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SUPPLIER RELATIONSHIP MANAGEMENT FOR

ELECTRONICS MANUFACTURING SERVICE COMPANY

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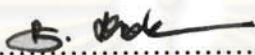
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สินค้าอิเล็คทรอนิกส์ (SUPPLIER RELATIONSHIP MANAGEMENT FOR
ELECTRONICS MANUFACTURING SERVICE COMPANY) อ. ที่ปรึกษาวิทยานิพนธ์
หลัก: รศ.ดร. ปารเมศ ชุติมา , 170 หน้า.

งานวิจัยนี้มีจุดประสงค์เพื่อที่จะศึกษาความสัมพันธ์กับผู้ส่งมอบสำหรับบริษัทรับจ้างผลิต
อุปกรณ์อิเล็คทรอนิกส์ การริเริ่มงานวิจัยดังกล่าวจำเป็นที่จะต้องค้นคว้าหาข้อมูลสนับสนุนเพิ่มเติม
จุดประสงค์หลักของงานวิจัยนี้คือ เพื่อ ลดและป้องกันความผิดพลาดในการจัดส่งอุปกรณ์
อิเล็คทรอนิกส์ไปทำการตรวจสอบถึงปัญหาที่บริษัทของผู้ส่งมอบ โดยคำนึงถึงความถูกต้อง และ
เวลาในการจัดส่งอุปกรณ์ รวมไปถึงวิธีการป้องกันและลดความผิดพลาดในการจัดส่งอุปกรณ์ไปยัง
ผู้ส่งมอบ

ในการบริหารความสัมพันธ์กับผู้ส่งมอบในที่นี้ ได้รวมไปถึงการคัดเลือกผู้ส่งมอบ โดย
วิธีการตรวจสอบผู้ส่งมอบ และทำรายการตรวจสอบเพื่อเป็นแนวทางสำหรับทำการตรวจสอบผู้ส่ง
มอบอื่นๆที่ให้บริการแบบเดียวกัน สำหรับการบริหารความสัมพันธ์กับผู้ส่งมอบเพื่อทำการลดความ
ผิดพลาดในการจัดส่งทำตรวจสอบถึงที่มาของปัญหา FMEA (Failure Mode and Effect Analysis)
ถูกนำมาใช้เพื่อการประเมิน แนวโน้มของปัญหาที่ทำให้เกิดความล่าช้าในการจัดส่งถูกระบุขึ้นมา
ทั้งสิ้นรวม 44 หัวข้อ จากนั้นได้นำการวิจัยโดยมาคัดเลือกหัวข้อความเสี่ยงลำดับที่มีความสำคัญ
เพื่อทำการแก้ไขจำนวนทั้งสิ้น หัวข้อ 24 ได้ถูกนำมาวิเคราะห์เพื่อหามาตรการป้องกันสาเหตุหลักที่
ทำให้เกิดปัญหาความล่าช้า มาตรการป้องกันความเสี่ยง 2 มาตรการได้ถูกจัดทำขึ้นเพื่อลดค่า RPN
ในกลุ่มความเสี่ยงหลัก ผลที่ได้จากการให้คะแนน RPN หลังจากมาตรการป้องกันความผิดพลาด
นำไปใช้ พบว่าลดความเสี่ยงลงได้ถึง 60% ผลจากการพัฒนาทำให้ความล่าช้าในการดำเนินการ
ลดลง ช่วงเวลาในการดำเนินการสามารถทำได้ตามความต้องการของลูกค้า และพัฒนาจากเดิมมาถึง
60% เป็นการพิสูจน์ถึงผลจากการทำวิจัยที่ทำให้เกิดความก้าวหน้าทั้งในด้านเวลาและคุณภาพ

ศูนย์ระดับภูมิภาคทางวิศวกรรมระบบการผลิต ลายมือชื่อนิสิต. Pornthip Ch.

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PORNTHIP CHENGSUEBSANT: SUPPLIER RELATIONSHIP MANAGEMENT FOR ELECTRONICS MANUFACTURING SERVICE COMPANY. THESIS ADVISOR: ASSOC. PROF. PARAMES CHTIMA, Ph.D., 170 pp.

The purpose of this research is to study the potential root cause of the delays in Failure Analysis process including supplier selection. The extended research on its characteristics will be necessary. The objectives of this research are to minimize and prevent the delay in our internal process to ship part for performing failure analysis at supplier site. This will be focus on of time and quality. Preventive methods will also be created.

Supplier relationship management including for supplier assessment by using audit method and create the audit checklist as a guideline for other supplier audit in the same service. For supplier development which focuses on the delivery, FMEA (Failure Mode and Effect Analysis) will be used to assess the risk sensitivity from 44 potential root causes. The assessment of the RPN (Risk Priority Number) using Analysis shows that there are in total of 24 critical potential root causes. The analysis of critical potential root causes is done by using 5 why analysis and creating the preventive actions is. Two mains preventive action would resolve the intensity of these potential root causes to lower the RPN value of the critical potential root causes. The results show that the RPN after applying preventive actions has reduced by 60%. After implementation of time that use for delivery process improve from normal 60% and also meet for customer requirement., There were improvements in the delaying shipment showing a big improvement compared with to the normal process. It is proven that development process has improved the result of the project in terms of time and quality.

The Regional Centre for Manufacturing Systems Engineering   Student's Signature Pornthip Ch.
Field of Study: Engineering Management......   Advisor's Signature Param.
Academic Year: 2010......

Acknowledgements

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จุฬาลงกรณ์มหาวิทยาลัย

Chapter I

Introduction

1.1 Background of the research

Regarding to, Electrical Manufacturing service (EMS) Company or Contract Manufacturing (CM) is building product by following customer product design and customer requirement. In the electronic business, almost of raw material is a commercial part, which is available in the market. It bases on the customer design and selected part at the design stage. The EMS Company is out-sourcing which Original Equipment Manufacturer (OEM) selected for cost reduction but also keep the core competency inside the company. Thus, the design is still publish from the OEM and let the EMS produces by follows their design. Therefore, almost component had already selected source and controlled by customer, EMS needs to purchase part by follows customer vendor approval.

Due to electronic part is a commercial part which available in the market. IT is the main point that makes electronic assembly company hard to keep supplier as a long-term relationship. Price is also the first focus from the customer and will follows by the quality, delivery and technology. As a flatness world which technology is going so fast, it makes a high competitive on the pricing of the electronics part and make the price decreasing consecutively. For supplier to remain in the market the price shall reasonable when compare with the competitors. It is very hard for customer to use the high quality part with the high price to support their product. So, almost customers always choose the acceptable quality with the lower price to compete with the other competitors in the market.

1.2 Statements of Problems

Supplier management or sub-tier management is quite a popular topic which customer needs the EMS to manage the sub-tier which they selected. Refer to figure1 which is the clearly figure on the web consists of upstream and downstream side. In this research will focus on the upstream side.
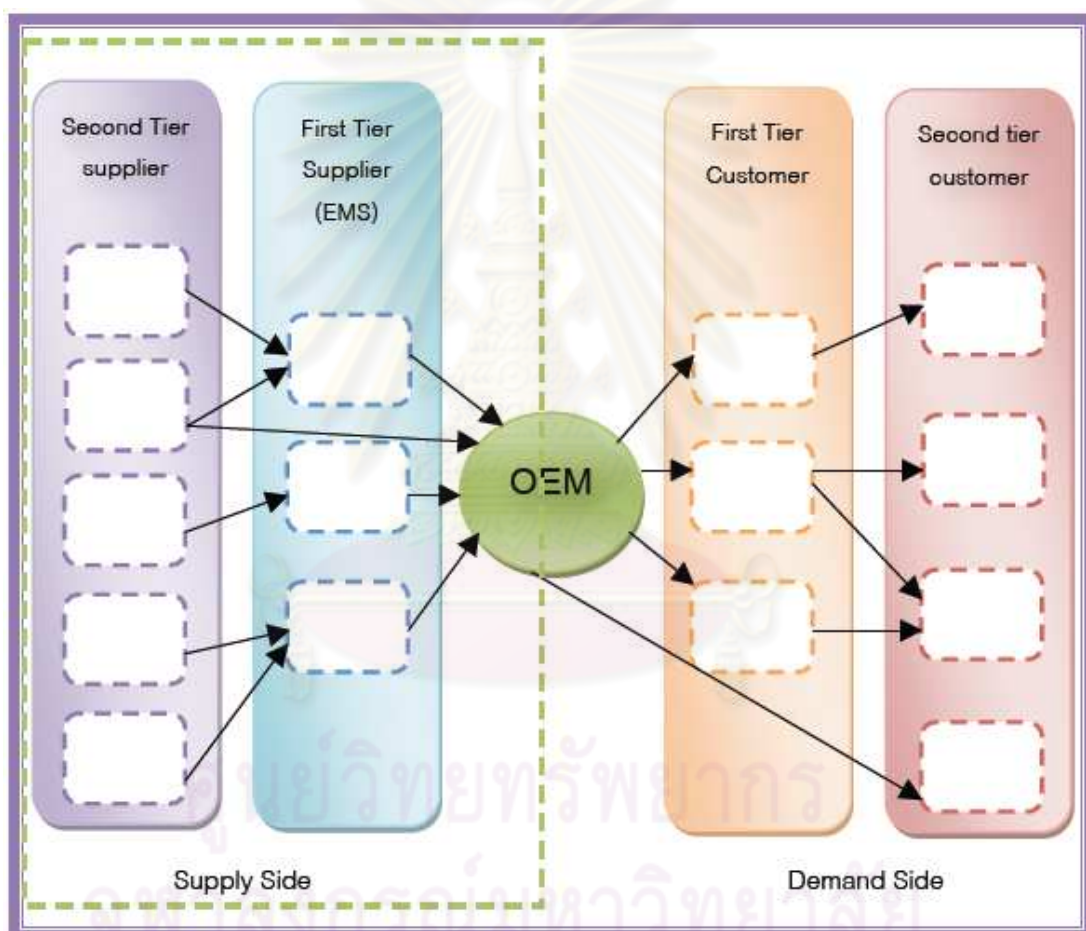
Figure 1 : Supply Chain Network (1)

Customer needs the EMS Company focus more on the sub-tier management and deploy the requirement and document for the failure analysis turn-around time. This is the new things which EMS Company to create the flow and tighten the internal process to meet on the customer requirement. Not only the EMS internal site

but also relate to the sub-tier site which EMS Company needs to co-ordinate and set up agreement and timeline at supplier site to support the customer requirement.

The reason that customers need to focus more on the failure analysis turn-around time due to they need the EMS company can solve the problem on time and does not concern to the shipment. The things that EMS company needs to do right now is finding the way to meet the customer requirement and keep monitoring on the internal and external performance for providing the customer that we're following the requirement which will make them satisfy.

1.3 Research objectives

To develop some document to make supplier selection more effective and improve on supplier relationship by focusing on the quality service in order to have a better support and gain more on customer satisfaction

1.4 Research scope

The thesis on Supplier relationship management in electronic company will be researched and written under the following scope:

1. This study does in open source supplier that support to EMS Company.

2. This study focuses on open source supplier selection and quality service only.

3. This study focuses on the supplier selection, supplier development performance and measurement on the Supplier Relationship Management

1.5 Expected Benefits

From the result that the thesis will generate, the supplier relationship management, direct benefit is to create a smooth business and help on the less time, guarantee on the quality of the raw material, gain the good service from the supplier

and help company to gain more on the customer satisfaction. These are some of the benefits of the supplier relationship management program in both direct and indirect way.

- Selected the reliable supplier, which can support on cost, delivery, quality and technology and manage relation as the long-term collaboration.

- Create more opportunity for company to recommend open source supplier to customer which makes company has more power and authority beyond supplier.

- Possibly improve on the supplier relationship to gain more benefits, efficiency or assurance on the product.

- To ensure on the quality and support from the supplier site to manage inventory.

- To manage good relationship from the supplier to gain more on service and support.

- To make the more efficiency and accurate on the supplier performance review on the responsiveness.

1.6 Research Methodology

The research procedure of the thesis about supplier relation management will be following these steps, which are:

1. Literature Review

- Study the literature that includes the concept of supplier relation management in the term of types of relation including on the supplier development performance and supplier development process.

- Study the literature on the supplier selection tools and techniques.

- Study Tools, Techniques and Model of supplier relation management that can be applied to electronic company.

2. Process study and information gathering

- Gather detailed information about topics within the scope of the thesis

- Gather information internally to select the supplier which should be improving on the service and performance.

- Gather information on the supplier information in term of quality service and organization.

3. Supplier Relation Management study Process

- Create team and brainstorm with other concern people on the supplier selection step.

- Selected the supplier, which need to be developed on the performance to serve on the quality in the right time.

- Identify all problems on supplier performance that need to be developed.

- Identify factors both supplier side and EMS Company side which because the problem on the delays service and support.

- Try to develop a standard agreement to be guidance for other supplier

- Do evaluation and monitoring on the result of the standard document to measure on the supplier service.

4.   Summary

•   Summary of the result to improve on the service from supplier
     which led to gain more on the customer satisfaction.

•   Thesis writes up

Chapter II

Theories and Literature review

Nowadays, world becomes flatness because of globalization. Business world is more competitiveness because everything moving so fast and connect quite easily. Data transfers from one place to another faster than before. In the competitive world, everything needs to move accurate and faster to survive. Each company finds the way and solution to gain advantage over competitor. How to improve the business to work more efficiency and faster than previous. Firms are more consider on the supply chain management to make it more efficiency and make the business survive on the competitiveness world. Almost of companies have to deal with many suppliers in the chain and it depend on each other services. The overall performance is influenced by the company in the chain.

2.1 Supply Chain Management

Supply Chain management is quite close definition to the logistics management. Actually, Supply Chain management has some overlap scopes with the logistics management as many people understanding.

APICS dictionary defines term of supply chain as "process from the initial raw materials to the ultimate consumption of the finished product linking across supplier-user companies," or as the "functions within and outside a company that enable the value chain to make products and provide services to the customer" (2)
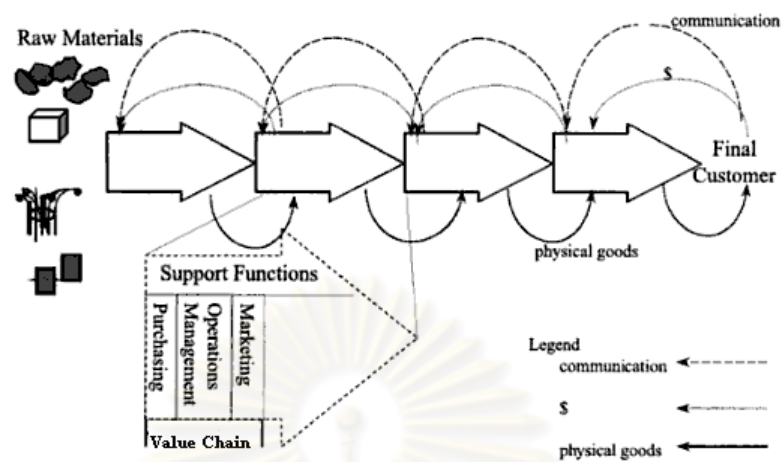
Figure 2 : Supply Chain (3)

From Figure2, Supply Chain is a series of arrows which moving from raw materials to final customer. Each arrow still represents as individual firms which link in the chain. In supply chain, it does not consist of the physical movement such as raw materials and products between firms only but also involves the flow of information, commercial and fund as well.

Moreover, Stevens also provide a good definition on the supply chain management as "A supply chain is a system whose constituent parts include material supplier, production facilities, distribution services liked together via a feed forward flow of materials and the feedback flow of information" (3)

Supply chain management has many definitions from many people which can define as Figure3,

Authors	Definition
Tan et al. (1998)	Supply chain management encompasses materials/supply management from the supply of basic raw materials to final product (and possible recycling and re-use). Supply chain management focuses on how firms utilise their suppliers' processes, technology and capability to enhance competitive advantage. It is a management philosophy that extends traditional intra-enterprise activities by bringing trading partners together with the common goal of optimisation and efficiency.
Berry et al. (1994)	Supply chain management aims at building trust, exchanging information on market needs, developing new products, and reducing the supplier base to a particular OEM (original equipment manufacturer) so as to release management resources for developing meaningful, long term relationship.
Jones and Riley (1985)	An integrative approach to dealing with the planning and control of the materials flow from suppliers to end-users.
Saunders (1995)	External Chain is the total chain of exchange from original source of raw material, through the various firms involved in extracting and processing raw materials, manufacturing, assembling, distributing and retailing to ultimate end customers.
Ellram (1991)	A network of firms interacting to deliver product or service to the end customer, linking flows from raw material supply to final delivery.
Christopher (1992)	Network of organisations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer.
Lee and Billington (1992)	Networks of manufacturing and distribution sites that procure raw materials, transform them into intermediate and finished products, and distribute the finished products to customers.
Kopczak (1997)	The set of entities, including suppliers, logistics services providers, manufacturers, distributors and resellers, through which materials, products and information flow.
Lee and Ng (1997)	A network of entities that starts with the suppliers' supplier and ends with the customers' custom the production and delivery of goods and services.

Figure 3 : SCM definitions (4)

The definition of supply chain management is manage the chain both supplier and customer to achieve higher customer satisfaction at lower total cost to the chain by managing the four basic flows which are material flow, information flow , finance flow and commercial flow. The supply chain management also adds value into the process and improves the whole chain to minimize waste. Figure 4 is explaining for the supply chain process to link the relationship along the chain and also including information flows and production and material flow.
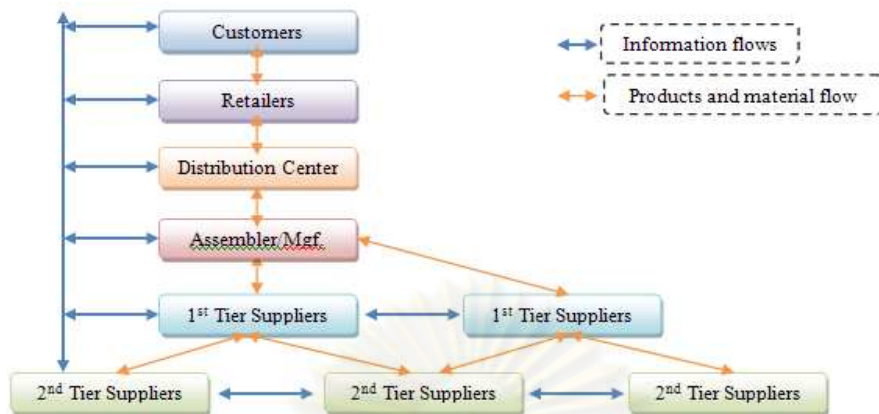
Figure 4 : Integrated Supply Chain Model (5)

2.2 Supply Chain Relationship

Supply chain relationship is one important factor to make effective supply management. It affects to the whole supply chain in term of the four basic flows. Evolution of the supply chain relationship adapts from vertical integration to make the ownership of the suppliers into partnership.

