Huan, et al, 2004). In each of these activities allow the emergence of the risk for risk identification and risk agents in this study using the SCOR model, researchers will be ditel detailing the risks and opportunities in the fifth source of risk management activities of the supply chain.

### 2. The concept of Supply Chain Risks Management

SCRM or Supply Chain Risk Management is defined as the risk management efforts throughout the company's supply chain coordination and collaboration with business partners in order to ensure certainty of profitability and sustainability of the business. According Vanany et al, 2009 as a general concept of SCRM group two main issues that should be the company to create a sustainable supply chain:

1. Risk of Supply Chain, covering operational risk and disruption risk.

2. Mitigate risk approach aims to support the management of demand, supply, products and information.

Operational risk is defined as the risks are always attached to the uncertainty of business processes, such as the uncertainty of demand, supply uncertainty and uncertainty costs. While disruption risk is defined as the risk of unexpected (disorder or chaos) caused by natural events (eg disaster earth, tsunamis, floods, etc.) and events due to human error such as fires, terrorist attacks and much more.

### 3. Linkage with Robust Supply Chain and Supply Chain Sustainability

Definition robust design is a design that aims to minimize interference from noise factor (uncontrollable disorder) or uncontrollable factors. Given the characteristics of a vulnerability in the supply chain, the design of a supply chain network that is robust or reliable indispensable. Tang, 2005 defines a robust supply chain is supply chain that is able to survive when faced with a variety of disorders and unforeseen disasters. If it appears an unexpected disruption and have a negative impact on the supply chain of a product, it means the condition of the supply chain network vulnerable. According to Tang, 2005 if an interruption occurs, an attempt to minimize the negative impact on the risk on the disorder can only be done by companies that implement proactive strategies, have a plan-contingency planning (contingency plan) to mitigate the risk.

Cophra and Sondhi, 2004 also suggest the need for proactive plans in the management of production capacity, inventory, and delivery flexibility. While Faisal, et al., 2006 identified 11 variables that can drive the success of the company in the management of a sustainable supply chain risk, to 11 variables enablers include: 1) information sharing; 2) agility in the supply chain; 3) trust between partners in the supply chain; 4) information security assurance; 5) CSR / Corporate Social Responsibility; 6) Policy incentives and profit sharing in the supply chain; 7) preparation of strategic plann risk; 8) risk sharing; 9) Knowledge of risk in the supply chain network; 10) continual risk; and 11) the collaboration between partners in the supply chain.

### 4. The concept of Supply Chain Vulnerability

Meaning literally vulnerability is a condition that is affected, then the supply chain vulnerability can be defined as a system of supply chain vulnerable or affected by various elements of uncertainty in the supply chain itself.

The term "Supply Chain Vulnerability" proposed by Svensson, 2002, which is used to describe the interdependency between business entities in the supply chain risks and opportunities that will arise in any supply chain will affect the ability of the product to the creation of "better / better "; "Quicker / faster" and "cheaper / cheaper". So some risk measurement should carefully by considering two aspects, namely: the first aspect trigger sources of risk or known risk agents, need to identify whether sourced from internal scope of the company; dyadic relationship (relationship supplier-manufacturer or manufacturer-distributor partners) or appear in a broader scope, namely at the level of the supply network (supply network). The second aspect is the general risk evaluation is subjective and depends on the assessment of the good cooperation relations which exist in the upstream or downstream. In the study Svensson, 2000 risk is defined as the variance that lead to negative consequences for all business entities involved in the supply chain.

Associated with vulnerability in the supply chain, some researchers define the concept of risk from a variety of perspectives, among others:

a. The producer or the output perspective, risk is defined as a result or output that can not be predicted with certainty, which will be unwelcome and may affect productivity or be counter productivity (Alijoyo, 2006)

b. Perspectives of consumers, the risk is defined as uncertainty and the consequences of the cancellation of the purchase of a product or service ( Faisal, et al 2006).

c. The process perspective, risk is defined as an enabler factors that could affect the achievement of the objectives that usually have unintended negative effects (Alijoyo, 2006)

Of the various definitions of risk, risk measurement in this study refers to the definition of risk raised by Christopher, 2003 which identifies all the risks that occur in the information flow process activities, material flow and the flow of products from suppliers to delivery of products to the final consumer. The focus of risk assessment based multi-source well sourced perception of cross-functional teams in the manufacturer, supplier, or LSP. Gaudenzi and Borghesi, 2006 emphasize three things that must be observed in the measurement of risk: (1) what drives the risk; (2) where the risk is; (3) what the risk is associated with.

## 5. House of Risk Framework as a step to identify risks

Risk management framework has actually been developed by several parties, such as the standard AS / NZ 4360 (Australia) and BSI (UK). The framework of risk management generally contains steps and foundation for the identification, analysis and evaluation of risks and design risk mitigation strategies that could be implemented company. House of Risk (HOR framework) as an analytical technique for the identification of sources of risk and a number of supply chain risk events that could potentially arise and hinder the process of supply chain management. And the framework Hor researchers can select a number of agents of risk based index value priority risk agents that need to be considered SMEs furniture to think about a number of efforts to mitigate these risks.