Figure5 shows on the level of the relationship and how closeness with supplier.
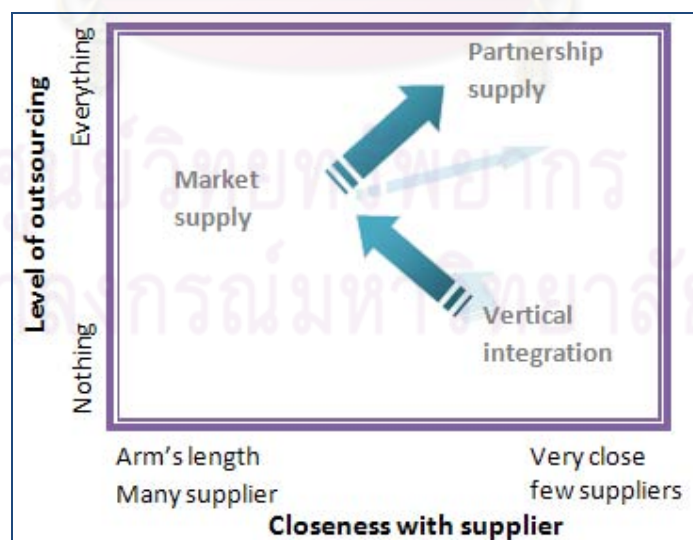
Figure 5 : Trend of Supply Chain Relationship (1)

Partnering defined by Stuart Emmett, Barry Crocker as "an ongoing relationship between two organizations which involves a commitment over an

extended time period, and a mutual sharing of the risks and rewards of the relationship" (6). Supply chain develops to closer relationship as interdependent and contract as a long-term relation. The benefit of this closer, company can improve the lead-time to launch the new product and delivery, improve quality of the supplier, more powerful on competitive strategy, closer to the customer relationship and cost reduction.

The key succession factor to maintain long-term relationship and make the supply chain effectiveness is to create the trust along the supply chain. It leads to lowering cost, reduction waste in the chain and reduction the duplication effort.

In conclusion, to form a partnership supply is a good way to work together in the same objective and business direction. The closer relation makes competitive advantage to company and closer to the customer as well. It will make company can support and provide service to support the customer requirement. But either vertical integration or partnership, it cannot identify which is the best type of relationship. It seems like the best relationship is the relation which create the most cost effective and support customer requirement in the right place and time to gain customer satisfaction.

2.3 Single source or Multi source

In competitive environment and globalization, company has to select the right source for support the core product and process of the company. The process to selection supplier is quite important to get the reliable supplier which can provide product in the right price, right place and right time to get competitive advantages.

Base on trend of the supplier management, to reduce the number of supplier is also considering to reduce cost and make long term relationship for more controlling and sharing information and technology. To select supplier, company should be considering to the number of the supplier and should realize on the advantage and disadvantage of each type.

As Joel D at el provide the reason of advantages for both single supplier and multi supplier as below, this also should be considering that the company suitable for which one.

"Reasons favoring a single supplier

1. *To establish a good relationship* : Using a single supplier makes it easier for the firm to establish a mutually beneficial strategic alliance relationship, especially when the firm can benefit from the supplier's technology and capabilities

2. *Less quality variability*: since the same technology and processes are used to produce the parts when using a single source, variability in the quality levels is less than if the parts are purchased from multiple suppliers

3. *Low cost*: buying from a single source concentrates purchase volume with the supplier, typically lowering the purchase cost per unit. Single sourcing also avoids duplicate fixed costs, especially if the component requires special tooling or expensive setups.

4. *Transportation economics*: Because single sourcing concentrates volume, the firm can take advantage of truckload shipment, which is cheaper per unit than the less-than-truckload rate. By moving up to full truckloads, the firm has the option of using both rail and motor carriers. Rail carriers are more efficient for hauling heavy loads over long distances.

5. *Proprietary product of process purchases*: If it is a proprietary product or process, or if the supplier holds the patents to the product or process, the firm has no choice but to buy from the sole source.

6. *Volume too small to split*: If the requirement is too small, it is not worthwhile to split the order among many suppliers. Single sourcing is also a good approach for acquiring no vital suppliers and services.

Reasons Favoring multiple suppliers

1. *Need capacity:* When demand exceeds the capacity of a single supplier, the firm has no choice but to use multiple sources.

2. *Spread the risk of supplier interruption:* Multiple sources allow the firm to spread the risk of supply interruptions due to a strike, quality problem, political instability, or other supplier problems.

3. *Create competition:* Using multiple sources encourages competition among suppliers in terms of price and quality. While modern supplier management philosophy discourages the use of multiple sources simply to create competition, this may still be the preferred approach for sourcing no vital items that do not affect the firm's competitive advantage. Using a single source to develop alliances for these types of purchases may not be cost-effective.

4. *Information:* Multiple suppliers usually have more information about market conditions, new product developments, and new process technologies. This is particularly important if the product has a short product life cycle.

5. *Dealing with special kinds of businesses*: The firms, particularly government contractors, may need to give portions of their purchases to small, local, or women- or minority –owned businesses, either voluntarily or as required by law.

The number of supplier to use for one type of purchase has change from the traditional multiple suppliers to more modern use of fewer, reliable suppliers and even to the extent of using a single supplier. Relationships between buyers and suppliers were traditionally short term, adversarial, and based primarily on cost, resulting in mutual lack of trust. Buyer-Supplier relationship, particularly in integrated supply chain setting, has evolved today into trusting, cooperative and

mutually beneficial long term relationship. Firms today reduce their supply base to only the best suppliers". (7)

IGDS Supply chain management, WDG 2008 also provide the table which compare between single source and multi source for each time period as Table1,

	Single Sourcing	Multi Sourcing
Short-term **0-1 years**	Future uncertain Need staffing flexibility Minimal investment Deteriorated learning High selling costs Limited quality improvement Low commitment Innovation unlikely	Future uncertain Volume uncertain Need staffing flexibility Will have peaks and troughs Minimal investment Deteriorated learning High selling costs Limited quality improvement Very low commitment Innovation zero
Medium-term **1-3 years**	Short term horizons Reluctance to take on staff Short payout investment Limited efficiency programs Improved Learning curve Moderate commitment Some innovation	Short time horizons Need staff flexibility Minimal investment No efficiency programs Moderate learning curve Limited commitment Innovation unlikely
Long-term **4+ years**	Future predictable Optimal staffing and training High capital investment Product development Good efficiency programs Steep learning curve Minimal paperwork High commitment Complacency Commitment to innovate Partnership probable	Volumes uncertain Smaller volumes Staffing uncertain Moderate capital investment Efficiency programs Steep learning curve Maintains competitive edge Moderate commitment Innovation unlikely

Table 1 : Long term impact of single sourcing and multi sourcing (1)

2.4 Supplier Selection

In business, raw materials and component parts is the main cost of a product. Supplier Selection is one of the keys factors to improve on the cost reduction. One of the most important processes that organization should be considering is evaluation, selection and continuous measurement of suppliers.

Roger Moser (2007) define supplier selection as "Supplier selection is part of supplier management and includes all activities necessary to select a specific supplier for basic materials, products or services on a long-term or short-term basis based on a supplier's respective capabilities and offerings in order to generate competitive advantages" (8)

Supplier selection is a necessary process for a competitive advantages and long-term collaborate with the right supplier. Selected the right supplier will help firm to gain more competitiveness and effectiveness of the material control and improve along the whole supply chain. Supplier selection, firms should considering on risk analysis and management, price negotiation, contract negotiation including proprietary, warranty/licensing right, bid management and quotation, supplier relation and allocation management and supplier performance management.

"Supplier Selection decisions determine how many and which suppliers should be selected as supply sources and how order quantities should be allocated among the selected suppliers". (9) (Han Lee,2000)

Supplier selection, normally all potential suppliers which may be able to supply part to firm will be listed and firm will considering for all of supplier and simultaneously reduce the potential supplier pool along the selection process to get the optimal suppliers.

Before performing selection supplier, the things that should be considering are

- Selection Criteria

    A guideline for selection criteria is provided as below,

    - Total quality management policy

    - BS 5750/ISO 9000 certification or equivalent

    - Implementing latest techniques e.g. JIT, EDI

- In-house design capability

- Ability to supply locally or worldwide as appropriate

- Consistent delivery performance, service standards and product quality

- Attitude on total acquisition cost

- Willingness to change, flexible attitude of management and workforce

- Initial contact

- Formal evaluation

  - Price quotation

  - Financial data

  - Reference checking

  - Supplier visit

  - Audits, assessments or surveys

  - Initiation test

Selection Criteria is the focusing of the firm which of the main point of the supplier that firm need to know and using this data to decide for the relationship in the future. So, the selection Criteria should be suitable and matching with the core competency of the business and match with the policy of the company. It also thinks about the customer requirement as well. Selection Criteria should match with the product and customer requirement which will make things to be easier for long-term relationship.

Selection Criteria has many people summaries as a guideline for considering. Table2 summarizes the finding of Dickson's study regarding the importance of the 23 supplier selection criteria

Rank	Factor	Mean Rating	Evaluation
1	Quality	3.508	Extreme importance
2	Delivery	3.417	
3	Performance history	2.998	
4	Warranties and claim policies	2.849	
5	Production facilities and capacity	2.775	Considerable importance
6	Price	2.758	
7	Technical capability	2.545	
8	Financial position	2.514	
9	Procedural compliance	2.488	
10	Communication system	2.426	
11	Reputation and position in industry	2.412	
12	Desire for business	2.256	
13	Management and organization	2.216	
14	Operating controls	2.211	
15	Repair service	2.187	Average importance
16	Attitude	2.120	
17	Impression	2.054	
18	Packaging ability	2.009	
19	Labor relations record	2.003	
20	Geographical location	1.872	
21	Amount of past business	1.597	
22	Training aids	1.537	
23	Reciprocal arrangements	0.610	Slight importance

Table 2 : Supplier Selection Criteria (10)

It also has too many people try to review and do analysis for identical more point which should be considering as a criteria for selected supplier which will be the partner in the future. Base on the study, the four main points that almost company considering are price, delivery, quality and technology.

Table3 is providing a comprehensive view of the criteria that academics and purchasing practitioner considered important in the supplier selection decision.

Researchers	Rank order of supplier selection criteria	
Banville and Dornoff (1973)	1. Service 2. Product Quality 3. Supplier support 4. Low price 5. Reputation 6. Proximity to supplier	7. Friendship with supplier 8. Salesman's personality 9. Supplier extends credit 10. Prestige of dealing with supplier 11. Reciprocity 12. Improves my status in my company
Choa et.al (1993)	1. Delivery reliability 2. Product quality 3. Price	4. Professionalism of salesperson 5. Service/responsiveness to customer needs 6. Buyer-seller relationship
Dempsey (1978)	1. Delivery capability 2. Quality 3. Price 4. Repair service 5. Technical capability 6. Performance history 7. Production facilities 8. Aid and service 9. Control systems 10. Reputation	11. Financial position 12. Attitude toward buyer 13. Bidding compliance 14. Training aids 15. Progress communication 16. Management and organization 17. Packaging capability 18. Moral/legal issues 19. Geographic location 20. Labor relations record
Fawcett (1993)	1. Delivery dependability 2. Domestic content laws 3. Engineering capability 4. Financial strength	5. Price 6. Proximity 7. Quality 8. Technology
Lehman and O'Shaughnessy (1974)	1. Delivery 2. Price 3. Flexibility 4. Reputation 5. Technical specifications 6. Past experience 7. Sales service 8. Maintenance 9. Financing	10. Ease of use 11. Reliability 12. Technical service 13. Preference of user 14. Confidence in salesmen 15. Convenience in ordering 16. Training offered 17. Training required

Table 3 : Supplier Selection Criteria: Finding From selected Studies (1)

To select and cutting down supplier can be done step by step as below,

1. *Market Research:* To search for all suppliers in the market, in this step the component that firm needed is in the list but the problem is what is selling in the open market? Who is produce the materials that firm needed? Who can support in terms of product capabilities, costs, and delivery? In this step, all information about supplier will be collected as much as possible. Company also find more general information for the new source as below,

a) Recommendations from company technical personnel

b) The experience of the buyer and their record of previous sources.

c) Manufacturers and distributors in the same or related industry for the item being sought.

d) Trade and industrial registers and directors.

e) Industrial and professional publications.

f) Manufacturers/distributors catalogs.

g) Industrial shows and conventions.

h) Interviews with manufacturer's representatives.

i) Discussions with salespeople in related fields.

j) Discussions with purchasing associates.

k) Classified section of telephone directories.

2. *Strategy development:* All information that collected will be analyze follows the supplier selection criteria which set up by firms. Almost of criteria that should be considering can separate as below,

- General information Factors.

  a) Brief history of company

  b) Organization and key personnel

  c) Financial statements

  d) Previous customers

  e) Present and forecast workload

  f) Management policies

  g) Small, large, or disadvantaged business

  h) Major products manufactured

- Financial Factors.

    a) Present financial condition

    b) Availability of funds to perform proposed job

    c) Cost accounting system (s) employed

    d) Previous experience in contracts types

- Manufacturing Capabilities.

    a) Past experience with work similar to that proposed

    b) Adequate floor space, equipment, and other facilities to do proposed job.

    c) Qualified, trained, and experienced personnel

    d) Ability to meet delivery requirements

- Quality and Reliability Capabilities.

    a) Organization of quality control department

    b) Adequate manpower availability

    c) Is the reliability concept held by the vendor adequate for the proposed job?

    d) Have quality procedures been approved and by which agency? As an example: ISO 9000

    e) Procedure for first article testing

    f) What control is maintained over that part of the project which will be purchased?

- Development and Engineering Capabilities.

    a) Organization of the engineering and development activity

    b) Background and capabilities of personnel assigned to the project.

c) Adequate manpower employed. Plans for staffing

d) Allocation of manpower in terms of engineers, scientists, technicians, and administrators

e) Is the vendor capable of satisfying requirements for standards and format, technical reports, plans, and specifications?

f) How are engineering changes processed and controlled

The objective of this analysis for selected the suppliers which have a capability to build the quality product and supply the firm demands. In this step may setting a supplier visit and do the qualified-supplier lists or approved-vendor list in parallel.

The selection of vendor will be base on the product technology and company requirement and may be influence by evaluation of the vendor's ability to adequately and effectively serve the company and its customers in terms of reliability, quality, delivery, engineering competence, and economic factors.

Company also needs to do supplier evaluation by considering on below,

a) Previous experience with the vendor.

b) Suitability of production capacity, both available and reserve.

c) Ability to consistently produce required quality.

d) Location of production facilities.

e) Attitudes, capability, and policy of management.

f) Past and present labor conditions.

g) Special skills, techniques, and equipment.

h) Engineering, design, and technical assistance available.

I) Reputation as a fair and honest business organization.

j) Willingness to maintain adequate cost records for purposes of audit.

k) Financial resources.

l) Ability to make required delivery schedule(s).

m) Manner of handling defective/rejected materiel.

n) Capacity to obtain necessary materials through sound, aggressive purchasing operation.

o) Existing quality program and procedures.

3. *Contract negotiation:* This is a negotiate step and select supplier and leads to place order. Competitive quotations are the preferred method for supplier selection among approved vendors. Various other mean to supplement, or in lieu of, competition will be used as appropriate. After selected the vendor base on above information, negotiate on price and set agreement with supplier to ensure that supplier understand on the company contact on payment terms, terms and condition and know-well on packaging requirement.

4. *Supplier Relationship Management:* This is following up step with supplier to ensure that supplier follows on our agreement as supply the correct part, delivery on time, provide quality product and also inform on the new technology of the company and provide notification when have any change relate to the product and process.

Pre-survey should been conduct of new potential vendor and on-going re-evaluations of qualified vendors by analyzing their performance in terms of capacity, quality, delivery and development with the intent of helping improve the vendor's and the company's performance.

To measure on the supplier performance, it has some mechanisms for measuring as

- Assessments or audits

- Periodic supplier self assessments

- Ongoing supplier evaluation or supplier grading

- Customer awards

"If a firm has reduced its supply base to a much smaller level, and if remaining supplier usually received longer-term agreements, the willingness or ability to switch suppliers is diminished. This makes selecting the right suppliers an important business decision" (11)

Company also should be ensure that the selected supplier is met the five rights of purchasing as right price, right time, right quality and right source.

To select the supplier, purchasing need to ensure that

1. The right suppliers are selected

2. They are meeting performance expectations

3. Appropriate contractual mechanisms are employed

4. A good relationship is maintained with these suppliers

In conclusion, supplier selection can be classified into 4 main process which shows in Figure6.
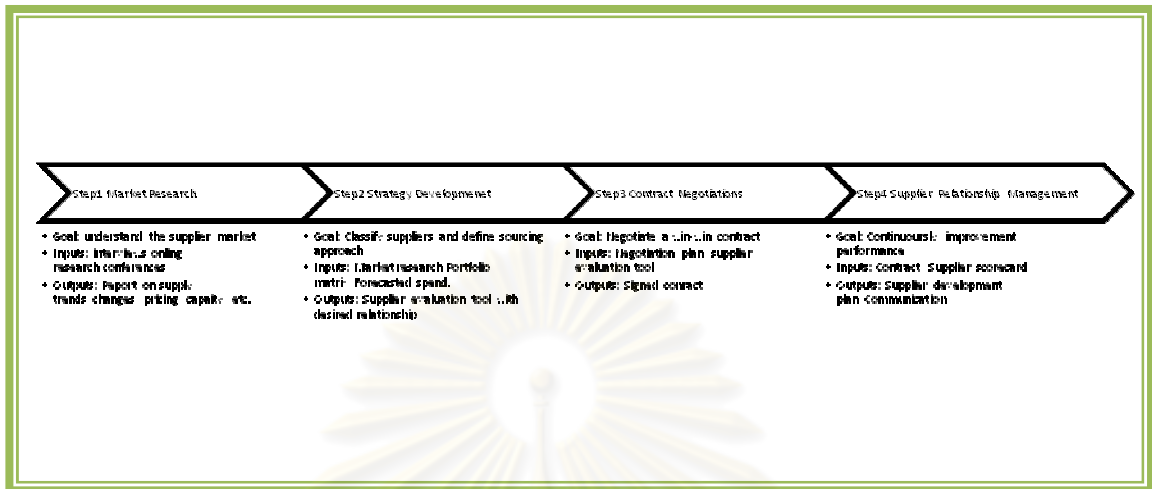
Figure 6 : Supplier Selection Process (11)

2.5 Supplier Development Management

If we need to source material, one of strategic that we do to get the competitiveness is create and develop supplier. In this case, kind of supplier will separate to 4 levels base on relationship as Figure7,
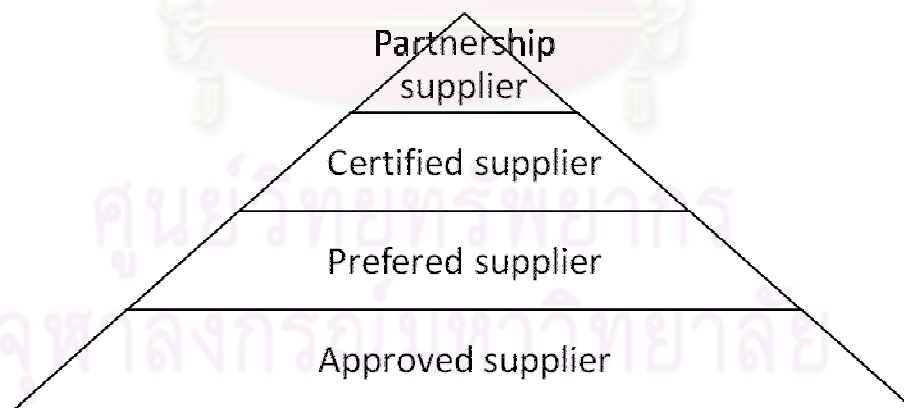
Figure 7 : Level of supplier

1. Approved suppliers

This is the first step after supplier had been selected from the selection process. This is the monitoring on the supplier performance and set some commitment between supplier and firms. In this step, supplier needs to

convey the product which is met the requirement and specification with the reasonable price. The main focus on the approved vendor list will base on product quality, price and time of delivery.