Framework-based approach to risk management Failure Mode and Effect Analysis using hor. Reasons study using House of Risk Framework is because Hor as one of the techniques can help analyzing potential causes of impaired, measuring the probability of occurrence of any event risk and can be used to evaluate efforts to prevent and manage risk (Christopher, 2003; Pujawan and Geraldine, 2009) . Figure .1 illustrates hor matrix framework.

Figure 1. *HoR Framework*

| Step 1 Where are the Risk (SCOR model) | Step 2 What are the risks (Risk Event/E) | Step 3 Determine severity (S) | Step 5 Risk Agents $A_1$ $A_2$ $A_3$ ........................ $A_m$ | |
|---|---|---|---|---|
| | | | Step 6 Relationships between risk agent and the identified risk even | Step 4 Potential Causes of Risk |
| Plan | | | $A_1$ $A_2$ $A_3$ ..................... $A_m$ | |
| | $E_1$ | $S_1$ | $E_1$ $R_{11}$ $R_{12}$ $R_{13}$ ......................... $R_{1m}$ | $C_1$ |
| Source | $E_2$ | $S_2$ | $E_2$ $R_{21}$ $R_{22}$ $R_{23}$ ......................... $R_{2m}$ | $C_2$ |
| | $E_3$ | $S_3$ | $E_3$ $R_{31}$ $R_{32}$ $R_{33}$ ..................,, $R_{3.m}$ | $C_3$ |
| Make | . | . | . | . |
| | . | . | . | . |
| Deliver | . | . | . | . |
| | . | . | . | . |
| Return | . | . | . | . |
| | $E_n$ | $S_n$ | $E_n$ $R_{n1}$ $R_{n2}$ $R_{n3}$ ................. $R_{nm}$ | $C_n.$ |
| | | | Step 7 Determine Occurrence (O) $O_1$ $O_2$ $O_3$ ......................Om | |
| | | | Step 8 Determine Risk Priority index (P) $P_1$ $P_2$ $P_3$ .............................. $P_m$ | |

in which:

$E_i$ or *risk event*, or risk event number i = 1, 2, etc.

$C_i$ or *potential causes of risk*, in which i = 1, 2, etc.

$A_j$ or *risk agent* or the cause of risk, in which j = 1, 2, etc.

$S_i$ or *severity level of risk* or the severity of risk as perceived by the resource person calculated using the

formula $S_i = \sqrt[k]{S}_{i.1}$ x $S_{i.2 X ......}$ x $S_{i.k;}$

in which i = 1, 2, etc. and k is the assessment by the person number k

$O_j$ or *occurrence level of risk* calculated using the formula $O_j = \sqrt[k]{O_j 1 x O_j 2 x ... x O_j}_{i.1}$ in which j = 1, 2, etc.

and k is the assessment by the person number k

$R_{ij}$ is the correlation between risk agent number j and risk number i; when there is correlation, the value is 1; when there is not, the value is 0.

$P_j$ or risk priority index calculated using the formula

$$P_j = O_j \sum_{i=0}^{n} S_i x (Rij x W)_j$$ in which j = 1, 2, etc. and Wij is the value of correlation between risk agent

number j and risk event number i

## C. Research Methodology

### 1. Data Collection Techniques

Supply chain risk measurement does not use objective measurements but using subjectively perceived size of the owners or managers of SMEs. The reason researchers use measurements perceived as most companies are reluctant to share the objective performance data for confidentiality considerations (Ward et al, 1996). Additionally, Pagell and Krause (2004) stated that in addition to the effect of the age of the company's operations, cross-industry survey research in general will have individual performance may differ in different industries, which will affect the results of the survey. Ledwith (2000) also argues that subjective measurements allow rational comparison between companies operating in different market situations. So in this study did not allow

the measurement of risk data to obtain quantitative data supply chain financial risks, but rather in the form of data supply chain risk perceived to be borne by the company and assumed magnitude of the risk value as the financial consequences to be borne by the company.

While the data collection methods using several stages, the first to use the technique Focused Group Discussion by conducting interviews as much as 6 SMEs furniture ASMINDO members (Association of Indonesian furniture Branch DIY). FGD needs to be done in order to design a questionnaire about risk agents and the risk of recurring events, researchers in exploration and identification agent of risk and incidence of supply chain risk has involved a team of experts to seek be taken in the development of research instruments.

## 2. Data Analysis Techniques

Heizer, et al 2006 defines Quality Function Deployment (QFD) as a process for menentapkan customer desires (what customers) and translate them into the attribute "how" so that each functional area can do so. The term is also commonly known QFD house technical quality of the graphics to explain the relationship between the customer's desire and products. So by setting the relationship an operations manager can build a product with several features such as the customer desires. If translated in the context of risk management, the proper term instead HOQ or House of Quality is House of Risk.

## 3. HoR or House of Risk.

Data analysis techniques will be used as a tool HoR tool to assist companies in identifying risk agents and entire risk events that will result from any agent identified risks. According Pujawan and Geraldine, 2009 in outline, the stages in the strategic planning framework with the help of Hor divided into two phases: the first phase is the phase identification of risk (risk identification) and the second phase is the phase of risk management (risk treatment) as HoR second stage. However, in the analysis of the results of the mapping agency risk and risk events, the authors recommend a number of risk mitigation actions based on a literature review, a more ideal should use a framework for designing a HoR two risk mitigation actions are applicable for furniture companies. Hor first stage as the stage for the data input work has 8 steps as follows:

Step 1 Identify the activities in the supply chain based on the SCOR model, with a view to facilitate the detection process in which the risk of potentially emerge (where are the risk)

Step 2 Identify the entire incident risks that may appear on any activity in the supply chain.

Step 3 Identify Severity Level or degree of impact of each risk event, using a scale of 1-10.

Step 4 identification result (potential causes) an occurrence of the activity of the supply chain process, as a result will help to describe what disorders arising from any risk.

Step 5 Identify the agency risk (risk agent), which detects any factors which may cause the occurrence risks identified in step 2.

Step 6 Identification of correlation between an event to trigger agent risk. If an agency risk of causing a risk, it can be said there is a correlation. If a strong correlation is weighted 9; correlations are given weights 3 and a weight of 1 to the value of the correlation is weak.

Step 7 Identify opportunities emergence (occurance) of each agent risks, to determine the risk of chance occurrence of an agent using a scale of 1-10

Step 8 Determination of the risk priority index value, priority will be used benchmark index for recommendation selecting agent which risks need to design a risk mitigation strategy. Furthermore later identified risk index will be analyzed using a Pareto chart is a chart to identify and map the problems or risks that occur in decreasing frequency order, meaning that will present the potential risks that may appear very large to small.

## D. Data and Analysis

## 1. Results of Focused- Group- Discussion

Risk is a factor causing agents that cause risks with different characteristics inherent in each risk thereof. In principle any risk events can be generated not only from a risk factor alone. So the risk agents can trigger multiple events at the same risk. FGD results identified 43 risk events and 23 agents risk.

Table 1. Summary of Results of FGD

| SCOR model | Activities in Supply Chain | Risk Event | Risk Agent |
|---|---|---|---|
| Plan | - Planning the product development cycle. <br> - Planning the design and standardization of product quality <br> - Planning engineer staffing needs <br> - Planning the production process control <br> - Understanding of the contract or customer reguirement <br> - Planning strategy supplier selection | - Cancel the contract (1) <br> - Ex-perception of contract (2) <br> - Negotiations are often constrained (3) <br> - Limitations staff engineer (4) <br> - Inability to engineer (5) <br> - Error concept products (6) <br> - Incompatibility designs or pictures (7) <br> - The delay in responding to the request (8) <br> - Dependence on a single supplier (9) | - Do not make long-term planning (1) <br> - Crashes and natural disasters (2) <br> - Environmental pollution (3) <br> - The economy is not stable / exchange rate fluctuations (4) <br> - Weakness in the selection of the supplier (5) |
| Source | - The process of material per periodic forecasting <br> - The process of sharing information material requirements and production schedules with suppliers <br> - Preparation of Bill of Materials (BOM) in the aggregate <br> - Scheduling reorder point materials and schedule of benefits. <br> - Maintenance of cooperative relationships with suppliers of raw materials or subcontract | - Price fluctuations of materials or components (10) <br> - The quality of materials is not within specifications (11) <br> - Delivery of materials in the message is often too late (12) <br> - Stockout (13) <br> - Lead time is very volatile supply (14) <br> - The issuance of the purchase order is often too late (15) <br> - Bankruptcy supplier or subcontractor colleagues (16) | - The manufacturer does not have an inaccurate reference material prices (6) <br> - Limitations of supply capacity subcontracted suppliers or colleagues (7) <br> - The need for relatively large and volatile materials (8) <br> - Technology partners or suppliers are not compatible or support (9) <br> - Do not have a supplier comparator (10) |
| Make | - Preparation of production schedule <br> - The decision on production capacity <br> - Maintenance of machines <br> - Maintenance employees directly related to the production process <br> - Monitoring the quality of products and production processes <br> - The process of forecasting demand for products <br> - Assignment in factory <br> - Management of unexpected interruptions in production systems | - The production process often delay (17) <br> - Machine Breakdown (18) <br> - Extinction of light (19) <br> - Scheduling production process often retreat (20) <br> - Stacking Saw timber (21) <br> - Elements scattered products (22) <br> - Swelling hours / frequent overtime (23) <br> - Defective products (24) <br> - Errors in the set up of the machine (25) <br> - The process of making the mall often ill-fitting (26) <br> - Errors in the marking of components for processing (27) <br> - Accidents in factories (28) <br> - Mechanism tracking system is often constrained (29) | - Request often abrupt (11) <br> - Changes in production plans (12) <br> - Weaknesses in the control system (13) <br> - Strikes work (14) <br> - Do not have a manual procedure in production (15) <br> - Approval weak (16) <br> - TK high turnover rate (17) |
| Delivery | - Management of packaging <br> - Management of transport and distribution <br> - Setting the schedule loading and transhipment of goods <br> - Management of the buyer's order <br> - Management of cooperative relationships with triple agent or distributor | - There was a shortage in the assembly in the warehouse (30) <br> - Damage haul trucks (31) <br> - Schedule frequent loading and shipment delay (32) <br> - The risk of product buildup in Port (33) <br> - Delivery hampered by congestion and damage to the highway (34) <br> - Overstock finished product in the warehouse (35) <br> - The risk of trading or negotiations with the port (36) <br> - The cost of delivery can not be predicted (37) <br> - Foreign Exchange Risk (38) | - Maintenance of equipment less (18) <br> - The quality of the material supply from the supplier does not meet quality standards (19) <br> - Lack of coordination with outside parties (20) <br> - Fleet condition is old (21) |
| Return | - Evaluation of customer complaints <br> - Determination of post-purchase policy <br> - Adaptation to the change of environment <br> - Customer Relationship Management. | - Delivery orders late (39) <br> - Quality of the order is not in accordance with buyer demand (40) <br> - Risk is damaged in shipping (41) <br> - Feasibility packaging (container) (42) <br> - Not right amount (43) | - The technical evaluation is weak (22) <br> - Booking less detailedl (23) |