2. Preferred suppliers

    After monitoring supplier performance for a while, if supplier can meet the standard without any problem on product and time delivery and has a little bit competitive than other supplier in the approved vendor list, this supplier will be classify to preferred supplier. A little bit competitive such as,

    *   When demands increasing, supplier can meet the fluctuated demand and still meet on time delivery without any problem on product quality.

    *   Supplier must have the proactive and have a creativity to improve the product.

    *   If supplier found any problem on the product, it does a proactive by alert on the quality issue and also provides the containment action and recovery plan to prevent high impact with customer/company.

    *   Supplier needs to do a long-term relationship with the company in the future.

3. Certified supplier

    Certified supplier means no incoming inspection is performed on a product or grouping of product. Normally, incoming inspection will perform 100% check or sampling to ensure the quality of the product from supplier. No incoming inspection can call as ship-to-store, ship-to-stock, dock-to-stock and ship-to production. This will help company to reduce cost on inspection cost and resources.

This means supplier building trust in terms of product quality, no return and recalled product until company trust and skip to perform incoming inspection.

4. Partnership supplier

Partnering defined by Stuart Emmett, Barry Crocker as "an ongoing relationship between two organizations which involves a commitment over an extended time period, and a mutual sharing of the risks and rewards of the relationship" (6). Almost companies develop to closer relationship as interdependent and contract as a long-term relation. The benefit of this closer, company can improve the lead-time to launch the new product and delivery, improve quality of the supplier, more powerful on competitive strategy, closer to the customer relationship and cost reduction.

To classified level of the supplier, Federal-Mogul provides the guideline for rating in Figure8.

Road to Supplier Performance Excellence
2007 Supplier Rating Criteria
Overview

Overall Rating Weighted Point Score:
Preferred: 90 to 100
Acceptable: 70 to 89
Developmental: 0 to 69

Supplier Scores and Category Weighting

Quality Category: Rating Criteria

The Quality category is comprised of two components:

> Parts Per Million (PPM) 50 percent
> Quantity of supplier corrective action requests (SCARs) issued 50 percent

PPM is based on SCARs. Both the number of SCARs and PPM are reported monthly. SCAR responsiveness does not factor into the supplier's Overall Score. Currently, it is only displayed on the Scorecard.

PPM Count	Points	# of SCARs	Points
0	100	0	100
1 – 25	90	1	70
26 – 50	80	2 – 4	40
51 – 100	60	5+	0
101 – 250	40		
251 – 500	20		
501+	0		

SCSS (Supplier Cost-Saving Suggestions): Rating Criteria

5 percent target performance:
SCSS are targeted at 5 percent of the year's forecasted dollars spent. The supplier must make SCSS submittals to the plant or the commodity manager.

Score	SCSS Measurement
100	5% and above
85	4% to 4.9%
70	3% to 3.9%
40	2% to 2.9%
20	1% to 1.9%
0	0.9% and below

Figure 8 : Federal-Mogul's supplier rating criteria (12)

In conclusion, to form a partnership supply is a good way to work together in the same objective and business direction. The closer relation makes competitive advantage to company and closer to the customer as well. It will make company can support and provide service to support the customer requirement. But either

relationship or partnership, it cannot identify which is the best type of relationship. It seems like the best relationship is the relation which create the most cost effective and support customer requirement in the right place and time to gain customer satisfaction.

2.6 Supplier Development Process

"A-Seven step approach to supplier development is out-line below

1. *Identify critical products and service.* Assess the relative importance of the product and services from a strategic perspective. Products and services that are purchased in high volume, do not have good substitutes, or have limited sources of supply are considered strategic suppliers.

2. *Identify critical suppliers*. Supplier of strategic suppliers that do not meet minimum performance in quality. On-time delivery, cost, technology, or cycle time are targets for development.

3. *Form a cross-functional team.* Next, the buyer must develop n internal cross-functional team with a clear agreement for the development initiative.

4. *Meet with top management of supplier*. The buyer's cross-functional team meets with supplier's top management team to discuss details of strategic alignment. Supplier performance measurement, improvement, and professionalism.

5. *Identify key project*. After the promising opportunities have been identified, they are evaluated in terms of feasibility, resource and time commitment, and expected return on investment. The most promising projects are selected.

6. *Define details of agreement*. After agreement has been reached on the development projects, the partners must jointly decide on the metrics to be monitored such as percent improvement in quality, delivery and cycle time.

7. *Monitor status and modify strategies.* To ensure continued success, management must actively monitor progress, promote exchange of information, and revise the strategy as business conditions warrant." (7)

2.7 Benefits of supplier selection and development

Benefits of supplier selection and development can listed as below,

1. **Cost reduction:** as a selection process to get supplier which can support the company's requirement and pass the supplier monitoring process until company get the reliable supplier to ensure that supplier provides the product quality and building trust into product. Company can reduce cost due to incoming inspection can be skipped. It can reduce man-power to perform inspection to ensure quality of product.

   To get the reliable supplier can help to reduce on the production cost such as scrap cost and rework cost including development technology costs as well.

   Table4 shows how the levels of supplier relationship will reduction on costing.

Level of supplier relationship	Checking Quality of product
Approved Supplier	100% incoming inspection
Preferred Supplier	Sampling method incoming inspection
Certified Supplier	No incoming inspection

Table 4 : Comparison between supplier level and incoming inspection check

2. **Quality:** To evaluate supplier and supplier selection will be helped company to select the right source which can support on the right price, right time and right quality. Supplier performance also should be monitoring to ensure on the quality of the product as well.

3. **Lead time reduction:** relate to the supplier relationship which company can trust on the product specification and quality. Company can skip incoming inspection which reduce on cost and help to reduce lead time to convey parts into production line. Company does not need to spend time to ensure on the raw materials. If the demand is high volume which concern to big demands of the raw material, it can help quite much to reduce inspection time which leads company can reduce time to market.

     In term of long-term contact which help company to share more information through the supplier to improve on the communication and share technology to each other which can help to shorten time to market and get the competitiveness.

4. **Delivery/Service improvement:** Reliable supplier can provide the quality parts in the right time. It can help to reduce time to serve customer and also help to minimize time in the company production and reduce some waste such as inspection time and rework time.

5. **Continuous improvement:** due to company core competency it may different from the supplier. If company selected the reliable supplier, it will help company to share on the technology with support to the company core competency. It also helps each others to improve along the process. In case that company found some quality issue from the supplier, this will be a good point to supplier to improve on product quality. In case that the failure does not concern on the supplier, supplier also can help company to improve on the design and application to make the product more reliable and reduce failure at the end-user site.

6. **Technology:** Due to supplier is not company core competency and technology is running so fast. Supplier will focus on their core competency

to support the customer and this is an opportunity to gain the knowledge and technology from the supplier site.

7. **Inventory Control:** selected the right source will help to control on the inventory turn and inventory size due to company can forecast demand and place order to the supplier and sharing information together on the production plan. Supplier also can schedule their production to support on demand and deliver in the right time that company needs the part to support the production. This will help for both supplier site to plan the production and company to control inventory.

2.8 Type of relationship

Normally buyer will be emphasize to make a good relationship with supplier by using hypothesis as

One day that we do not think "he/she is a supplier", they will become our partnership.

We can make a good relationship with any people but cannot call all of them as friends. So, we need to reduce number of supplier to get the best and choose as closet friends.

Every firms that have a bad image is also cannot keep a good relationship with others as same as supplier who does not keep the word and follows agreement is also cannot keep and maintain relationship with others as well.

Relationship with supplier can be classified into 4 levels as

1. "Market – A company needs a specific product or service, and it simply purchases that on the market from the best bidder. Of course, the goals and the objectives of the tow actors involved in the transaction might not math; for this reason the relationship is not exclusive, the buyer could find other

suppliers and the seller could find other customers. As a consequence its time horizon is often short

2. Vertical alliance – This is typically a multi-dimensional and goal-oriented relationship between two firms in which both risks and rewards are shared. Companies with similar objectives decide to collaborate either on inventory management or on new product development or on marketing activities; and these are only a few samples. Due to the goals commonality and the kind of information shared, this relationship presents typically a medium-long term commitment. Such a commitment and collaboration often lead to strategic benefits for both partners. With regard to this kind of relationship, one of the main and most critical themes debated in literature is surely trust between the companies

3. Equity Partnership – This is a relationship in which the level of commitment is even higher than in the previous case. Goals and objectives of the two companies are so similar that the financial structure of the relationship changes, the two actors start sharing equity interests and they are not tow completely separate entities anymore. For this reason collaboration and integration become even stronger and the firms share their destiny. Some examples can be found in subsidiaries, joint ventures and equity interests' cases.

4. Vertical Integration – Finally, vertical integration deals with mergers and acquisitions. This solution provides full control over all the activities performed and the objectives become all the same. The costs of acquiring or merging another company could be very high and the efforts in making the two cultures compatible could be very high as well. Due to the characteristics of this relationship , the time horizon is very long because the switching costs related to the integration and relevant" (13)

Table5 from Stefano is summarizing the level of relationship between customer and supplier and provide the mechanism of each relationship levels.

	Market	Vertical Alliance	Equity Partnership	Vertical Integration
Goals	Different	Some of them are equal	Most of them are equal	All the same
Time horizon	Short	Medium-long	Medium-long	Long
Proprietary structure	Two different entities	Two different entities	Equity sharing	Ownership
Main feature	Competitive arm's length relationship	Collaborative relationship	High level of risk-sharing	One totally integrated activity

Table 5 : Spectrum of coordination mechanisms between customer and supplier (13)

When a longer team relationship is formed information, technology, resources are sharing and there is risk associated. Trust is very necessary for the long-term relationship due to almost of information sharing to other companies. Mari Sako had classified types of trust into 3 types, "namely 'contractual trust', 'competence trust' and good will trust'. Mutual trust between trading partners is seen to entail both efficient out comes (due to freer information disclosure and commitment) and in efficient outcomes (due to greater non-pecuniary switching costs)." (14) Mari Sako (1992) teaches us that the development of "trust" between trading partners is an ambiguous concept. To progress we must decide what we mean. She distinguishes between;

1. Contractual trust – The belief that the other party will deliver that which you could successful sue him for not delivering. It was for many years the guiding principle of most American and British inter-firm trading. Contracts became more and more prescriptive, more and more detailed,

longer and longer, and lawyers became richer while factories inspected 100% of everything delivered to ensure compliance with the contract.

2. Competence trust – forms one of the bases of the quality revolution. It is the belief that the other party will behave in predictable manner because he is a competent professional at his own job. In quality terms, he will have built quality into his product and carried out any necessary inspection prior to deliver. The contract may still be prescriptive, but hour by hour monitoring of compliance is redundant.

3. Goodwill trust – is the basis of many Japanese trading relationships and takes inter-action between the parties beyond the contract. It is the (justified) assumption that the two parties are on the same side. That the common objectives they share over-ride the respective objectives which may differ. Your supplier will do something because it obviously needs doing, and not because he is contracted to do it.

2.9 Potential Contract Relationships
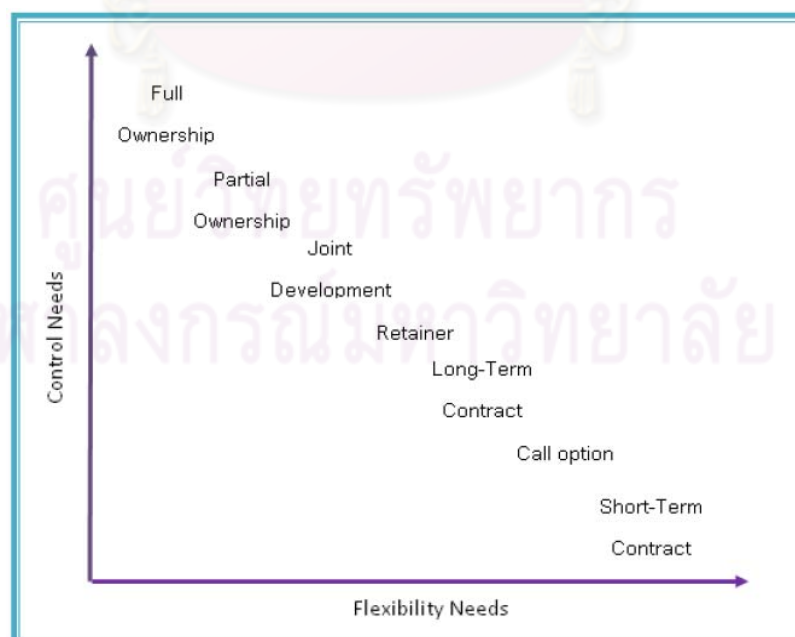
Figure 9 : Quinn's potential contract relationship with suppliers (15)

Figure9 shows the relationship between flexibility and controlling supplier. If control needs quite high the flexibility will be less. To select each type of relationship, it depends on which they are suitable for the company and situation along the supply chain. For definition of each relationships Quinn J at al explains as below,

"The following are some examples of the relationships that can be established between full ownership and short term contract

Partial Ownership – License the technology or buy "know-how" that will let the company be the best on a continuous basis. An example of partial ownership could be a franchise. For example, this can be the case of McDonald's. The individual buys the "know-how" and he/she operates the business

Joint Development – Establishment of a project with a knowledgeable supplier that will ultimately give the company the capability to be best at a certain process. For instance, Nike has a multi-tier partnership strategy. One example for joint development is Nike's relationship with its "developed partners" which produce Nike's latest and most expensive "statement products". Nike and its suppliers produce lower volumes, co-develop products and co-invest in new technologies.

Retainer – The retainer is when the supplier has not a strong position but the buyer wants to keep it as supplier because it gives him some competitive advantage. There are some cases where the buyer tries to help the supplier to improve its performance. A good example of a retainer is Nikes "developing sources" tier. Nike works with them because of the low labor cost and their capacity to diversify assembly locations. All produce exclusively for Nike, which has a strong "tutelage" programmed to develop them into higher suppliers.

Long-Term Contract – Long term contract or purchase agreement gives a secure source of supply and a proprietary interest in knowledge or other property of vital interest to the company and the supplier. For example, in the automotive industry the gearboxes for the automobiles are purchased on a long-term contract basis.

Call option – For example, strategically Mc Donald's has formed a pool of people available on "call option". Mc Donald's calls in part-time and casual workers to handle extensive daily variations –peaks of demand-. This way it can cover its peak periods without having a fixed cost of employees. It also minimizes idle time in non peak periods." (1)

Chapter III

Supplier assessment and supplier development methodology in existing process

3.1 Statement of problem

In this time, the two main problems that facing right now are programming part process and wrong package rejection at incoming inspection. Normally, the both programming part and re-package is service within the same service supplier. So, in this time that selected the new supplier, the two main points will be the focus items for supplier assessment.

- **Programming Part problem**

    Right now, customer does not support and develop on programming component internally. Cost is quite high to develop this process internally due to it concern on the socket of the component, programming run, controlling process, handling process and etc. Due to the cost cut down, it leads to find out-source for programming part to support the production and customer accept to pay on cost which will concern to the programming outside.

    Not only on the cost concern but also for the capability for internal programming does not enough to support for all customer needs. Due to the demand ramp up for all customer which company support, the internal programming is cannot support for all requirement for all customer to meet the shipment target date.

- **Wrong package rejection problem**

Normal process in electronic manufacturing company which building Printed Circuit Board Assembly (PCBA), the normal process flow in the front-end shows as Figure10,

Figure 10 : Front-end process flow

In this time, the main problem which found at incoming inspection is the material comes in the wrong package which does not match on the Surface Mount Technology (SMT) process. SMT process requires packaging as a tray or tape and reel. The chip placement, which using in the SMT process is the machine to pick up the part and place on the PCB. This machine can all as chip placement to chip shooter. Due to Chip placement machine require the Tape and Reel package or Tray package. Tube package cannot support for the chip placement machine and machine requires the Surface Mouth Device (SMD) which shows in below figure. Tube package can be used for the Wave soldering process which using operator inserts the component through the hole of the PCB. Below figure shows the SMT machine which showing that parts should comes as Tape and Reel and IC figure is represent for the SMD and Through hole component.

Figure11 shows on the SMT machine and SMT component VS Through hole component
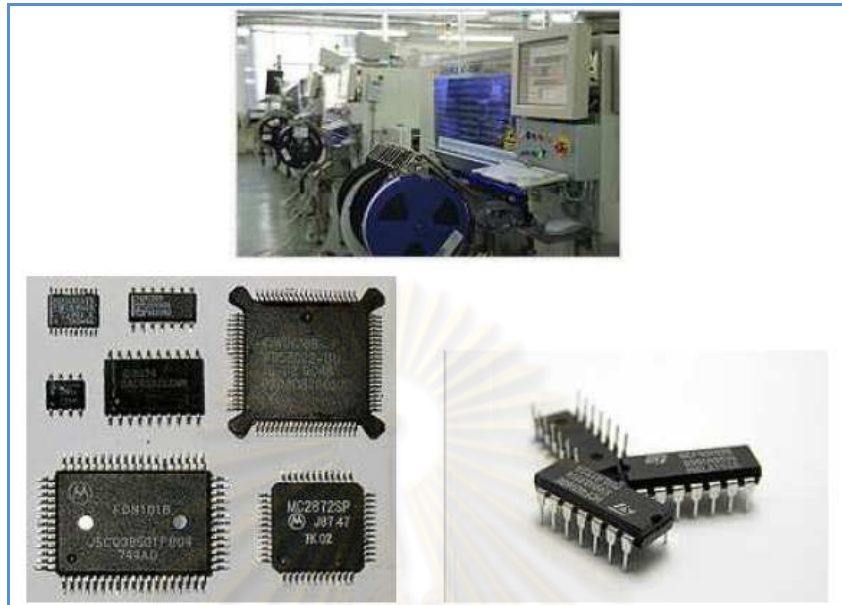
Figure 11: SMT machine and IC package

Figure12 shows the same part but using with different process and SMT process and through hole process. Package of the component will different on the lead frame.

Figure 12: SMD VS through hole component (16)

Base on incoming report by monthly, the packaging is a high defect criterion at incoming more than 80% per figure13. Package which reject at incoming inspection does not concern on the component package as SMT or though hole, this criteria concerns on the packing contain the component. The packaging can classify into 2 types as Tube and Tape and Reel.
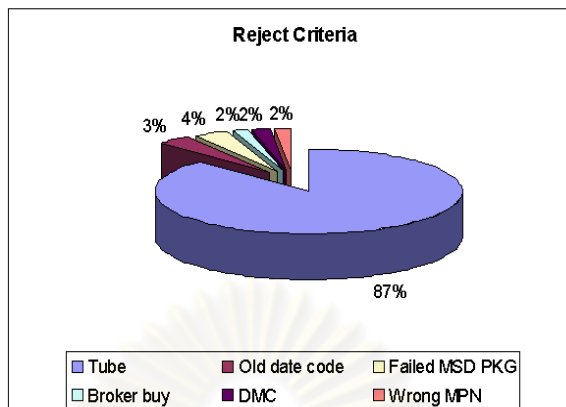
Figure 13 : Incoming Reject Criteria

The packaging issue is the thing that cannot avoid. Per supplier requirement, the reel package needs to meet the Minimum Order Quotation (MOQ). Due to some customer products are high mixing products but low volume. This is the main reason to lead us cannot meet the MOQ and supplier cannot provide the reel package to us. So, below figure shows the element of Tape and Reels.