Then after making inferences about the agent risk and risk events in the scope of the manufacturer's supply chain, the next step is to conduct interviews with sources FGD to map the correlation between the risk agents risky events that frequently appear in the scope of the company and Table 2 presents the correlation matrix of each risk agents with a number of risk events that may arise due to the risks triggered by the source.

Table 2. Correlation Matrix Agent risk with risk events

| Number of risk agent | Discription | List of the risk event cause by the risk agent |
|---|---|---|
| RA 1 | There is no long-term plan | 9; 13; 17; 20; 25; 35; 38; 39 |
| RA 2 | Disturbances and natural disasters | 39 |
| RA 3 | Environmental pollution | 1; 5 |
| RA 4 | Unstable Economy | 1; 3; 35; 38 |
| RA 5 | Weakness supplier selection | 11; 12; 13; 14; 29 |
| RA 6 | The price of inaccurate | 9; 10 |
| RA 7 | Limited supply of suppliers | 12; 14; 17; 20; 43 |
| RA 8 | Volatile material needs | 10; 11; 12; 13; 14; 17; 20 |
| RA 9 | Technology is not compatible | 9; 10; 11; 12; 13; 14; 17; 20 |
| RA 10 | There is no comparison supplier | 9; 10; 11; 12; 13; 14; 17; 20 |
| RA 11 | Often sudden demand | 9; 10; 11; 12; 13; 14; 17; 18; 20 |
| RA 12 | Changes in production plans | 13; 17; 20; 23; 35; 39; 40; 43 |
| RA 13 | Weaknesses in oversight | 7; 11; 12; 17; 20; 23; 26; 27; 30; 40 |
| RA 14 | Strike | 17; 20; 39 |
| RA 15 | There is no manual procedures | 17; 20; 24; 26; 27; 28; 40 |
| RA 16 | Approval weak | 7; 24; 40 |
| RA 17 | Labor turnover rate is high | 17; 23; 39 |
| RA 18 | Less equipment maintenance | 18; 28 |
| RA 19 | The quality of materials is not standard | 40 |
| RA 20 | Less is no coordination with the triple agent logistics | 17; 20; 29; 36; 39; 43 |
| RA 21 | Conditions worn fleet | 31; 34; 37 |
| RA 22 | Weak technical evaluation | 13; 24; 37; 40; 41 |
| RA 23 | Booking less detailed | 38; 43 |

**2. Analysis hor 1 which identifies the agent j to the potential risk / ARP (risk potential of agent j) and Pareto diagram illustration hor 1 based group market (Joint-Local-National-Export).**

This first year, the focus of research studies on risk mapping and risk agents, then the analysis will be obtained hor 1 potential occurrence of each agent with a set of risk events caused by agents such risks. Ordering agents that have the potential risks of the biggest risks to the smallest agents. By knowing the value of the ARP would be associated with the ranking agent priority for risk mitigation strategies designed. Before designing risk mitigation strategies that appear in the scope of the manufacturer, the second year should be followed for the evaluation of business entities related to cross both suppliers or logistics partner companies if there is a risk that is affected by external sources of risk. Evaluation of cross assessed needs to be done to achieve the effectiveness of the proposed contingency plans to mitigate risk.

a. HoR 1, the analysis of a sample of SMEs Combined (Local / National / Export)

Figure IV.1. Pareto diagram Value Risk Priority Index (Combined sample)
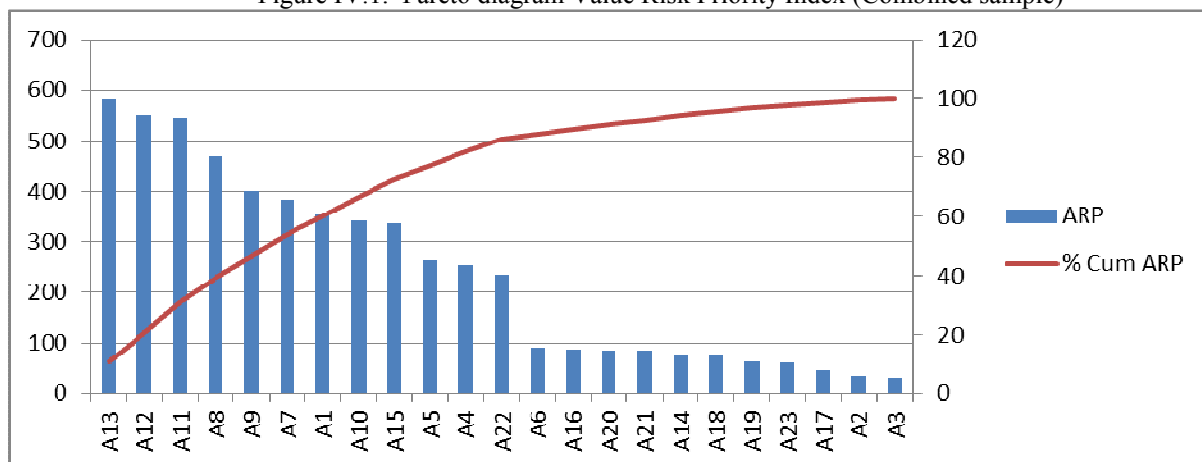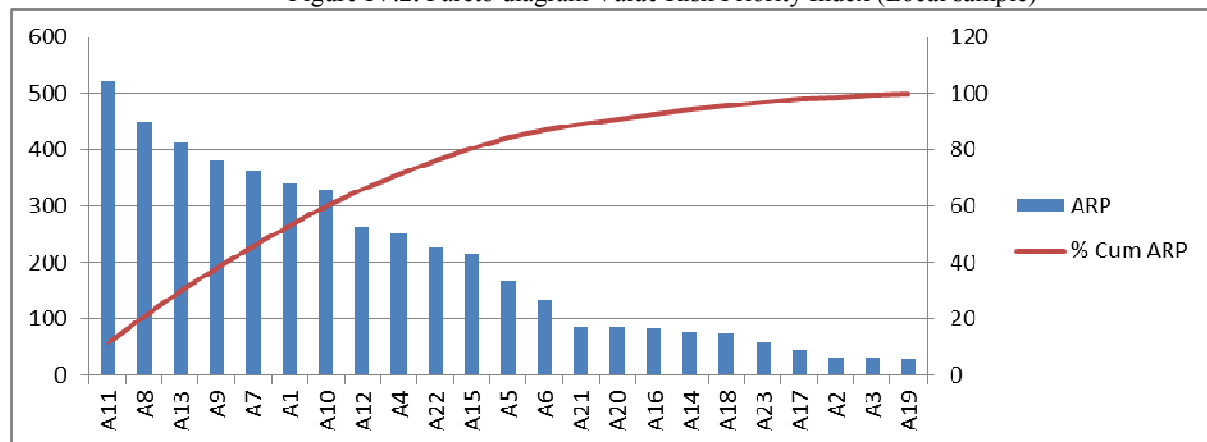


Based on Pareto diagram ARP table IV.1 total sample (84 SME) presents the rangking of ARP from the smallest value to the largest, agents risk ARP value of more than 400 have 5 agents or sources of risk include the risk of weak oversight agency or ARP13; Changes in production schedules or ARP12; Request often morbidly

predictable or ARP11; Material needs of large and volatile or ARP8 and Technology incompatible or ARP9. If the observed correlation matrix agent relationship with the risk of occurrence of risk, then the source of the risk of lack of supervision in the production process at the plant impact on the emergence of risk events such as mismatches in the design or image; quality of materials or components from suppliers not to specification; delivery of materials or components in the message is often too late; often delay the production process; scheduling production processes often in execution retreat; swelling working hours or overtime; mal-making process often do not fit (low precision); errors in the marking of components currently in process or assembled; shortage occurs in the assembly in the warehouse; quality of the order is not in accordance with the request of the buyer. Furthermore, to identify the impact of the risks stemming from risk agents 12 or changes to the production schedule can be seen in Table IV. 3.