Figure14 shows consist of Tape and Reel package. This figure will help to understand more on the Tape and Reel shape and specification name.
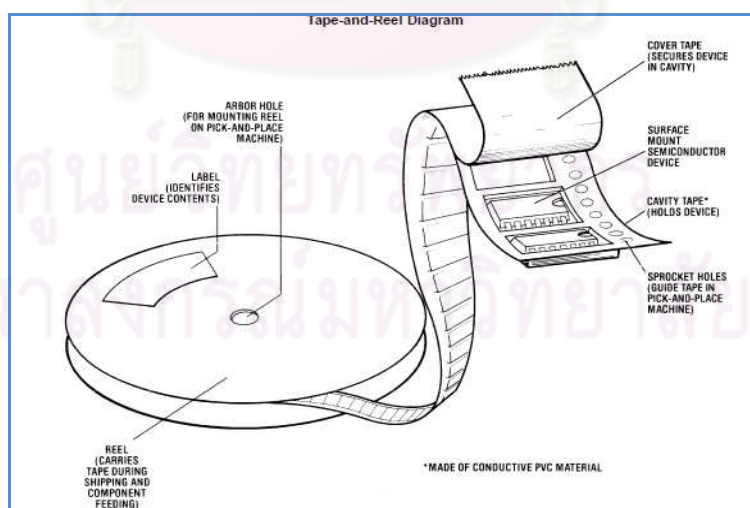
Figure 14 : Tape and Reel specification (17)

Figure 15 : Packaging of IC (18)

Figure15 from the right is Tape and reel package, after are the tube package and the last one shows Tray package. As explain above tape and reel and tray package can use for supporting SMT. Tube package can using for through hole process.

Inventory control is also one more reason that leads to the wrong package coming to the receiving area. To purchase low quantity for supporting the low volume leads the tube package instead of the reel.

Due to the tube package cannot use in production; re-reel process is required for support the production before release part.   The out-side re-reel is the point that should be considering to reduce the additional job function in the company.

For both programming and re-reel process, almost of Service Company for tape and reel and programming part are doing together in the same company. Due to sometimes customer need to send a small quantity to programming and need to return in a tape and reel package. So, these two

services always support in the one company. So, for supplier assessment will complete for both programming and re-reel process.

Due to Service Company also support for both of programming IC and re-reel in the same place. So, this is a good opportunity to expand the program IC to outside. Because program IC also need to spend a lot of money on the IC socket and software to programming part, so outsource is a good ways to think about.

Program IC in the company also cannot expand capability to support for the all customer in the company. Due to limited of the socket and program IC station.

3.2 Presently supplier for re-reel and programming part

Normally, process flow for programming and tape and reel is quite similar for every service company. The things that concern to us is how do they control and verify that they can provide the thing exactly good back to us.

The normal process flow for programming part and re-reel process can be referred from Figure16.

Due to this is concern on electronic component which quite sensitive for Humidity and Electrostatic. So, we need to ensure that all service company can control for Moisture Sensitive Device (MSD) and Electro Static Discharge (ESD) while handling component and control base on J-DEC standard.

The things that we do internally to be ensure and traceability on the failure in case that occurs is inspection and keeps the record of the component. Details that we keep records such as Manufacturing part number, supplier name, component marking, date code and lot code. This is the important things that we need to keep to ensure that out-source will not ship the wrong part back to us.

Supplier A

Supplier A is located in Singapore which support for both programming and tape and reel process. They also support for 24 hrs and 7 days a week which quite flexible for turnaround time.

- **Advantages**

    1. This company establish more than 10 years which has more experience for programming part and re-taping process.

    2. It has too many type and size for pocket and reel package.

    3. It has too many socket to support IC program

    4. We can save cost for socket and programmed part due to this is not core competency of our business.

    5. They have a huge library of programmers and algorithms, which can support 500k devices from more than 125 IC manufacturers.

    6. This company also located in Thailand

    7. Good control on ESD and MSD

        a. Exercise DAILY stringent ESD parameter check

        b. Conductive production floor

        c. Grounding system – 1 mega ohm resistance

        d. Static dissipative mats on all machines and workstations

        e. Humidity and temperature control

     f.   EDS monitoring system on all machines and workstations

     g.   Use of anti-static finger cords when handling devices

- **Disadvantages**

1. It needs to spend time for arrange shipment in case that we shipped part back to Singapore site. Almost, we will choose to arrange shipment to Singapore due to our company located in the free-zone which need time to process too many document and this company does not support on document for custom clearance.

2. It needs to pay on high freight cost to ship small amount to re-reel at other country. Although for Thailand site, they also charge for taking part back to company 500 baths per shipment which quite expensive.

3. This is only Service Company which does not sell part from manufacturing. So, we need to purchase the blank IC and perform incoming inspection at out site to ensure that the blank part is correct. Then, we will ship blank part to service company for programming. This will add more process for incoming inspection for blank IC and IC programmed.

4. If found any problem on programming, we need to spend time to arrange shipment back and contact with supplier due to of different time and holiday.

Supplier B

- **Advantages**

    1. This company establish more than 10 years which has more experience for programming part and re-taping process.

    2. It has too many type and size for pocket and reel package.

    3. We can save cost for socket and programmed part due to this is not core competency of our business.

    4. This supplier manufactures their own carrier tape and cover tape.

    5. This company has 24 machines available for Tape and Reel which make 25 million units per month

    6. Good control by using X-Y-Z measuring scope and has auto visual inspection to ensure that the product after re-reel will not found any problem. They also perform the peel back testing.

    7. Good control on ESD and MSD

        a. ESD awareness is sufficient with conductive flooring and work benches

        b. Conductive work tops

        c. Humidity controller in place

- **Disadvantages**

    1. It needs to spend time for shipment.

2. It needs to pay on high freight cost to ship small amount to re-reel at other country.

3. This company does not support for programming part. They supports for tape and reel only.

4. If any failure occurs which need to investigate with this company, it needs to spend time to arrange shipment part back and communicate for Return part Authorization.

Supplier C

Supplier C is also located in Singapore. This supplier is not only service on programming and re-taping but also selling part direct from manufacturing.

- **Advantages**

1. This company establish more than 10 years which has more experience for programming part and re-taping process.

2. It has too many type and size for pocket and reel package.

3. It has too many sockets to support IC program

4. They support part direct from manufacturing which we can purchase the blank IC and let them programming part for us before ship part to our plant.

5. They have capability to do the laser marking or polyester or kapton labeling.

6. This company using automation line to handling the product for programming which reduce the human error and handling process.

7. Good control on ESD and MSD

- **Disadvantages**

1. It needs to spend time for arrange shipment.

2. It needs to pay on high freight cost to ship small amount to re-reel at other country.

3. If found any problem on programming, we need to spend time to arrange shipment back and contact with supplier due to of different time and holiday.

4. Supplier does not agree to ship a small quantity for support First Article due to it is concern on freight cost and shipment period.

3.3 Supplier assessment and evaluation

For supplier assessment and evaluation, we summarize the information and prepare team for assessment and perform auditing as below steps,

Gathering information

Before we go to assess supplier, we need to understand and get more information on their process steps. Figure16 shows the flow chart of the programming process including the Tape and Reel process which we need to understand and focus on each step to scope on the specific area and weaken point to ensure that all the main process in this flow chart will not relate the problem once they had been qualified and support us.
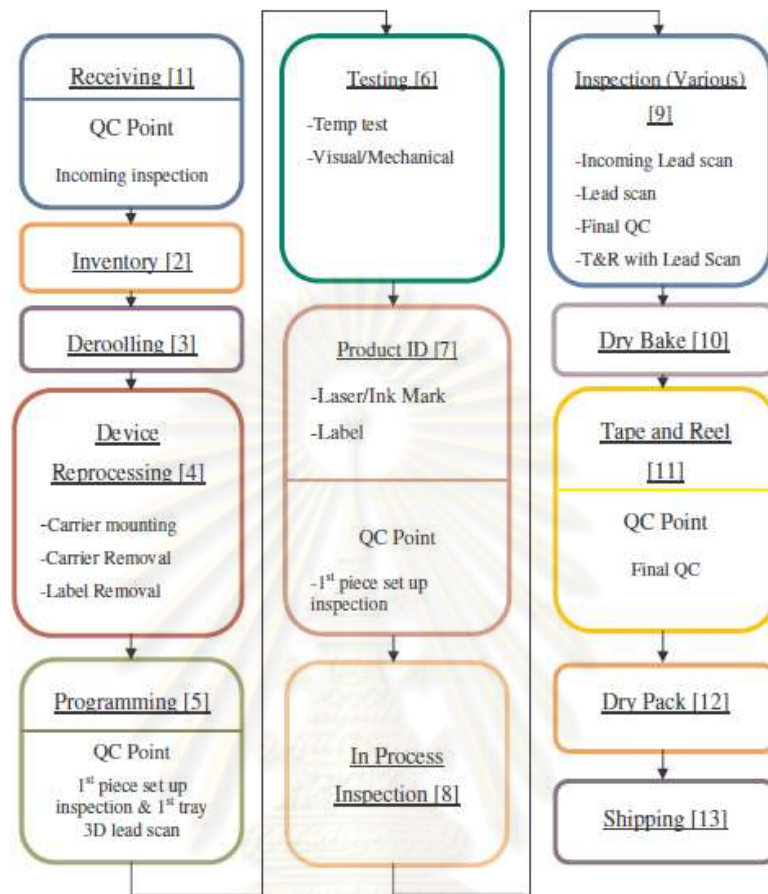
Figure 16 : Programming and Tape and Reel process flow chart

Set up Team

After gathering information and try to understand on supplier process flow, we need to set up the audit teams which need to known well on each process and have been passing the audit training.

So, for this auditing the programming and tape and reel process, the Audit team consists of the

Quality Team who known well on the Incoming process, inventory keeping, packing and incoming control

Quality system guys who known well on the quality standard including ESD control, ISO, MSD control including J-DEC standard.

IC programming team who known well on the IC programming process and how to ensure that the program is correct. This program IC team is required due to this team will have an experience on the IC program process and also how to check that the program is loading correctly. Technical support from this time is required for audit and guidance out-source for more improvement and development.

After setting up the audit team, man power for concern audit people will be calculate for reduce time for audit. The member of each team has been shows as Table 6.

TEAM	Number of People
Quality	3
Quality System	1
IC Programming	3

Table 6: Number of member per team

Supplier visit/Preliminary survey

After Supply Chain Team review on the General information on the company background, financial result, cost concern, business growth and to be a long-term partnership with company. SCM team will request to conduct visiting for review on capability, quality, system and process before conduct the full audits and assessment.

After we are gathering information on their process, we go to do the preliminary survey for scope down the point of focus in each area and do some observation to find the weaken point of each area.

While visit the supplier to check on the facility, capability and quality control, if we found some point which can improve before perform audit. We also discussed with them in the wrap up meeting after finish visit and let them improvement prepare themselves for full audit in next.

After set up team audit, so we set up the timeline base on the all information and gathering all information that we need to use for performing audit. After gathering information from audit team, we are setting the timeline as figure 17,
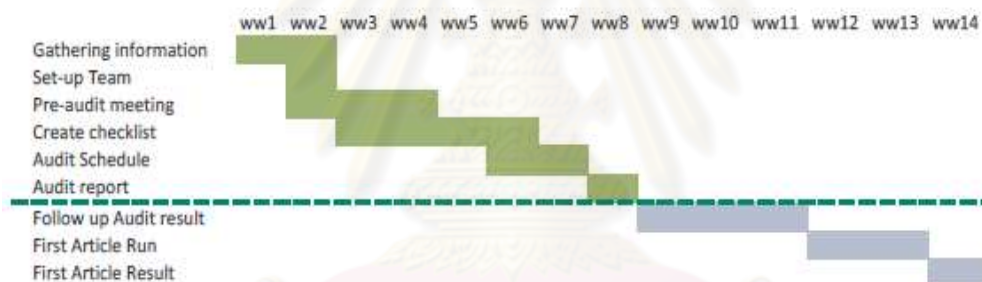
Figure 17 : Process timeline for auditing

Pre-Audit Meeting

After set-up team audit and gathering more information through the supplier visit, we need to create the checklist for helping us to focus on the waken point which may create the problem while performing audit. This checklist will keep us to stay in the focus area and focus point which we need to ensure and analyze for the potential weaken point which quite risk and can create the problem in the future.

The checklist needs to crate and to be suitable for the programming and re-reel process. The general question but cover for all weaken point area will be helpful for performing audit for other programming and tape and reel service. A good checklist also helpful for the annual re-audit in the future. Although audit checklist need to be review by period to update information, this also can use as a guideline.

In the meeting, we do the brainstorm from the audit team which known well on each area and sharing the experience from the auditing which perform by outside to our area and found some non-conformance. An experience from each people is quite helpful and to be share in the meeting to gathering information and analyze to create for the checklist that we will use while performing the audit.

- <u>Identified the critical process</u>

Programming part and re-reel process do not have the complicated process to do and control. The things that we need to focus are handling and controlling part for ESD and MSD.

After brainstorm and gathering information base on the previous experience and base on the document and quality standard the focus point that considering are

1. component/device control

2. Programming Operation

3. Product Identification/Logistic Control

4. ESD/Moisture Control Handing

5. Quality Systems

6. Quality Control of IQA-OQA

7. Problem Analysis and Corrective Action

8. Customer Satisfaction

- <u>Create audit checklist</u>

After we completed to identify the critical process, the details of each process that we need to check and ensure also had been discussed and brainstorming.

We also setting how to score for the audit to checking the ranking of the out-source performance. Scoring question applies a score of 0, 1, 2 or 3 to each question, with the following definitions:

0 = No evidence exists

1 = some or little evidence exist without documented procedure

2 = Item/procedure included and generally acceptable. However the planning and execution still need some improvement.

3 = Meets the criteria referred to in the question. Planning and execution is through and outstanding.

The sum of the category scores will provide an overall rating of the supplier's capability. The total system rating will be categorized as follows:

Approved to Self-Assess = 80% - 100% of available points

Conditionally Qualified = 65% - 79% of available points (action plan required to improve)

Not Approved = Less than 65% of available points

The checklist has developed from general to be a specific on the programming and re-reel process topic as figure18,
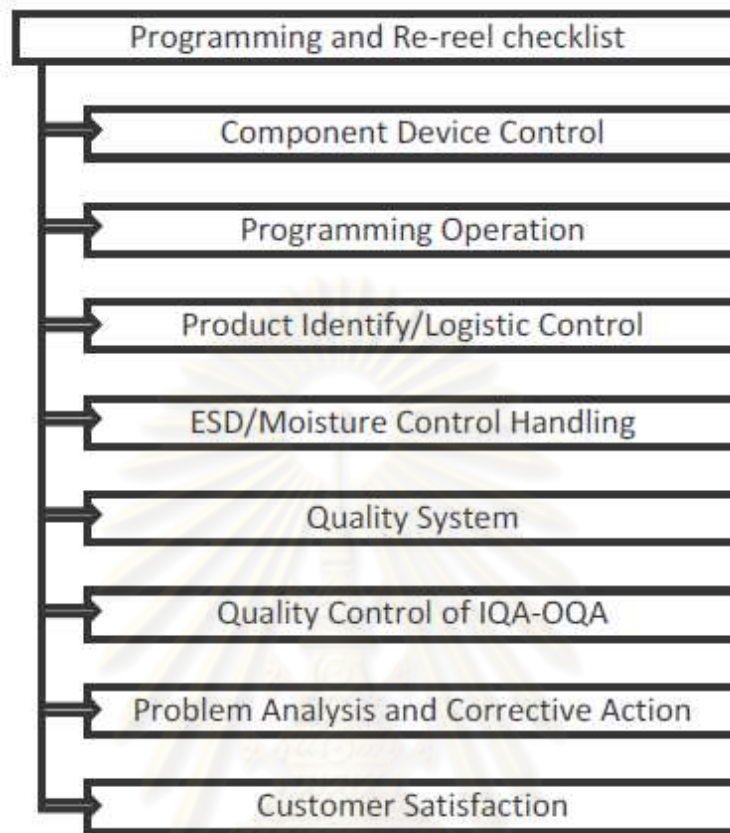
Figure 18 : Audit Checklist for programming and tape and reel topic

Checklist had been created for programmed and re-reel service which can listed per topic as

1: COMPONENT/DEVICE CONTROL

1.1	**Receiving**	Score	
1.1.1	Are engineering records accurate? Customer P/N, label information, program code, etc.	3	
1.1.2	Are engineering records accurate? Customer P/N, label information, program code, etc.	3	
1.1.3	Where are parts stored? How effectively are parts stored and tracked?	3	
1.1.4	How often do you do inventory count?	3	
1.2	**Component Preparation**		
1.2.1	Are engineering records accurate? Customer P/N, label information, program code, etc.	3	
1.2.2	Distributed throughout the line?	3	
1.2.3	Is there EC's control in place? How?	3	
1.3	**Kitting**		
1.3.1	Is there a shop order system in place? Proper security in kitting area?	3	

1.3.2	How are returns to stores handled?	3	
	Sub Score	**27**	

Table 7 : Checklist for Component/device control

2: PROGRAMMING OPERATION

2.1	**Programming Capability**	**Score**	
2.1.1	What type of machine used for program? Is this the best technology?	3	
2.1.2	Is there adequate machine used for program?	3	
2.1.3	What is typical mechanical yield of this machine? Do you do co planarity audits?	3	
2.1.4	What are the physical means by which you can receive the master program codes? FTP?	3	
2.1.5	What other services or programs do you have to offer?	3	
2.2	**In-Process Control**		
2.2.1	Is there a proper buy-off after every new set up?	3	
2.2.2	Is program master update and control? How?	3	
2.2.3	Are there documented Process Instructions for each operation?	3	
2.2.4	Are there appropriate checks and double-checks for critical operations? Examples? (i.e. Program Code).	3	
2.2.5	Are there any Industrial or Internal Specifications referred to? Are they being followed?	3	
2.2.6	Do you have a Yield program in place? Do you measure in PPM or percentages?	3	
2.2.7	What is your current/typical process for *First Article* approval?	3	
2.2.8	How do you control the movement of semi-finished product? Dedicated Kanbans? Travel tickets?	3	
2.2.9	Do you have a documented Problem Reporting structure?	3	
2.2.10	Are operators empowered? To shut down process?	3	
2.2.11	QE available at all times?	3	
2.2.12	Can you track IQL of incoming parts?	3	
2.2.13	Do you have a NCM process for Line Fallout? How?	3	
2.2.14	What do you offer in terms of Failure Analysis? Electrical? Mechanical?	3	
2.2.15	What is your FA Turn-around-time?	3	
2.2.16	How do you track and solve problems?	3	
2.2.17	Dedicated process?	3	
2.2.18	Do you issue CA reports?	3	
2.2.19	Do you have a process for identifying and containing Maverick Lots?	3	
2.2.20	Example of FA activity resulting from defect found at Ship Lot Audit.	NA	
2.2.21	Is all equipment functioning properly?	3	
2.2.23	Is there regular maintenance and calibration?	3	
2.3	**SPC Control**		
2.3.1	Is SPC deployed on process control?	3	
2.3.2	How is control determined?	3	
2.3.3	What is the sequence of events when an out of control point is charted?	3	
2.3.4	Is cause established and CA taken before material flow resumes?	NA	
2.4	**Verification and Test**		
2.4.1	Do you do 100% verification or otherwise? Is this logged?	3	