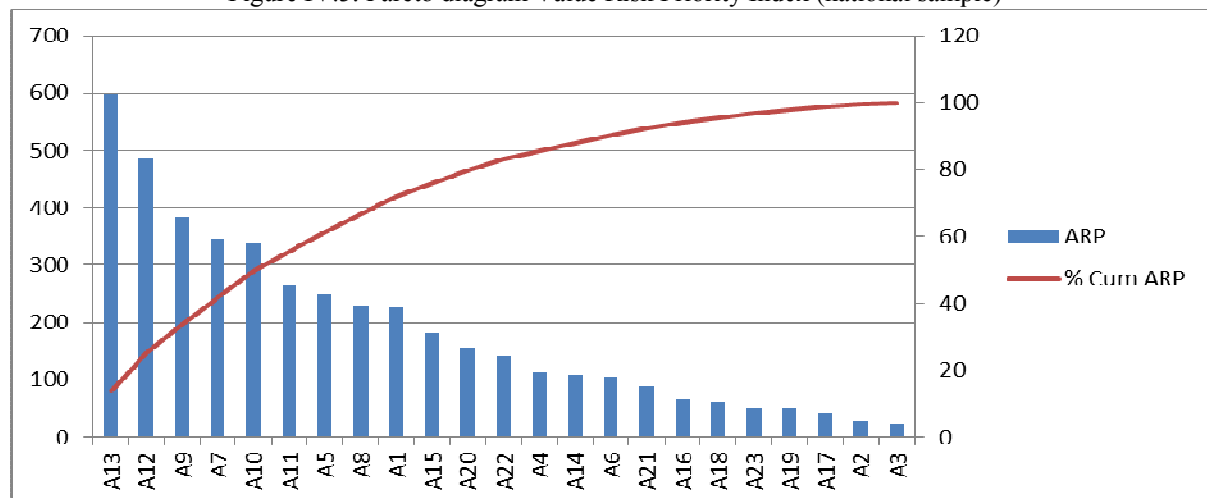b. Hor 1, the analysis of a sample of SMEs with Local Market Scopa

Based on Pareto Chart IV.2 ARP table on a sample of SMEs which focus on the local market presents the rangking of ARP from the smallest value to the largest tilapia, ranked five ARP or agent risks that require measures of risk mitigation strategy is the source of risk or risk agents: Request often morbidly predictable or ARP11; Material needs of large and volatility or ARP8; weak supervision or ARP13; Technology is not compatible or ARP9 and Limitations ARP suppliers supply 7. If the observed correlation matrix agent relationship with the risk of occurrence of risk, then the source of the risk of inquiry are often not be predicted will impact the risk of events such as: dependence on a single source of supply; the price of materials or components required to fluctuate; quality of materials or components from suppliers not to specification; Frequent stock-out (running out of material, so that the production process to be delayed); Lead time or waiting time supply fluctuates suppliers; often delay the production process; frequent damage to the engine and the scheduling of the production process is often executed backwards. Furthermore, to identify the impact of the risks stemming from risk agents to 8 or large raw material requirement can be seen in Table IV. 3.

Figure IV.2. Pareto diagram Value Risk Priority Index (Local sample)



c. HoR 1, the analysis of a sample of SMEs with National Market Scopa

Figure IV.3. Pareto diagram Value Risk Priority Index (national sample)



Based on Pareto Chart IV.3 ARP table on a sample of SMEs which focus on the national market

presents the rangking of ARP from the smallest value to the largest tilapia, ranked five ARP or agent risks that require measures of risk mitigation strategy is a source of risk or agent: weak supervision or ARP13; production schedule changes often occur ARP 12; Technology is not compatible or ARP9; 7 ARP suppliers supply constraints and no supplier or ARP comparator 10. If the observed correlation matrix agent relationship with the risk of occurrence of risk in Table IV.3 above, then the source of the risk of lack of control in the production process at the plant impact on the emergence of risk events such as mismatches in designs or drawings; quality of materials or components from suppliers not to specification; delivery of materials or components in the message is often too late; often delay the production process; scheduling production processes often in execution retreat; swelling working hours or overtime; mal-making process often do not fit (low precision); errors in the marking of components currently in process or assembled; shortage occurs in the assembly in the warehouse; quality of the order is not in accordance with the request of the buyer. Furthermore, to identify the impact of the risks stemming from risk agents 12 or changes to the production schedule can be seen in Table IV. 3.

d. Hor 1, the analysis of a sample of SMEs with Skopa International Market

Figure IV.4. Pareto diagram Value Risk Priority Index (sample Export)
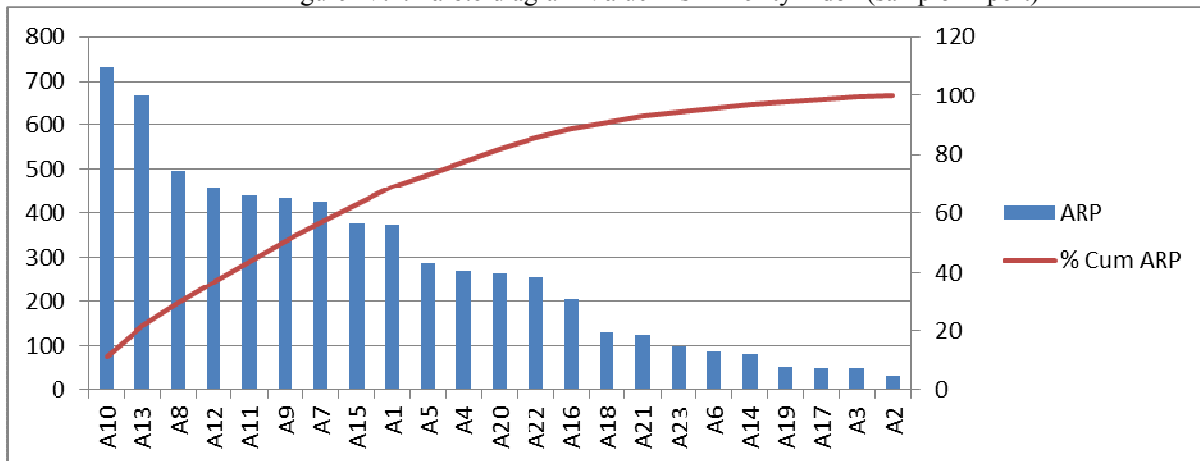


Based ARP table IV.4 Pareto diagram on a sample of SMEs which focus on the export market presents priorities ARP from the smallest value to the largest, ranked five ARP or agent risks that require measures of risk mitigation strategy is a source of risk or agent: there is no comparison supply company ARP10 ; weak supervision or ARP13; ARP8 major raw material requirements; production schedule changes often occur ARP 12 and often sudden demand. If the observed correlation matrix agent relationship with the risk of occurrence of risk in Table IV.3 above, then the source of the risk of lack of supply company comparison reflects the manufacturer's production process in a way to subcontract initial process work to their supplier partners. And sources of risk absence supplier company comparison impact on the emergence of risk events such as: dependence on a single source of supply; the price of materials or components required to fluctuate; quality of materials or components from suppliers not to specification; Frequent stock-out (running out of material, so that the production process to be delayed); Lead time or waiting time supply fluctuates suppliers; often delay the production process; frequent damage to the engine and the scheduling of the production process is often executed backwards. Furthermore, to identify the impact of the risks stemming from risk agents to 13 or weak oversight by the manufacturer can be seen in Table IV. 3.

## 3. Discussion

Norman and Jansson, 2004 mentioned several factors such as the global supply chain, shorter product cycles, capacity constraints and limitations as a supplier of important factors that could trigger the supply chain risk. This study uses the setting of SME manufacturers of furniture and handicraft products in the region of Yogyakarta and surrounding areas, and risk mapping results obtained from 23 sources of risk and the 43 risks that may arise can hinder the process of the supply chain of furniture and handicraft products. Goh et al (2007) classifies two types of risk based on the source of risk is the risk that often arise in the internal process of supply chain networks and the risks stemming from the external environment. The results of in-depth interviews with a few entrepreneurs and managers of the Yogyakarta branch ASMINDO data showed that the risk of the manufacturer is often influenced by their business partners, such as suppliers, customers and even logistics agent. Some respondents mentioned that there should be a study of government regulations related adverse and conflicting so that more increases the risk of supply chain system within the furniture manufacturer. Rules which strongly inhibits the production process and lead to the risk of supply of raw material supplier qualification does not meet the quality specifications as material export products. On the upper level are many suppliers are still weak in the execution of recording activity and marking material flow supplied to the system log tracking

mechanism has not been effective.

Mapping in the scope of supply chain risk is measured by using the manufacturer perpsektif SME owners and questionnaire design process is based on in-depth interviews with representatives of as many as five SMEs that until today exist and active in industry associations. The results of interviews with the team of expert reconfirmed with some of the results of risk mapping studies conducted by previous researchers Pujawan and Geraldin, 2009. The difference this study with previous research is focused on the research identification and risk mitigation based on a subjective perspective of the manager. While this study was designed using a multi-year and a subjective perspective of a variety of multi sources include a survey of manufacturers, suppliers and agents involved in the logistics supply chain of furniture and handicraft products.

Analysis of the first year focused on process mapping and assessment of priority ranking the risk agents that can potentially trigger a variety of supply chain risk. To obtain a picture of the results of in-depth risk mapping sequential analysis, which identifies priority ranking the risk agents in a sample of SMEs that have scope markets: local, national, export and joint analysis. When examined diagram ARP paretto either jointly or group analysis of the market can be concluded that there is a difference priority risk agents that need to be mitigated. If the group of SMEs that have skopa local market is the largest source of risk characteristics of demand that can not be predicted, the national group's largest source of risk is the lack of oversight and export group is triggered in the absence of risk source supplier comparison. The results of the interview, stretching furniture industry and craft businesses in the scope of the domestic market, especially in the region of Yogyakarta and surrounding areas experienced significant growth and trigger level business competition is very tight. The number of competitors' products in the local market have an impact on improving the local market demand uncertainty, and uncertainty of this demand can lead to numerous risks that impede the supply chain, among others, risks: dependence on a single source of supply; the price of materials or components required to fluctuate; quality of materials or components from suppliers not to specification; Frequent stockout (running out of material, so that the production process to be delayed); Lead time or waiting time supply fluctuates suppliers; often delay the production process; frequent damage to the engine and the scheduling of the production process is often executed backwards.