2.4.2	Is all sockets regularly maintained? Recorded?	3	
	Sub-Score	**93**	

Table 8: Checklist for Programming operation

3: Product Identification/Logistic Control

3.1	**Marking/Labeling**	**Score**	
3.1.1	What are your capabilities? (Laser Mark or Ink)?	**3**	
3.1.2	Barcode scanning capability?	**3**	
3.1.3	Is this done in conjunction with programming to eliminate application of wrong information?	**3**	
3.1.4	If not, how do you minimize this error?	**3**	
3.2	**Packaging**		
3.2.1	What are your packaging capabilities? (Tape & Reel/Tube/Tray)	**3**	
3.2.2	Re-baked components? Vacuum sealed? New desiccant?	**3**	
3.2.2	Carton labeling? Bar-coding abilities? Secure storage area?	**3**	
3.3	**Shipping**		
3.3.1	What is your Ship Lot Audit planning?	**3**	
3.3.2	Demonstrate with records.	**3**	
3.3.3	Do you have a copy of ▮▮▮▮▮'s Quality Specification Document (QSPEC)? How is it controlled?	**NA**	
3.3.4	Verification to customer Quality Specifications?	**3**	
	Sub Score	**30**	

Table 9 : Checklist for Product Identification and Logistic control

4: ESD/MOISTURE CONTROL HANDLING

4.1	**Moisture Controls for Sensitive Component**	**Score**	
4.1.1	Are ambient conditions controlled or monitored?	**3**	
4.1.2	What is the current temperature and humidity? (Expect to see 25 C / 55% RH).	**3**	
4.1.3	Is all stored product being kept dry?	**3**	
4.1.4	Is ambient exposure time controlled?	**3**	
4.1.5	What equipment do you have? Nitrogen ovens? Sealing tools?	**3**	
4.1.6	How do you dry components?	**3**	
4.1.7	How do you re-package components?	**3**	
4.2	**ESD protections and controls.**		
4.2.1	Does the Supplier have a facility certified to ANSI/ESD S20.20? Auditor to record certificate number and date.	**3**	
4.2.2	ESD POLICY DOCUMENT NO:_____	**3**	
4.2.3	ANY ESD AWARENESS PROGRAM PLANNED? (FREQUENCY:_____)	**3**	
4.2.4	Is all equipment, tables, carts, etc. grounded?	**3**	
4.2.5	Are all carrying trays, packaging materials, floor documents, etc. ESD approved?	**3**	

4.2.6	Are employees grounded while handling ESD sensitive devices? Auditor note: Industry practice requires a wrist strap while seated if sensitive devices are being handled. Auditor to observe employees while performing work operations for wrist or foot straps. Note: Foot straps require an ESD floor or floor mat to function.	3	
4.2.7	Is ESD monitoring equipment routinely calibrated or verified?	3	
4.2.8	Is there a documented ESD procedure? Auditor to record response and procedure number.	3	
4.2.9	Do all employees who come into contact with ESD sensitive devices receive initial ESD awareness training before they handle any device and re-trained at least every 24 months? Auditor to verify evidence that initial training and re-training has taken place	3	
4.2.8	Does the procedure identify the level of Human Body Model (HBM) ESD sensitive parts that their process can safely handle? Auditor note: example, Celestica states that all sites can handle any ESD sensitive device that has a Human Body Model sensitivity	3	
4.2.9	PROPER RECORD FOR WRIST STRAP CHECK? FREQUENCY : _____ a) IQA b) STORE c) ASSEMBLY d) TESTING	3	
4.2.10	PROPER RECORD FOR WRIST STRAP TESTER CALIBRATION? a) FREQUENCY : _____ b) CALIBRATED BY : _____	3	
4.2.11	IS GROUNDING METHOD USED ON ALL WORKSTATIONS DOCUMENTED?	3	
4.2.12	Are the items used to control ESD at the site attached to electrical ground? Auditor to record response. Evidence of the following is required: The Supplier must show that for all ground able ESD control items are connected to the 3rd wire AC ground. Note: A pictorial example of the resistance measurement to AC ground is attached below.	3	
4.2.13	Are ESD Protected Areas identified? (Signs, floor tape, etc.)	3	
4.2.11	PROPER RECORD FOR WORKSTATION GROUND CHECKS?	3	
4.2.12	WORKSTATION LAYOUT DRAWING AVAILABLE? GROUNDING CHECK INCLUDE: a) 1 Mohm RESISTOR b) CONTINUITY CHECK? c) FREQUENCY : _____	3	
4.2.13	ANY PROPER RECORD FOR WORKSTATION SURFACE RESISTIVITY CHECK?	3	
4.2.14	RESISTIVITY CHECK INCLUDE: a) SURFACE RESISTIVITY VALUE MEASURED : _____ b) SURFACE CONDITION (STAIN, DIRTY, ETC) c) FREQUENCY : _____	3	
4.2.15	ARE REGULAR ESD AUDITS CONDUCTED?	3	

No.	Question	Score	
	a) AUDIT FREQUENCY : _____		
	b) AUDIT DEPT : _____		
	c) DATE OF LAST AUDIT : _____		
4.2.16	DO ALL TEST PROCEDURES CLEARLY INDICATE THE PROPER FUNCTIONAL TEST SEQUENCE FOR ALL FUNCTIONAL TESTERS TO PREVENT HOT PLUGING?	3	
4.2.17	Are the instruments used in support of the site's ESD control program calibrated or functionally checked per the site calibration procedures? Note: This would include items such as wrist strap / footwear testers, resistance meters, electrostatic field meters and air ionizers.	3	
4.3	**Compliance Verification**		
4.3.1	Review the Supplier ESD process assessment records for the facility for the past 6 months. Auditor to review records. Evidence of the following is required: a - Are the assessments being done at specified frequency? b - Are the findings identified as minor or major in nature? c - Has the Supplier developed a corrective action plan for major findings? d - Has the corrective actions been closed?	3	
	Sub Score	**90**	

Table 10: Checklist for ESD and Moisture control handling

5: QUALITY SYSTEMS

No.	Question	Score	
5.1	Does the Supplier have a registered QMS certificate appropriate to their business? Eg TS16949 for automotive. *Requirement is ISO9000:2000 minimum* *Auditor to record certificate number etc in QMS Audit and Review section*	3	
5.2	How is the Quality Policy communicated and understood within the Supplier? *Auditor to record response.* Auditor to verify evidence that the Policy is communicated to employees and understood. Evidence may be in the form of one or more of the following: - Policy on show in prominent places around the facility, - Policy communicated as part of the induction training, - Policy handed out in pocket sized cards, - Policy located on the pages of log books or other company stationary, etc,	3	
5.3	How are Key Performance Indicators or other Quality Objectives set? *Auditor to record response.* Evidence of the following is required: a - Objectives being set and results measured by a suitable process, b - Review and Analysis of the results being held and Improvement activities implemented accordingly. c - Are the Objectives and Performance Indicators displayed for all employees?	3	

5.4	How does the Supplier define the internal audit schedule? *Auditor to record response.* Evidence of **all** the following is required: a - Audit schedule planned to show areas and process to be audited, b - Frequency of audits for each area defined, c - Results if previous audits considered when setting the audit schedule.	3	
5.5	Are all audits carried out by auditors to ensure objectivity and impartiality of the area or process being audited? *Check if audits are carried out by auditors independent of the process being audited*	3	
5.6	Is there evidence to show that non-conformances identified during internal audits are: a - Identified and recorded, b - Corrective Actions raised, closed and reviewed for effectiveness. c - Corrective Actions closed in a timely manner established.	3	
5.7	Is the internal audit schedule up to date and have all corrective actions raised been closed w/follow up or on track according to the expected completion date?	3	
5.8	How concessions or requests to ship off-spec parts are managed and is there a formal procedure? *Auditor to record response and procedure number.* Does the procedure ensure: a - Reason for concession is fully identified and off-spec data is available for review, b - Qty affected and date codes or batch identifiers are known, c - Corrective action is issued to correct the off-spec situation,	3	
	Sub Score	**24**	

Table 11 : Checklist for Quality systems

6: QUALITY CONTROL OF INCOMING AND OUTGOING MATERIAL :

No.	Question	Score	
6.1	What is the process for Incoming Quality Control Inspection? *Auditor to record response.* Evidence of the following being carried out consistently is required: a - Part Number, Date Code and qty Check, b - Vendor name and Purchase Order number, c - Visual inspection and / or functional testing as applicable to the part, d - Safeguards to ensure that the correct line item(s) on the PO are received?	4	
6.2	Are the Part Number, Date Code and Qty recorded in an online database or inventory logging system? Are the results of the visual or functional tests recorded in the database, inventory logging or other linked system?	2	
6.3	Is there a formal procedure which covers the IQC process? Has the procedure been followed in 100% of cases sampled?	3	

6.4	What is the process for managing the inspection of Outgoing Finished Goods? *Auditor to record response.*	**6**	
6.5	Is there an area, or areas for segregated, quarantined products and materials? *Auditor to record response and audit **all** areas identified by the Supplier.* In each of the NCM areas was there evidence of the following: a - Were the areas well identified as NCM areas? b - The materials well identified with p/n, defect, date etc? c - Was there evidence that materials were disposition (action) in a timely manner? d - Is there documented evidence of the disposition status and further actions?	**6**	
6.6	What is the labeling practice of the supplier? Can the supplier duplicate the information on the original label to the new label? How does the supplier ensure the original label information is correctly recorded on the new label? Does the supplier have barcode labeling capability?	**3**	
6.7	Does supplier complies to the EIA standard which applicable to the Taping and Reeling Process include EIA 481-A, 481-1-A, 481-2, 481-3, 296-E, 541, 556-A, 583 and 625. *Auditor to record and audit for the evidence*	**3**	
	Sub Score	**27**	

Table 12 : Checklist for Quality control of incoming and outgoing material

7: PROBLEM ANALYSIS & CORRECTIVE ACTION FOR CUSTOMER RETURNED DEFECTS:

No	Question	Score	
7.1	IS there a procedure for Customer returned product and management of handling customer defective material? Evidence of the following is required: a - Is there a route map/flow chart for the generic returns process showing each stage from RMA issue to CA closure? b - Is individual responsibility identified for each stage and department? c - Are timescales from receipt to CA replay identified d - Is the CA process based on a recognized technique? e.g. 8D, 5 why's, DMAIC etc.? *1 pt for each category to comply*	4	
7.2	Is there a dedicated contact for issuing RMAs to Customers? Is the expected time to issue an RMA within 24 hours of notification of defects by a customer?	1	

	To check recent cases to verify RMA response time, 1 pt if <24 hours, 0 pts if > 24 hrs		
7.3	Are the timescales from receipt to reply based on the JEDEC standard JESD 671-A, or meet Company's requirements of Standard 23 days, Urgent 9 days? *2 pts if all comply, 0 pt if not*	2	
7.4	Auditor to check 3 recent CA incidents, these do not need to be Company incidents. Does the supplier prioritize RC/CA analysis based on the customer reply timeline requirements? *2 pts if all comply, 0 pt if not*	2	
7.5	Are metrics for returns maintained (by product/customer) and feedback to production & test improvement plans? Are these communicated regularly on each shift? *2 pts if all comply, 0 pt if not*	2	
7.6	How is containment of the problem managed? Evidence of the following being carried out consistently is required: a - Purges for all affected material including WIP and Finished Goods, b - Shipping for affected material blocked c - Consideration given to purge of in-transit, hub and customer stock *To check 3 recent cases of containment, 1 pt of each category to comply*	3	
7.7	What is the process to identify the risk to other customers and initiate notification and recall from a single customer return? Is the process covered by a formal procedure and is there evidence that this has occurred in 3 recent cases *2 pts if all comply, 0 pt if not*	2	
7.8	Is containment implemented and completed within 24 hours? To check 3 recent cases, 2 pts if all comply, 0 pts if not.	2	
7.9	What is the process for Failure Analysis Evidence of the following being carried out consistently is required: a - Verification of the "defect" using the equipment which defined it's fitness for use b - off-line or extended, intensive testing to verify cases which are shown as "NTF" on line c - root cause identified to component level d - short term and permanent corrective actions identified *To check 3 recent cases, 1 pt for each category to comply*	4	

7.1	What techniques are used to identify Root Cause? E.g. Cause & Effect, 5-why's, Data collection and graphical representation etc Auditor to check for evidence in 3 recent cases that the techniques described by the supplier have been used in all cases. *2 pts if all comply, 0 point if not*	2	
7.11	How are suitable Case identified and are some formal tools used? E.g. DOE, DMAIC Auditor to check for evidence in 3 recent cases that the techniques described by the supplier have been used in all cases *2 pts if all comply, 0 point if not*	2	
7.12	How are corrective actions verified for effectiveness? E.g. data collection, graphical representation, hypothesis testing etc. Auditor to check for evidence in 3 recent cases that the techniques described by the supplier have been used in all cases. *2 pts if all comply, 0 point if not*	2	
7.13	Are customer's defects verified using the production processes which produced, tested, or verified their fitness for use? Auditor to check 3 recent cases	1	
7.14	Is there a system which tracks the timescale for each stage of the process and escalated the stage if the time is out of target? *2 pts if all comply, 0 point if not*	2	
7.15	Does the supplier have a documented and effective procedure to evaluate WIP or inventory where known non-conformances or "Quality Holds" have been placed by the customer or supplier? *1 pt if there is evidence of Quality Holds or Recall exist* Is the case of a "Quality Holds", is there an escalation process in place that requires timely customer notification? *1 pt if evidence of customer notification exist in all cases*	2	
	Sub Score	33	

Table 13 : Checklist for Problem analysis & Corrective action for customer returned defects

8: CUSTOMER SATISFACTION

No	Question	Score	
8.1	How do you proactively assess the level of on-going customer satisfaction for your products and services?	3	

	Evidence of the following is required: a - Satisfaction of Product Quality, b - Satisfaction of Commercial activity c - Satisfaction of service provisions		
8.2	How are targets set for customer satisfaction? Evidence of the following is required: a - Targets reviewed at least annually, b - Targets used to provide an early warning system for customer dissatisfaction c - Is there a minimum response time for acting on customer complaints?	3	
8.3	Is there evidence to show the trends of customer satisfaction are tracked and information posted for employee review?, and are the trends: a - Consistently above target b - Below target but increasing due to improvement activities c - Consistently below target -- no improvement d - below target and decreasing e - Bo tracking and trend analysis	NA	
8.4	How is customer dissatisfaction logged and corrected? Is there a formal process to implement improvements for customer dissatisfaction?	NA	
8.5	Is there a formal procedure which covers customer satisfaction Has the procedure been followed 100% in all cases sampled	2	
8.6	Is there a nominated customer service representative who is responsible for the above process?	1	
	Sub Score	9	

Table 14 : Checklist for customer satisfaction

This checklist had been come from our brainstorming and cross check the weaken point from our experience from our customer audit and other audits. This also discuss with the auditor and quality systems person to comment on the checklist until we got the final checklist as Table 7 - 14.

- **Audits, assessments or surveys**

While we set up the audit schedule and let the service company known on the agenda for the audit. Then we go to perform audit by using the checklist that we had been developed.

We separate the audit into 3 group to perform auditing in each area for reduce the audit time and let the auditor whom know well in each process to examine in each weaken point of each area.

The 3 group consist of

1 Quality team to check on the Component/Device control, product identification/logistic control, ESD/Moisture control handling, Quality control of IQA-OQA and Problem analysis & CA

2. Quality system to check on the Quality system and ESD/Moisture control handling

3. IC Program team to check on the IC program process

Each group will be performing audit by referring the checklist per topic as Figure 19.
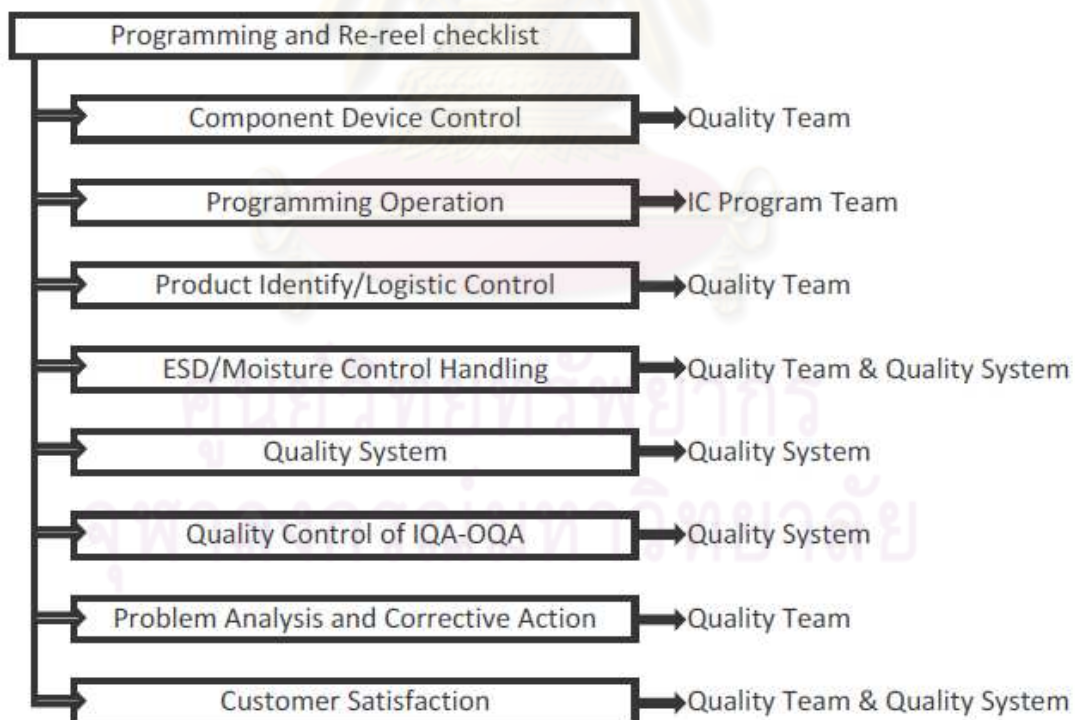
Figure 19 : Member of each topic per checklist

The score of each topic had been identified base on the ranking definition. The Score of this service company shows as Table 15 – 22.

1: COMPONENT/DEVICE CONTROL

1.1	Receiving	Score	
1.1.1	Are engineering records accurate? Customer P/N, label information, program code, etc.	3	3
1.1.2	Are engineering records accurate? Customer P/N, label information, program code, etc.	3	3
1.1.3	Where are parts stored? How effectively are parts stored and tracked?	3	3
1.1.4	How often do you do inventory count?	3	2
1.2	Component Preparation		
1.2.1	Are engineering records accurate? Customer P/N, label information, program code, etc.	3	3
1.2.2	Distributed throughout the line?	3	2
1.2.3	Is there EC's control in place? How?	3	1
1.3	Kitting		
1.3.1	Is there a shop order system in place? Proper security in kitting area?	3	3
1.3.2	How are returns to stores handled?	3	2
	Sub Score	**27**	**22**

Table 15 : Score of compoenet and device control topic

2: PROGRAMMING OPERATION

2.1	Programming Capability	Score	
2.1.1	What type of machine used for program? Is this the best technology?	3	2
2.1.2	Is there adequate machine used for program?	3	2
2.1.3	What is typical mechanical yield of this machine? Do you do co planarity audits?	3	2
2.1.4	What are the physical means by which you can receive the master program codes? FTP?	3	3
2.1.5	What other services or programs do you have to offer?	3	3
2.2	In-Process Control		
2.2.1	Is there a proper buy-off after every new set up?	3	3
2.2.2	Is program master update and control? How?	3	3
2.2.3	Are there documented Process Instructions for each operation?	3	3
2.2.4	Are there appropriate checks and double-checks for critical operations? Examples? (i.e. Program Code).	3	3
2.2.5	Are there any Industrial or Internal Specifications referred to? Are they being followed?	3	3
2.2.6	Do you have a Yield program in place? Do you measure in PPM or percentages?	3	1
2.2.7	What is your current/typical process for *First Article* approval?	3	3
2.2.8	How do you control the movement of semi-finished product? Dedicated Kanbans? Travel tickets?	3	3
2.2.9	Do you have a documented Problem Reporting structure?	3	3
2.2.10	Are operators empowered? To shut down process?	3	3
2.2.11	QE available at all times?	3	1
2.2.12	Can you track IQL of incoming parts?	3	3
2.2.13	Do you have a NCM process for Line Fallout? How?	3	3
2.2.14	What do you offer in terms of Failure Analysis? Electrical? Mechanical?	3	1
2.2.15	What is your FA Turn-around-time?	3	2

2.2.16	How do you track and solve problems?	3	2
2.2.17	Dedicated process?	3	3
2.2.18	Do you issue CA reports?	3	3
2.2.19	Do you have a process for identifying and containing Maverick Lots?	3	3
2.2.20	Example of FA activity resulting from defect found at Ship Lot Audit.	NA	NA
2.2.21	Is all equipment functioning properly?	3	3
2.2.23	Is there regular maintenance and calibration?	3	3
2.3	**SPC Control**		
2.3.1	Is SPC deployed on process control?	3	0
2.3.2	How is control determined?	3	0
2.3.3	What is the sequence of events when an out of control point is charted?	3	0
2.3.4	Is cause established and CA taken before material flow resumes?	NA	NA
2.4	**Verification and Test**		
2.4.1	Do you do 100% verification or otherwise? Is this logged?	3	3
2.4.2	Is all sockets regularly maintained? Recorded?	3	3
	Sub-Score	93	73

Table 16 : Score of programming operation topic

3: Product Identification/Logistic Control

3.1	Marking/Labeling	Score	
3.1.1	What are your capabilities? (Laser Mark or Ink)?	3	2
3.1.2	Barcode scanning capability?	3	3
3.1.3	Is this done in conjunction with programming to eliminate application of wrong information?	3	3
3.1.4	If not, how do you minimize this error?	3	3
3.2	**Packaging**		
3.2.1	What are your packaging capabilities? (Tape & Reel/Tube/Tray)	3	3
3.2.2	Re-baked components? Vacuum sealed? New desiccant?	3	3
3.2.2	Carton labeling? Bar-coding abilities? Secure storage area?	3	3
3.3	**Shipping**		
3.3.1	What is your Ship Lot Audit planning?	3	2
3.3.2	Demonstrate with records.	3	2
3.3.3	Do you have a copy of ███'s Quality Specification Document (QSPEC)? How is it controlled?	NA	NA
3.3.4	Verification to customer Quality Specifications?	3	3
	Sub Score	30	27

Table 17 : Score of product identification and logistic control topic

4: ESD/MOISTURE CONTROL HANDLING

4.1	Moisture Controls for Sensitive Component	Score	
4.1.1	Are ambient conditions controlled or monitored?	3	2
4.1.2	What is the current temperature and humidity? (Expect to see 25 C / 55% RH).	3	3
4.1.3	Is all stored product being kept dry?	3	3
4.1.4	Is ambient exposure time controlled?	3	3
4.1.5	What equipment do you have?	3	3

	Nitrogen ovens?		
	Sealing tools?		
4.1.6	How do you dry components?	3	3
4.1.7	How do you re-package components?	3	3
4.2	**ESD protections and controls.**		
4.2.1	Does the Supplier have a facility certified to ANSI/ESD S20.20? Auditor to record certificate number and date.	3	0
4.2.2	ESD POLICY DOCUMENT NO:_____	3	3
4.2.3	ANY ESD AWARENESS PROGRAM PLANNED? (FREQUENCY:_____)	3	3
4.2.4	Is all equipment, tables, carts, etc. grounded?	3	3
4.2.5	Are all carrying trays, packaging materials, floor documents, etc. ESD approved?	3	3
4.2.6	Are employees grounded while handling ESD sensitive devices? Auditor note: Industry practice requires a wrist strap while seated if sensitive devices are being handled. Auditor to observe employees while performing work operations for wrist or foot straps. Note: Foot straps require an ESD floor or floor mat to function.	3	3
4.2.7	Is ESD monitoring equipment routinely calibrated or verified?	3	2
4.2.8	Is there a documented ESD procedure? Auditor to record response and procedure number.	3	3
4.2.9	Do all employees who come into contact with ESD sensitive devices receive initial ESD awareness training before they handle any device and re-trained at least every 24 months? Auditor to verify evidence that initial training and re-training has taken place	3	3
4.2.10	Does the procedure identify the level of Human Body Model (HBM) ESD sensitive parts that their process can safely handle? Auditor note: example, Celestica states that all sites can handle any ESD sensitive device that has a Human Body Model sensitivity	3	3
4.2.11	PROPER RECORD FOR WRIST STRAP CHECK? FREQUENCY : _____ a) IQA b) STORE c) ASSEMBLY d) TESTING	3	3
4.2.12	PROPER RECORD FOR WRIST STRAP TESTER CALIBRATION? a) FREQUENCY :_____ b) CALIBRATED BY : _____	3	3
4.2.13	IS GROUNDING METHOD USED ON ALL WORKSTATIONS DOCUMENTED?	3	3
4.2.14	Are the items used to control ESD at the site attached to electrical ground? Auditor to record response. Evidence of the following is required: The Supplier must show that for all ground able ESD control items are connected to the 3rd wire AC ground. Note: A pictorial example of the resistance measurement to AC ground is attached below.	3	3
4.2.15	Are ESD Protected Areas identified? (Signs, floor tape, etc.)	3	3
4.2.16	PROPER RECORD FOR WORKSTATION GROUND CHECKS?	3	3

		WORKSTATION LAYOUT DRAWING AVAILABLE?	3	2
4.2.17		GROUNDING CHECK INCLUDE:		
		a) 1 Mohm RESISTOR		
		b) CONTINUITY CHECK?		
		c) FREQUENCY : _____		
4.2.18		ANY PROPER RECORD FOR WORKSTATION SURFACE RESISTIVITY CHECK?	3	2
4.2.19		RESISTIVITY CHECK INCLUDE:	3	3
		a) SURFACE RESISTIVITY VALUE MEASURED : _____		
		b) SURFACE CONDITION (STAIN, DIRTY, ETC)		
		c) FREQUENCY : _____		
4.2.20		ARE REGULAR ESD AUDITS CONDUCTED?	3	2
		a) AUDIT FREQUENCY : _____		
		b) AUDIT DEPT : _____		
		c) DATE OF LAST AUDIT : _____		
4.2.21		DO ALL TEST PROCEDURES CLEARLY INDICATE THE PROPER FUNCTIONAL TEST SEQUENCE FOR ALL FUNCTIONAL TESTERS TO PREVENT HOT PLUGING?	3	2
4.2.22		Are the instruments used in support of the site's ESD control program calibrated or functionally checked per the site calibration procedures? Note: This would include items such as wrist strap / footwear testers, resistance meters, electrostatic field meters and air ionizers.	3	2
4.3		**Compliance Verification**		
4.3.1		Review the Supplier ESD process assessment records for the facility for the past 6 months. Auditor to review records. Evidence of the following is required: a - Are the assessments being done at specified frequency? b - Are the findings identified as minor or major in nature? c - Has the Supplier developed a corrective action plan for major findings? d - Has the corrective actions been closed?	3	2
		Sub Score	**90**	**79**

Table 18 : Score of ESD and Moisture control handling topic

5: QUALITY SYSTEMS

No.	Question	Score	
5.1	Does the Supplier have a registered QMS certificate appropriate to their business? Eg TS16949 for automotive. *Requirement is ISO9000:2000 minimum* *Auditor to record certificate number etc in QMS Audit and Review section*	3	1

5.2	How is the Quality Policy communicated and understood within the Supplier? *Auditor to record response.* Auditor to verify evidence that the Policy is communicated to employees and understood. Evidence may be in the form of one or more of the following: - Policy on show in prominent places around the facility, - Policy communicated as part of the induction training, - Policy handed out in pocket sized cards, - Policy located on the pages of log books or other company stationary, etc,	3	3
5.3	How are Key Performance Indicators or other Quality Objectives set? *Auditor to record response.* Evidence of the following is required: a - Objectives being set and results measured by a suitable process, b - Review and Analysis of the results being held and Improvement activities implemented accordingly. c - Are the Objectives and Performance Indicators displayed for all employees?	3	2
5.4	How does the Supplier define the internal audit schedule? *Auditor to record response.* Evidence of **all** the following is required: a - Audit schedule planned to show areas and process to be audited, b - Frequency of audits for each area defined, c - Results if previous audits considered when setting the audit schedule.	3	2
5.5	Are all audits carried out by auditors to ensure objectivity and impartiality of the area or process being audited? *Check if audits are carried out by auditors independent of the process being audited*	3	2
5.6	Is there evidence to show that non-conformances identified during internal audits are: a - Identified and recorded, b - Corrective Actions raised, closed and reviewed for effectiveness. c - Corrective Actions closed in a timely manner established.	3	3
5.7	Is the internal audit schedule up to date and have all corrective actions raised been closed w/follow up or on track according to the expected completion date?	3	3
5.8	How concessions or requests to ship off-spec parts are managed and is there a formal procedure? *Auditor to record response and procedure number.* Does the procedure ensure: a - Reason for concession is fully identified and off-spec data is available for review, b - Qty affected and date codes or batch identifiers are known, c - Corrective action is issued to correct the off-spec situation,	3	2
Sub Score		**24**	**18**

Table 19 : Score of Quality systems topic

6: QUALITY CONTROL OF INCOMING AND OUTGOING MATERIAL :

No.	Question	Score

6.1	What is the process for Incoming Quality Control Inspection? *Auditor to record response.* Evidence of the following being carried out consistently is required: a - Part Number, Date Code and qty Check, b - Vendor name and Purchase Order number, c - Visual inspection and / or functional testing as applicable to the part, d - Safeguards to ensure that the correct line item(s) on the PO are received?	4	4
6.2	Are the Part Number, Date Code and Qty recorded in an online database or inventory logging system? Are the results of the visual or functional tests recorded in the database, inventory logging or other linked system?	2	1
6.3	Is there a formal procedure which covers the IQC process? Has the procedure been followed in 100% of cases sampled?	3	3
6.4	What is the process for managing the inspection of Outgoing Finished Goods? *Auditor to record response.*	6	5
6.5	Is there an area, or areas for segregated, quarantined products and materials? *Auditor to record response and audit **all** areas identified by the Supplier.* In each of the NCM areas was there evidence of the following: a - Were the areas well identified as NCM areas? b - The materials well identified with p/n, defect, date etc? c - Was there evidence that materials were disposition (action) in a timely manner? d - Is there documented evidence of the disposition status and further actions?	6	5
6.6	What is the labeling practice of the supplier? Can the supplier duplicate the information on the original label to the new label? How does the supplier ensure the original label information is correctly recorded on the new label? Does the supplier have barcode labeling capability?	3	2
6.7	Does supplier complies to the EIA standard which applicable to the Taping and Reeling Process include EIA 481-A, 481-1-A, 481-2, 481-3, 296-E, 541, 556-A, 583 and 625. *Auditor to record and audit for the evidence*	3	3
Sub Score		27	23

Table 20 : Score of Quality control of incoming and outgoing material topic

7: PROBLEM ANALYSIS & CORRECTIVE ACTION FOR CUSTOMER
RETURNED DEFECTS:

No	Question	Score	
7.1	IS there a procedure for Customer returned product and management of handling customer defective material?	4	3

	Evidence of the following is required: a - Is there a route map/flow chart for the generic returns process showing each stage from RMA issue to CA closure? b - Is individual responsibility identified for each stage and department? c - Are timescales from receipt to CA replay identified d - Is the CA process based on a recognized technique? e.g. 8D, 5 why's, DMAIC etc.? *1 pt for each category to comply*		
7.2	Is there a dedicated contact for issuing RMAs to Customers? Is the expected time to issue an RMA within 24 hours of notification of defects by a customer? *To check recent cases to verify RMA response time, 1 pt if <24 hours, 0 pts if > 24 hrs*	1	1
7.3	Are the timescales from receipt to reply based on the JEDEC standard JESD 671-A, or meet Company's requirements of Standard 23 days, Urgent 9 days? *2 pts if all comply, 0 pt if not*	2	1
7.4	Auditor to check 3 recent CA incidents, these do not need to be Company incidents. Does the supplier prioritize RC/CA analysis based on the customer reply timeline requirements? *2 pts if all comply, 0 pt if not*	2	2
7.5	Are metrics for returns maintained (by product/customer) and feedback to production & test improvement plans? Are these communicated regularly on each shift? *2 pts if all comply, 0 pt if not*	2	2
7.6	How is containment of the problem managed? Evidence of the following being carried out consistently is required: a - Purges for all affected material including WIP and Finished Goods, b - Shipping for affected material blocked c - Consideration given to purge of in-transit, hub and customer stock *To check 3 recent cases of containment, 1 pt of each category to comply*	3	2
7.7	What is the process to identify the risk to other customers and initiate notification and recall from a single customer return? Is the process covered by a formal procedure and is there evidence that this has occurred in 3 recent cases *2 pts if all comply, 0 pt if not*	2	1
7.8	Is containment implemented and completed within 24 hours? To check 3 recent cases, 2 pts if all comply, 0 pts if not.	2	1

7.9	What is the process for Failure Analysis Evidence of the following being carried out consistently is required: a - Verification of the "defect" using the equipment which defined it's fitness for use b - off-line or extended, intensive testing to verify cases which are shown as "NTF" on line c - root cause identified to component level d - short term and permanent corrective actions identified *To check 3 recent cases, 1 pt for each category to comply*	4	2
7.1	What techniques are used to identify Root Cause? E.g. Cause & Effect, 5-why's, Data collection and graphical representation etc Auditor to check for evidence in 3 recent cases that the techniques described by the supplier have been used in all cases. *2 pts if all comply, 0 point if not*	2	2
7.11	How are suitable Case identified and are some formal tools used? E.g. DOE, DMAIC Auditor to check for evidence in 3 recent cases that the techniques described by the supplier have been used in all cases *2 pts if all comply, 0 point if not*	2	2
7.12	How are corrective actions verified for effectiveness? E.g. data collection, graphical representation, hypothesis testing etc. Auditor to check for evidence in 3 recent cases that the techniques described by the supplier have been used in all cases. *2 pts if all comply, 0 point if not*	2	2
7.13	Are customer's defects verified using the production processes which produced, tested, or verified their fitness for use? Auditor to check 3 recent cases	1	1
7.14	Is there a system which tracks the timescale for each stage of the process and escalated the stage if the time is out of target? *2 pts if all comply, 0 point if not*	2	1
7.15	Does the supplier have a documented and effective procedure to evaluate WIP or inventory where known non-conformances or "Quality Holds" have been placed by the customer or supplier? *1 pt if there is evidence of Quality Holds or Recall exist* Is the case of a "Quality Holds", is there an escalation process in place that requires timely customer notification? *1 pt if evidence of customer notification exist in all cases*	2	2

	Sub Score	33	25

Table 21 : Score of Problem analysis & Corrective action for customer returned defects topic

8: CUSTOMER SATISFACTION

No	Question	Score	
8.1	How do you proactively assess the level of on-going customer satisfaction for your products and services? Evidence of the following is required: a - Satisfaction of Product Quality, b - Satisfaction of Commercial activity c - Satisfaction of service provisions	3	3
8.2	How are targets set for customer satisfaction? Evidence of the following is required: a - Targets reviewed at least annually, b - Targets used to provide an early warning system for customer dissatisfaction c - Is there a minimum response time for acting on customer complaints?	3	2
8.3	Is there evidence to show the trends of customer satisfaction are tracked and information posted for employee review?, and are the trends: a - Consistently above target b - Below target but increasing due to improvement activities c - Consistently below target -- no improvement d - below target and decreasing e - Bo tracking and trend analysis	NA	NA
8.4	How is customer dissatisfaction logged and corrected? Is there a formal process to implement improvements for customer dissatisfaction?	NA	NA
8.5	Is there a formal procedure which covers customer satisfaction Has the procedure been followed 100% in all cases sampled	2	2
8.6	Is there a nominated customer service representative who is responsible for the above process?	1	1
	Sub Score	9	8

Table 22 : Score of Customer satisfaction Topic

After performed supplier assessments, the result of assessment shows 82.6%. This Score show that this supplier PASS for company target which set as minimum at 70% in every section

Score Summary

Section	Max Score	Actual Score	%
1: COMPONENT/DEVICE CONTROL	27	22	81.5
2: PROGRAMMING OPERATION	93	73	78.5
3: PRODUCT IDENTIFICATION/LOGISTIC CONTROL	30	27	90.0
4: ESD/MOISTURE CONTROL HANDLING	90	79	87.8
5. Quality Systems	24	18	75.0
6. Quality Control of IQA-OQA	27	23	85.2
7. Problem Analysis &CA	33	25	75.8
8. Customer Satisfaction	9	8	88.9
Totals	**333**	**275**	**82.6**

Figure 20 : Supplier assessment score

The things that we found from other supplier and it is quite good have been develop in this supplier as below,

1. Component/device control: we developed from our warehouse and advise them

   1.1 To separate and identify location on shelf.

   1.2 To keep the component in the control place to prevent someone move part and create the lost part issue.

   1.3 To identify customer name and separate the area to prevent mix part from other customer.

   1.4 The reject part should have label identify as a "non-conformance" and keep in control area

2. Programming Operation:

   2.1 Define the storage structure and setting storage path for each firmware on the server, they will separated folder by customer and programmed part number.

   2.2 Implement reject tray instead of reject bin to prevent the component damage on the pin/lead.

3. Product Identification/Logistic Control: we found that supplier C has a good identification label and format to identify and let us know which one had already programmed. The format of the label had already advice to this

supplier to identify the programming part and let them know that which one had already programmed.