Manuj and Mentzer, 2008 mentioned that the characteristics of demand uncertainty as one of the sources of risk that can not be avoided but can be respon effect of uncertainty in two ways, first if the demand is not predictable and performance of supply from suppliers also have unpredictable characteristics of the supply chain strategy the agile can be selected for minimize effect of uncertainty itself. Several strategies or agile agile company must focus on improving the process capability is more responsive and risk hedging. But if low uncertainty supplier capacity, meaning that a relatively stable supply capacity of the supplier's supply chain management strategies are advised to focus on cost efficiency by using posponement strategy and single sourcing.

ARP sequence in the group of SMEs which have the highest national market scopa is the source of the risk of lack of oversight or controlling, can be meaning that a group of SMEs in line with the extent of the market is less balanced with good management oversight that could pose some risks such as: discrepancy in the design or image; quality of materials or components from suppliers not to specification; delivery of materials or components in the message is often too late; often delay the production process; scheduling production processes often in execution retreat; swelling working hours or overtime; mal-making process often do not fit (low precision); errors in the marking of components currently in process or assembled; shortage occurs in the assembly in the warehouse; quality of the order is not in accordance with the request of the buyer. Efforts to minimize the risk of lack of supervision is to encourage SMEs to have awareness about the practices of quality control management. discrepancy in the design or image; quality of materials or components from suppliers not to specification; delivery of materials or components in the message is often too late; often delay the production process; scheduling production processes often in execution retreat; swelling working hours or overtime; mal-making process often do not fit (low precision); errors in the marking of components currently in process or assembled; shortage occurs in the assembly in the warehouse; quality of the order is not in accordance with the request of the buyer.

Tang, 2005 explained that the supply chain risk reduction efforts are actually very closely with improvement programs such as TQM. But many companies are reluctant to invest improvement programs and the impact of supply chain risk triggering and the argument according to research findings that lack of management control in the scope of the factory turned out to have an impact on a number of risks that need improvement programs for quality improvement.

Analysis on the exporter group identified that the most pressing source of risk to be managed in an effort to mitigate the risks due to the absence of comparable suppliers. Unavailability of suppliers comparison reflects that the manufacturer dependence on suppliers is very high, this can pose some risks such as dependence on a single source of supply; the price of materials or components required to fluctuate; quality of materials or components from suppliers not to specification; Frequent stock-out (running out of material, so that the

production process to be delayed); Lead time or waiting time supply fluctuates suppliers; often delay the production process; frequent damage to the engine and the scheduling of the production process is often executed backwards. The findings of this study are consistent with the results of research conducted by Finch (2004) which states that the cooperation network large companies often trigger a higher risk of supply chain, especially if the big companies must cooperate with small and medium-sized companies. The results of the field study, the majority of companies exporter to subcontract much of their production activities to other parties, mostly using small furniture craftsman subcontracting partners in Klaten and Wonosari. The unavailability of suppliers comparator if confirmed to some SME owners focus furniture exports constrained by the limited supply of the top suppliers of major components certified timber. To anticipate the effects of dependence on suppliers and minimize any risks resulting from the company's dependence on its suppliers, then the company should use the strategic inventory management strategy or strategic stock that is necessary to have a safety stock inventory in order to run a streamlined production process. (Tang, 2005).

### E. Managerial Implications

1. Analysis of ARP in the group of SMEs with local market scopa ARP highest value is an agency risk characteristics of demand uncertainty, reflecting the local level of competition in the furniture industry and handicraft is very high then the confirmation certainty of supply uncertainty from the perspective of the supplier needs to be done to generate alternative solutions mitigation strategies supplier in accordance with the context of the company's suppliers.

2. Especially in SMEs with a focus group recommended the national market if all supply chain risks resulting from weak supervision of risk sources and are not influenced by the source of the risk of their supplier partners it is advisable to invest in programs of TQM (Total Quality Management).

3. In the group of SME exports ARP highest value is not any comparison supply company, this reflects that bargaining power suppliers is very strong. Search The main problem as a single-source supplier companies need to be identified external risks that could lead to the risk of internal supply chain system within the plant. So that the design solution proposed mitigation strategies in both good for the manufacturer, supplier or logistics agent can create furniture industry supply chain process that is reliable and sustainable. The second year of research activities considered necessary to be done in line with the opinion of Ritchie and Brindley (2007) which states that the company's global supply chain management is no longer focused on the scope of the organization but need synchronization between organizational perspective especially with partners and third-party suppliers as their logistics agent.

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