Figure21 shows the label artwork which identify on programmed version. This label will be use as high temp label to prevent any failure occur once pass into the process. We also advise them once attached the label, it should not cover for the notch which identify on pin1.
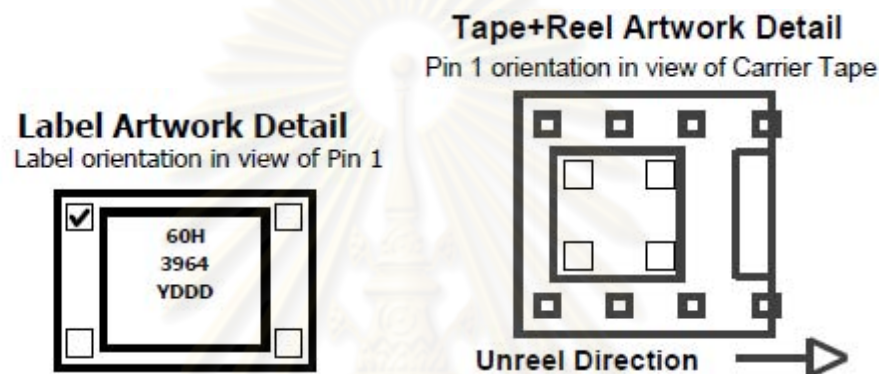
Figure 21 : Label art work

4. ESD/Moisture Control Handing: We had already comment on the wrist trap which should be a control part and let anybody know on the contact for preventing the Electro Static Discharge failure which can make the component damaged? So, the prevention has been implemented at production floor. Once wrist strap bad connection for some period, It still has full protection for device, The 4 ESD protectors had been implemented as following ,

4.1 Conductive floor for cover all production area,

4.2 Conductive shoe and smock for all employees who work on production floor

4.3 ESD chair for all stations

4.4 Wrist strap for all operators

4.5 Implement wrist strap alarm

4.6 Implement trolley to carry part

4.7 Implement Hygrograph meter to plot and monitor on humidity due to almost electronic component need to be control on temperature and humidity.

4.8 Implement the ESD tape on workbench to prevent using wrong type of tape because the non-ESD tape will create high resistance which may affected to the component.

5. Quality Systems: almost of items in the Quality systems section. This company is quite doing well and almost meets the company requirement.

6. Quality Control of IQA-OQA: The things that we found and let them to develop as

5.1 Preparing all tools for each station

5.2 Cover the fixture by ESD material i.e. ESD tape or ESD film.

5.3 Implement PM sticker for all machines to ensure that all machine had been calibrated on time and within specification.

5.4 Implement Bar code scanner to prevent the human error when writing down the information

5.5 For re-reel process, we advise them for peel back force tester to check on the taping process. They had already implement and install for peel back force tester,

7. Problem Analysis and Corrective Action: This item meets for all requirements.

8. Customer Satisfaction: They had already well done for this items due to they had already create the system to check on customer satisfaction such as

8.1 customer surveys and review rating from customer as yearly.

8.2 annual review for quality, cost and service satisfaction

- **Initiation test**

For initiation test, the First Article is created to monitor on the result and ensure that handling is meeting with standard for electronic parts. To release part

for mass production, we go to visit again and follow up on observation that we found to check on the readiness for programming and re-reel back to our site. All non-conformance items that we found once go to visit and audit need to be clear and take corrective action including preventive action. To ensure that this new qualified supplier can support us per our requirement, all this non-conformance items need to be done for improvement before we will release a mass product to them for programming and re-reel at their site. Almost items of non-conformance had already improved and meet for company's requirement.

Item	Reference No.	Non Conformance description	Category	Supplier Actionee	Supplier Response	Forecast clearance
1	IQA	CTH shipped Raw IC 147-42148-001 Qty 6000 pcs + Label 6100 pcs to EPS to program. No record for label 6100 pcs from CTH.	Observed	Monchai	Revise WI-QA01(Incoming Quality Control Procedure) item 2a ; for covering Label or all consigned material from customer same as blank IC, CTH must providing label spec for our IQA as well	Done
2	STORE	Store slip , without block Ending line , Potential someone fill more item after apporve.	Observed	Monchai	Already trained store operator and Supervisor about adding "Block ending line" for all slip especially store withdraw slip.	Done
3	STORE	Any change Document or revise must complete to sign off and fill Date	Observed	Monchai	Revise OP-QA02 (Control of documents) Item 5.1.6 ; by adding control rule for any info/data changed on each record form must be cross out with singed and fill date instead of liquid paper marking with rewriting, The liquid paper is not allow apply to any document or record form	Done
4	STORE	Component Security , No Lock door , When leave from Store location.	Observed	Monchai	Install automatic key locking on store door	20-Dec-10
5	IC program	Machine Idle state , Without identify to action before continue to Program component - Leave to break - Electric shutdown ,Suddenly Off - Start Shift - Leave to someplace (Toilet)	Observed	Monchai	Revise WI-EN02 (Programming Setup for FA and Mass production) item 5.15; set up and verify procedure to cover all idle machine state before continue programmig	Done
6	IC program	Conflict translate from English language to Thai Orange —> เหลือง	Observed	Monchai	Revise WI-PD01 (Manual Programming) for correcting Thai information	Done
7	IC program	Operator applied Liquid paper on document.	Observed	Monchai	Revise OP-QA02 (Control of documents) item 5.1.6 by adding control rule for any info/data changed on each record form must be cross out with singed and fill date instead of liquid paper marking with rewriting, The liquid paper is not allow apply to any document or record form	Done
8	IC program	Must special to Define Big Indian (Swop byte)	Recommend	Monchai	Revise detail in FAR report, and database by adding "(Swap Byte)" for big Endian option	Done
9	Label Printing	Out of Calibration date Citizen, CLP-7201C , S/N P004848 Cal date 1-7-10 Due date 1-8-10 Please review Printer requirment for calibration , and update	Observed	Monchai	Firstly we implement both PM and Calibration for this machine, After got advised from Khun Saroash, This Label printer machine is not required any calibration, only PM needed, So that only implement PM record for this machind as showing in the attached file. Referring to Zebra105SL userguide manual, Calibration is not required, FYI	Done
10	Tap & Reel	Out of calibration date / No update calibration system OriAO Digital Force gate Calibrated M/C 09070 Cal date 24-Jul-2009 Due date 24-Jul-2010	Minor	Monchai	The calibration was done by NEC since 12 Oct 2010 and next due date at 12 Oct 2011 but EPS cal tag did not update, so that we decide to use NEC cal tag and only one cal tag for one machine, please see more detail as attached file	Done
11	Tricker yield.	No Tricker yield to get approval CTH before ship. Agreement to define tricker yield , If yield lower than 97.0% , MUST inform to CTH and get approval before Ship Programed part to CTH.ot	Agreement	Monchai	Revised OP-PD03 (Finished Goods Control & Delivery) by adding trigger yield and shipment approval before ship out, Item 5.1.4	Done
12	Combine / Merge Lot	CTH NOT allow to merge , mix , Combine Good and Defect with different Lotcode and Datecode return back to CTH.	Agreement	Monchai	FIFO control, Starting from receiving, store and WIP. We use WO(work order) for controlling of each batch and will update to CTH by each WO if any problem found	Done
13	Shipment	Must provide QVR (Quality verification report) attach with Shipment to CTH.	Agreement	Monchai	Revise WI-PD03 (Vacuum Sealing and Packing) by adding QVR report in packing box with QVR label indentifying on outer box	12-Nov-10

Table 23 : Readiness of out-source Company for programming and re-reel

Table23 shows that out-source company already improved on the observation once we go to visit and perform audit them. So, we're monitoring for the

programmable part and result of programmable part and re-reel process shows as figure 22,

Figure 22: First Article form

This supplier also supports for First Article running to ensure that the programmed part can be used in our production. This First Article run is for free. For the agreement, we agree for 5 pieces to run as First Article to ensure for the functional

of the IC programmed. After testing and the result are coming, we will submit for the mass production of IC programmed.

P/N	CTH PO No.	PO. QTY	IQA			NCMR No.	Work order No.
			Original QTY	Accept QTY	Reject QTY		
2470-12033-055PLE	No PO (FA Project)	-	5	5	0	-	902007
60H3976-B	No PO (FA Project)	-	5	0	5	09020	909011
60H3964-A	No PO (FA Project	-	5	0	5	09021	909013
77P2313	No PO (FA Project)	-	5		5	09022	909012
77P2997A_N	3400105565	100	100	98	2	09032	911007
	3400107077	300	300	299	1	10004	1001011
77P2997B_N	3400105565	100	100	98	2	09031	911008
	3400107077	300	300	299	1	10004	1001012

P/N	Processing worksheet				
	Total Number	File Name:	CheckSum:	Produce Date	Finish Date
2470-12033-055PLE	5	flashImageRainbow_2008_11_26.BIN	5E266231	8/17/2009	8/17/2009
60H3976-B	5	60H3965,J80714,CODE,BIN.mif	0x3C7DE489	9/18/2009	9/18/2009
60H3964-A	5	60H377,J80720,R0,Code,BIN,mif	0X0F913E5B	9/22/2009	9/22/2009
77P2313	5	45D0181,G40439,R0,CODE,BIN.bin	0x37498768	9/18/2009	9/18/2009
77P2997A_N	100	harpy_2122_2MB_WWN_0x50000C90000002C4_0x1C31EF50.bin	0x0C41EF50	11/17/2009	11/17/2009
	300			1/13/2010	1/13/2010
77P2997B_N	100	harpy_2122_2MB_WWN_0x50000C90000002C0_0x1C31EF51.bin	0x0C41EF51	11/16/2009	11/17/2009
	300			1/12/2010	1/13/2010

Table 24 : List of initail run result

Table24 shows the initial run for FA component and much more quantity which had already PASS for FA.

They also have a service to do programmed out-side and right now, they service programming at our company which is quite benefits to improve on the shipment time, shipment cost and can reduce some process such as inspection component before perform programmed, this also reduce the handling process which can make a lot of failure due to the poor handling.

3.4 Supplier Development Process

Supplier development process had been using for reduce the Failure Analysis turnaround time to meet the customer requirement. The information and requirement from customer had been share to supplier.

This point will be development and improve for our internal process to reduce any delay to meet customer's requirement on the Failure Analysis Turnaround time.

For the supplier site, it is almost of the customer control supplier. They also give us the guideline for action if any supplier does not response on time and cannot meet on the customer requirement which will shows in the appendix.

3.4.1 Identify critical products and service.

The critical of the product and service is concern on the Failure Analysis turnaround time for the Critical events which identify as Catastrophic, Potential Safety issue, Line Stop, Stop ship or Customer requests.

Many customers are setting up the time-line for the Critical events. After summarize and selected the tighten timeline. We selected for the tighten one to meet for the entire rest customer requirement. The critical timeline to be set up as table 25,

Failure Analysis Type	Normal	Urgent	Deliverables
Initial Response	5 days	24 hours	• Curve trace data on all or subjected pins • Functional Status • If fail, outline of analysis steps & estimate timeline • If pass, return parts to ▇▇▇ via overnight carrier
Preliminary Failure Analysis	10 days	48 hours	• Preliminary identification of root cause • Recommendations for corrective actions and containment
Completed Failure Analysis (8D Report)	15 days	5 days	• Completed failure analysis report in 8D format • If appropriate, corrective action plan with timeline
Status Schedule	weekly	daily	• Progress report on work completed • Projection on next actions • Updated timelines

Table 25 : Timeline for failure analysis process

3.4.2 Form a cross-functional team.

This cross-function was setting up internally. We are setting up the meeting for all concern people and department which will drive this process to meet customer's requirement. Many department is concerning to follows and expedite internal to meet the customer target to meet the timeline.

The concern people who need to be involved on this project are

1. Debug or Test Engineer: who ensure and trigger that the component has a problem and this problem may concern with the supplier.

2. Customer Quality Engineer: who discussed with customer on the Critical events and updated to customer on the progress.

3. Process Quality Engineer: who ensure that the failure does not concern on our internal process and verify the part before ship part back to supplier.

4. Supplier Quality Engineer: who contact with supplier for returning part and discussed with supplier to perform failure analysis.

5. Production Team: who remove part and prepare part for arrange shipment

6. Planner and Buyer: who create the document and arrange shipment back to supplier

7. Shipping Team: who packing part and do the shipment.

3.4.3 Meet with top management of supplier.

For ABC Service Company, this topic for Failure analysis timeline had been discussed while auditing.

ABC Service Company had also provided the timeline for failure analysis turnaround time to align with the customer requirement. For the timeline of ABC Service Company will be explain in topic 3.4.4

For others supplier which does not control by our company, we also try to align this program with supplier by discussed and informed them on the customer requirement once they come to visit us. In supplier visiting time, we have a chance to meet with them and discussed on customer requirement which supplier need to follow and meet the target. Example of the supplier visit that we have a change to discuss with had been show in Table26 .This performance is needed to meet the customer target and this will be one of the items for supplier scorecard to measurement on the supplier performance.

Date	Supplier name	Visitor name	commodity	Purpose/Agenda
13-May-10			Optic	Topics ; 1. Demand Forecast 2. XML Test Report Transfer a. Issue associated with wrong part number and associated 8D corrective action report b. Resolve issues associated with our inability to transfer data electronically. 3. Schenker Status 4. Quality/RMAs a. Review quality report b. Close any issues associated with the 3 active RMA
14-Jun-10			Power supply	LP eng. come to verify/ analysis Mfg : NSR003A0X4-49Z high failure at ICT.
15-Jul-10			Power supply	Quartery visit review the performance support/ pending issue.
30-Jun-10			Power supply	General visit
9-Jul-10			IC	1. FA Turn around and Arrow support 2. Wrong part ship 4 case, with need improvement support for 8D report and corrective action to prevent ship wrong part from Arrow. 3. request Arrow to provide and Minimmize Communication loop for FA RMA
27-Jul-10			Optic	Date : 27Jul 2010 10.00 - 11.00 : Introduction , mfg. update -- by 10.30 - 12.00 : FA requirement/expectation to 12.00 - 13.00 : ------ break time 13.01 - 14.30 quality & DPPM trends ,Quality Highlight ,historical data of Field returns 14:31 - 15.00 : Quality issue follow up/update 15.01 - 16.30 : Others 16.31 - 17.30 : Wrap up and close a meeting
29-Sep-10			IC	1. Quality FA turnaround time 2. Low DPPM claim 3. Forecast of product
18-Nov-10			IC	1. Advanced MP Technology's Quality procedure 2. traceability of parts 3. Audit results 4. Challenges for AMPT 5. Questions and Answers for

Table 26 : Supplier meeting list and agenda

In case that we do not meet the supplier management team, all information for FA turnaround time requirement also include to the communication e-mail loop. Almost supplier is customer control, if supplier cannot support per customer requirement, customer will be added into communication e-mail loop for expediting.

If supplier provides the poor support, this will escalate to the Supply Chain Team and Global Team to warn and set up the Supplier Quality Improvement program.

3.4.4 Identify key project.

The key of this project is to meet customer requirement on failure analysis turnaround time. This should be meet target both supplier site and internally as well. That's why we need to set up meeting and invited concern people to brainstorm and set up internal timeline for each department. The job definition and function are identified and clear in this stage. Process flow and timeline have been created as figure 23 and Table 27,
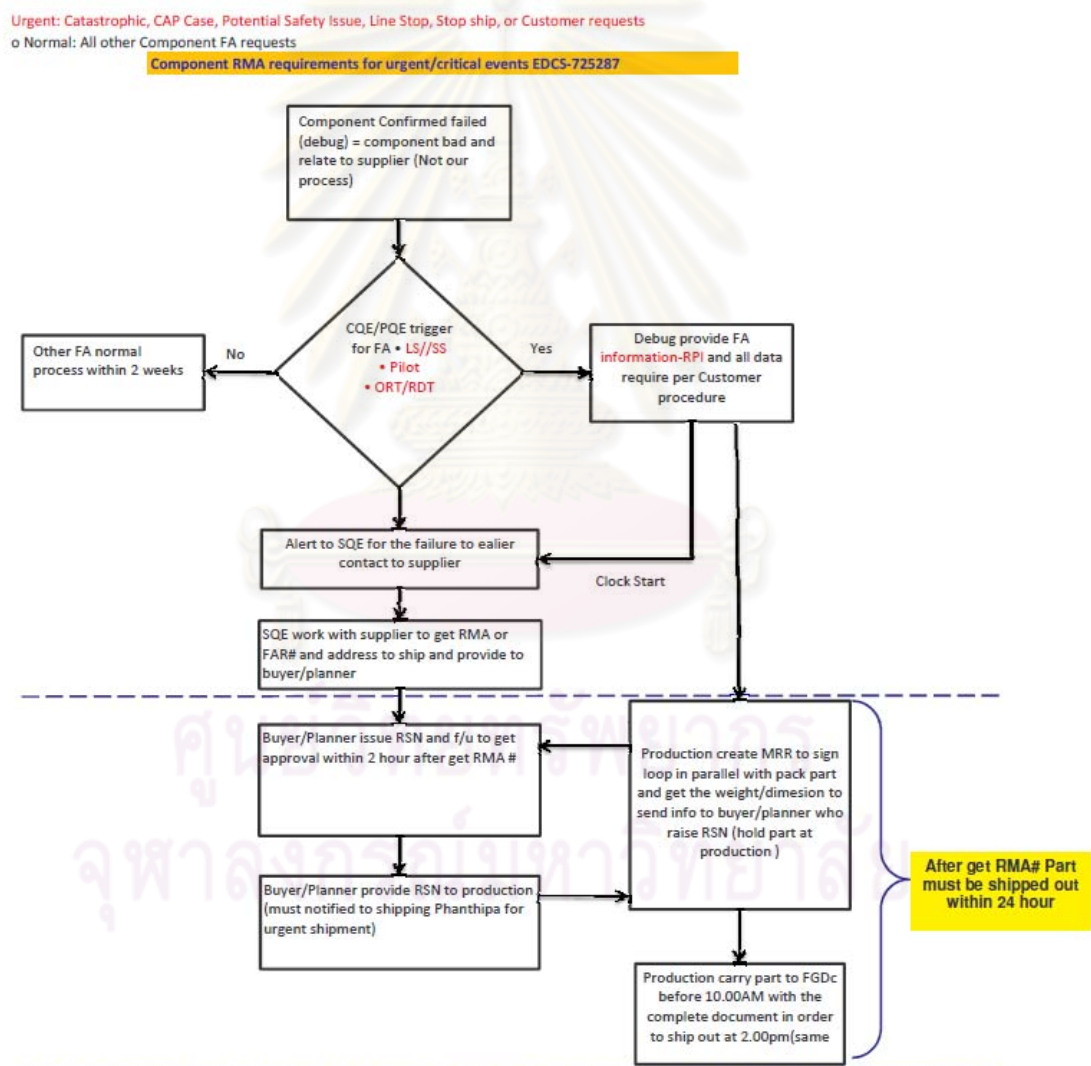
Figure 23 : Internal process flow for ship part to supplier

Items	Action	owner	Clock start
1	Debug confirmed failed	Debug	
2	CQE/PQE trigger for FA LS /LA/SS . Phot . OMT/RDT and alert to SQE	CQE/PQE	
3	Issue RPI priority 1 and attached all necessary information and CQE notified to SQE prior submit RPI. Clock start once analyze submitted RPI to SQE	Debug/PQE	
4	Create MRB and sign loop	Production Numpol	
5	Pack part and measure dimension/weight and send information to buyer to fill in RSN . And hold part in production		
6	SQE communicate to Supplier to get FARR and address to ship		24 hour SLA status
7	Buyer/Planner issue RSN and get approval within 1-2 hour .Get completed before 10.00AM and notified to ghanthipa for urgent shipment	Buyer/Planner	1-2 hr
8	SQE to coordinate with production to move the partpack with RSN and document to FGDc before 10.00AM	SQE/Production	
9	shipping ship the part out in same day at 2.00pm	shipping	10am to 2.00pm

Table 27 : Timeline of each process to ship part back

The above process flow chart and timeline are using for our internal to meet the customer requirement. The customer requirement also concern with the supplier site for the root cause and corrective action in case that supplier confirm failure.

Only our site can meet the customer requirement and fulfill on customer satisfaction. Supplier site is one more factor which we need to drive and set agreement with them and let them to follow the timeline and requirement.

To reduce the turnaround time to meet customer requirement, FMEA tools had been used to identify potential root cause of the delay in the turnaround time process.

Guideline for ranking lever of severity, occurrence and detection are also follows guideline from some past project such as risk management for prefabricated classical Thai house construction project and the experience of each member in the teams combining with the point of view of customer requirement. Each facto is combined and applying follows FMEA Reference Manual Fourth Edition (2008) from Chrysler LLC, Ford Motor Company, General Motors Corporation.

The FMEA rating scale had been derived and discussed to focus and apply to reduce the delay in the Failure Analysis Turnaround for our internal. The ranking which and been derived for calculate and potential cause and analyze for the major cause which make the delay and need the immediate improvement will be calculate by using 3 majors factors which are severity, occurrence and detection. The scope and rating will be using the below guideline,

Severity Ranking

Severity (S): How serious is the impact of the end effect?

Effect	Project time effect	Criteria : Severity of Effect (Customer Effect)	Rank
Hazardous effect	cannot ship part out to supplier	Customer cannot know on the root cause to solving the problem on time / failure mode effects safe operations of the device to the user and/or building	10
Serious effect	delay in shipment process > 3 days	Customer does not know on the real root cause of the failure / Device does	9

		not comply to law/compliances regulations	
Very high effect	delay in shipment process ≤ 3 days	The delay process is making the other Finish good product STOP SHIP / Failure mode will cause premature wear-out, causing loss of operation while installed in the customer live environment AND once failure mode is experienced, unit operation cannot be recovered.	8
High effect	delay in shipment process ≤ 2 days	The delay process is making the line stop / Failure mode will cause premature wear-out, causing loss of operation while installed in the customer live environment AND once failure mode is experienced, unit operation can reasonably recovered BUT failure mode can re-occur.	7
Moderate effect	delay in shipment process ≤ 1 days	The delay process is making the line alert /Failure mode will cause early life device loss of operation prior to being installed in customer live network environment AND once failure is experienced, unit operation cannot be recovered.	6
Low effect	delay in our internal process and need time to solve < 18 hours but still can meet on customer requirement	Cause customer annoyance, and they seek for update/Failure mode will cause early life device loss of operation prior to being installed in customer live network environment BUT once failure is experienced, unit operation can be recovered BUT failure mode can re-occur.	5
Very low effect	delay in our internal process and need time to solve < 12 hours but still can meet on customer requirement	Cause customer annoyance, and they seek for update/Failure mode will cause performance degradation, loss of feature, performance is not optimal (device reboot does not fit this category as network is down during reboot) Failure mode will cause customer to be uncertain of device status	4
Minor effect	delay in our internal process and need time to solve < 6 hours but still can meet on customer requirement	Cause customer annoyance, but they do not complain/Failure mode will cause customer dis-satisfaction due to cosmetic and mechanical requirement	3

Very minor effect	delay in our internal process and need time to solve < 3 hours but still can meet on customer requirement	Very minor effect notice by customers and does not annoy or inconvenience customer/Failure mode will cause error message to be displayed to customer; error messages will not cause performance/downtime issue BUT might generate concern/question	2
No effect	No any delay in the process	Failure Mode will not be noticed by customer	1

Table 27 : Guideline for severity ranking

Occurrence Ranking

Occurrence is the measure of frequency of the failure happening in specific period. The frequency of the failure can be scale from 1 which is very low and 10 is very high.

The occurrence can be using the statistic data for accurate ranking how often that failure had been happening.

Likelihood of failure	Criteria : Occurrence of Cause (Incidents per items)	Rank
Very High	≥ 100 per thousand ≥ 1 in 10	10
High	≥ 50 per thousand ≥ 1 in 20	9
	≥ 20 per thousand ≥ 1 in 50	8
	≥ 10 per thousand ≥ 1 in 100	7
Moderate	≥ 2 per thousand ≥ 1 in 500	6
	≥ 0.5 per thousand ≥ 1 in 2,000	5
	≥ 0.1 per thousand ≥ 1 in 10,000	4
Low	≥ 0.01 per thousand ≥ 1 in 100,000	3
	≥ 0.001 per thousand ≥ 1 in 1,000,000	2
very Low	≤ 0.001 per thousand 1 in 1,000,000	1

Table 28 : Guideline for occurrence ranking

<u>Detection Ranking</u>

The Detection Failure mode is analyzed how the best of process control to detect the failure. The detection is ranking from 1 to 10. 1 using for the failure which is easily to detectable and 10 using for the failure which is impossible to detect or ever set any detection for detect the failure.

To lower rating of detection, it can be separated into 2 point of process control which is the preventive for preventing the failure occurs and detection for identify the failure and develop for corrective action.

Opportunity for Detection	Criteria : Likelihood of detection b y process control	Rank	Likelihood of Detection
No detection opportunity	No current process control ; Cannot detect or is not analyzed	10	Almost Impossible
No likely to detect at any stage	Failure Mode and/or Error (Cause) is not easily detected (e.g., random audits)	9	Very remote
Problem detection Post Processing	Failure Mode detection post-processing by operator through visual/tactile/audible means	8	remote
Problem Detection at Source	Failure mode detection in-station by operator through visual/tactile/audible means or post-processing through se of attribute gauging (go/no-go, manual torque check/clicker wrench, etc.)	7	very low
Problem Detection Post Processing	Failure Mode detection post-processing by operator through use of variable gauging or in-station by operator through use of attribute gauging (go/no-go, manual torque check/clicker wrench, etc.)	6	low
Problem Detection at Source	Failure Mode or Error (Cause) detection in-station by operator through se of variable gauging or by automated controls in-station that will detect discrepant part and notify operator (light, buzzer, etc.). Gauging performed on setup and first-piece check (for set-up causes only)	5	moderate
Problem Detection Post Processing	Failure Mode detection post-processing by automated controls that will detect discrepant part and lock part to prevent further processing	4	moderately high

Problem Detection at Source	Failure Mode detection in-station by automated controls that will detect discrepant part and lock part to prevent further processing	3	high
Error Detection and/or Problem Prevention	Error (Cause) detection in-station by automated controls that will detect error and prevent discrepant part from being made	2	very high
Detection not applicable; error prevention	Error (Cause) prevention as a result of fixture design, machine design or part design. Discrepant parts cannot be made because item has been error-proofed by process/product design	1	Almost certain

Table 29 : Guideline for detection ranking

After got the guideline for rating on the potential failure, the potential failure had been identify by using the brainstorming method to discussed on the potential of failure which can cause on the shipping the failure component to supplier site. The total count of potential failure can be summarizing to 44 potential failures spread out in each process. The number of potential failure in each process can by summarized and shows in Table 31.

Process Number	Process Name	Responsibility	No.
Process 1	Debug Process	Debug Team	10
Process 2	Trigger/RPI	Debug & PQE	4
Process 3	MRR Create	Production	2
Process 4	Pack part Production	Production	6
Process 5	SQE communicate	SQE	9
Process 6	Raise RSN	Planner/Buyer	2
Process 7	Move part	Production	3
Process 8	ship part	shipping team	8
Total			**44**

Table 30 : Summary of potential failure in each process

The potential failure mode and potential cause will be explained individually for more understand on the process and how it can be a potential failure and potential root cause.

Process1: Debug process

Wrong component part ship

Wrong component in this failure mode means that debug suspect the wrong component. The component which is the root cause of failure does not identified and shipped to supplier for investigate on the component failure. Debug suspected the wrong component because of too many reasons and it's also depends on the skill of debug also. Below is the list of potential root cause of wrong suspect component,

1. carelessness from debug to analyze

2. Carelessness to check the history of the board and component level

3. insufficient skill of debug

4. New hire employee

Component Damage

Component damage is also can create the failure in the production and may concern to reliability. Sometimes the damage is too small and we cannot detect by naked eyes. This also waste time to ship part back to supplier due to supplier also cannot verify on the component. The potential root cause of component damage also list as follow,

5. Using component does not follow component specification

6. Carelessness to check on component level

Delay to identify the suspect component

Debug also has a lot of work to clear out and analyze on the failure. Workload is also impotent to analyze and share the workload to make the job smooth. Some cases, it is quite difficult to analyze and need to spend time with it. To prevent any delay in the process, workload should be analyze and put the right man to do it. For delaying in the process, it's also possible that debug does not know which board is

failing as an urgent case per customer definitions. The causes of delay had been summarized as below,

7. Resource is not enough

8. Debug does not set priority for the urgent case

9. Debug does not know which one is the urgent case

10. New hire employee: For this new hire employee is also one of potential failure due to the new hire employee need to learn on the internal systems which can cause the delay in the urgent case.

Process2: Trigger/Request Problem Investigation (RPI)

Trigger wrong person

Trigger to the wrong person can create the delay in the process due to the right person does not get any alert for awareness of the urgent case. The wrong person whom been trigger is also may not known in details and does not set priority on the urgent case.

1. Does not know the contact person due to one customer have too many people to take care

2. Error to typo the name

Delay to ship part out

The triggering process can cause the delay to ship part out because details in the triggering form is also been use for arrange shipment. Some information also needs to provide to supplier to confirm that this part purchase in the correct channel. So, all information in the triggering process is very necessary to get a lot of information for the next process.

3. Information does not fill in the form correctly

Process3: Material Reject Report (MRR) Create

MRR send to wrong person

MRR is the paper which needs to sign loop for agreement to move part to the right location. The concern people who need to sign the MRR are Debugging, Process Quality Engineer (PQE), Supplier Quality Engineer (SQE) and planner/buyer.

Due to one business unit may have many SQE to take care per commodity as IC, Passive Component, Optic Component, Sheet metal, Print Circuit Board, Connector and etc. In each commodity will take care by different people.

Different people who take care in each commodity can create the confusion to production to find the right person for signing. The potential root cause of delay to complete the MRR will be listed as follow,

1. Does not know the contact person due to one customer have too many people to take care

Create MRR slowly

To Create document slowly will be affected to the next process, this document will using for moving part to the right location to ship part back to supplier.

2. carelessness to set priority for the urgent case

Process4: Pack part

Pack wrong part

Wrong part was pack and ship to supplier; it will waste time for communication for finding the root cause of the failure.

1. pack too many part in the same time

2. wrong part picking from the storage

Non-standard packing

Standard packing is required for ship part back to supplier. If package is not proper, it will be create the damage and delay for the failure analysis time. Moreover,

if the damage is cannot repair, we will lost part to perform failure analysis for identified the root cause and fix the problem.

3. ship the small quantity and does not have the proper package

4. Part does not identified as urgent and need to ship back to supplier

5. Lack of communication or unclear communication

6. Does not know the requirement of the component control

Process5: SQE communicate

Delay to get Return Material Authorization (RMA)

Process to get RMA, some supplier needs to fill the form and refer that request from for return part back. If we does not fill the form and the time zone is different, we will make a delay for 1 days and it will not meet the customer requirement to get the RMA within 24 hours.

If we contact to the wrong channel or wrong person in the supplier site, it will create delay to transfer information to the right channel for fasten on the RMA process.

1. does not know that supplier has a Failure Analysis / Return Material Authorization form

2. Contact to the wrong channel

3. carelessness for alert on the urgent case

Cannot return part back

If part does not purchase from authorize distributor, supplier will not allows to ship part back to perform failure analysis. So, this information need to be ensure that this part purchase direct from the right channel.

4. Part does not buy direct from the authorize distributor

Supplier cannot duplicate the failure

To get help from supplier for duplicating the failure that we found in our site, information for testing step and testing environment need to be clarifying to supplier. This information will be help supplier to get more understand and testing in the same condition that we found the failure at our site.

5. Less information on test step and test environment to supplier

6. Some information cannot share to supplier due to customer confidential

7. Lack of technical information

Delay to ship part out

All information, that we need supplier to provide, need to be clear at the first time that we request them to return part to prevent any delay.

8. Information that supplier provide is not enough for shipping part out

9. Lack of communicate information to supplier for getting approval

Process6: Raise RSN

Delay to ship part out

RSN is an internal process to get approve for arranges shipment back to supplier.

1. Too many people need to approve for arrange shipment

2. Authorize approval people does not come to work

Process7: Move part

Part move to wrong location

Our internal have many locations for each area concern such as RTV8 which is location to ship part back to supplier; RTV9 is location to ship part back to customer. Locations also identify the destination of the part. All information need to be cleared to move part in the correct location.

1. Concern people sign the documents does not clear to identify the location

2. Shipping team put the part to the wrong location

3. Lack of communication

Process8: Ship part

Delay to ship part out

Forwarder Account is one of cause which creates delay due to internal forwarder account need too many people for approval. Normally, out internal account will use to ship finish good to customer and for some urgent case which need to review case by case.

1. Supplier does not provide Forwarder Account

Ship damage part to supplier

Damage part ship to supplier, this is the cause that supplier cannot perform failure analysis and the problem cannot be solved and known on the root cause of the failure. Damage part can occur from handling and our internal process that we are overlook to take care component.

2. Carelessness to check the actual component after rework

3. Carelessness to save component while re-working

Wrong part ship to supplier

Wrong part ship to supplier, besides supplier cannot perform failure analysis and identify on the root cause of the failure, it also create cost for return part back from supplier site.

We need to ensure the correct part had been ship to supplier to prevent any delay and prevent to create additional cost.

4. Carelessness to check actual part from rework

5. Pack the wrong part

6. Lack of information about the component

7. Carelessness to check the actual component before arrange shipment

8. Unclear labeling on the packing

The table32 is summarizing of the potential failure mode including possible effect and possible cause. The possible cause and possible effect is the key to be a potential to make a failure occurs.

Process/Responsibility	No.	Failure Mode	Possible Effect	Possible Cause
Debug Process Debug	1	wrong component ship to supplier	ship good component back to supplier	Carelessness from debug to analyze
	2			Carelessness to check the history of the board and component level
	3			insufficient skill of debug
	4			New hire employee
	5	component damage	cannot ship part back to supplier	does not follow component specification
	6			Carelessness to check the component level
	7	Delay to identify the suspect component	delay to ship part back to supplier	Resource is not enough
	8			Debug does not set priority for the urgent case
	9			Debug does not know which one is the

				urgent case
	10			new hire employee
Trigger/RPI Debug & PQE	1	Trigger wrong person	delay to communication with supplier	Does not know the contact person due to one customer have too many people to take care
	2			Error to typo the name
	3	Delay to ship part out	delay to ship part out	Information does not fill in the form correctly
	4			Debug and Analyzer does not understand well on the form
MRR Create Production	1	MRR send to wrong person	delay to sign loop for component movement to the right location	Does not know the contact person due to one customer have too many people to take care
	2	Create MRR slowly	delay to sign loop for component movement to the right location	carelessness to set priority for the urgent case
Pack part Production	1	pack wrong part	wrong part ship to supplier	pack too many part in the same time
	2			wrong part picking from storage area
	3	non-standard packing	this can create other failure and damage the component	ship the small quantity and does not have the proper package
	4		cannot ship part to supplier	Part does not identified as urgent and need to ship back to supplier
	5			lack of communication or unclear communication
	6			Does not know the requirement of the component control
SQE communicate SQE	1	Delay to get RMA	delay to get Return Material	Does not know that supplier has a form to

			Authorization from Supplier	fill in
	2			Contact to wrong channel
	3			Carelessness for alert on urgent case
	4	Cannot return part back to supplier	cannot return part back to supplier	Part does not buy direct from the authorize distributor
	5	supplier cannot duplicate the failure	supplier cannot duplicate the failure and identify root cause	Less information on test step and test environment to supplier
	6			some information cannot share to supplier due to customer confidential
	7			Lack of technical information
	8	Delay to ship part out	delay to ship part out	Information that supplier provide is not enough for shipping part out
	9			lack of communication and information to supplier for getting approval
Raise RSN Planner/Buyer	1	Delay to ship part out	delay to ship part back to supplier	Too many people need to approve
	2			Authorize approval people does not come to work
Move part Production	1	part move to wrong location	cannot ship part out	Concern people sign the document does not clear to identify the location
	2			Shipping team put the part to the wrong location
	3			lack of communication
ship part shipping team	1	Delay to ship part out	Delay to ship part back	Supplier does not provide the

				Forwarder Acc
	2	ship damage part to supplier	supplier cannot analyze and perform failure analysis	carelessness to check the actual component after re-work
	3			Carelessness to save-component while reworking
	4	wrong part ship to supplier	supplier cannot analyze and perform failure analysis	Rework center provide the wrong part
	5			packing team pack the wrong part
	6			packing team does not know the supplier logo on the component
	7			carelessness to check the actual component before arrange shipment
	8			Unclear labeling on the packing box

Table 31 : Summary of potential failure for overall process

The tools that we are using for identification the possible root cause of the delay process are consist of

- 5's why analysis

- Brainstorming technique

- Pre-audit (inspection of each process to find the possible cause of delay)

- Meeting and implementation

The tools uses to identify the possible root cause help the member easier to point on the potential root cause. All of the tools are quite easily to use and easily to understand. Once, we are combining all the tools and using all the tools together. It's quite an efficiency tools to make team can identify the potential root cause faster.

After we got the potential root cause and effect, next step we have to be done is analyzing by scoring per FMEA tools. If the score is quite high, it means that is the major processes which need to take action immediately.

Table 33 is showing for analysis by ranking for severity, occurrence and detection and also calculate for the RPN.

	No.	Possible Effect	Possible Cause	Severity	Occurrence	Detection	RPN
Debug Process	1	ship good component back to supplier	Carelessness from debug to analyze	9	5	10	450
	2		Carelessness to check the history of the board and component level	9	5	10	450
	3		insufficient skill of debug	9	3	9	243
	4		New hire employee	9	5	9	405
	5	cannot ship part back to supplier	does not follow component specification	10	2	10	200
	6		Carelessness to check the component level	10	2	10	200
	7	delay to ship part back to supplier	Resource is not enough	9	5	10	450
	8		Debug does not set priority for the urgent case	9	3	10	270
	9		Debug does not know which one is the urgent case	9	5	10	450
	10		new hire employee	9	5	10	450

Trigger /RPI Debug & PQE	1	delay to communication with supplier	Does not know the contact person due to one customer have too many people to take care	7	2	10	140
	2		Error to typo the name	7	1	8	56
	3	delay to ship part out	Information does not fill in the form correctly	9	3	9	243
	4		Debug and Analyzer does not understand well on the form	9	3	10	270
MRR Create Production	1	delay to sign loop for component movement to the right location	Does not know the contact person due to one customer have too many people to take care	7	3	10	210
	2	delay to sign loop for component movement to the right location	carelessness to set priority for the urgent case	9	3	10	270
Pack part Production	1	wrong part ship to supplier	pack too many part in the same time	9	7	9	567
	2		wrong part picking from storage area	9	5	9	405
	3	this can create other failure and damage the component	ship the small quantity and does not have the proper package	9	4	8	288

	4	cannot ship part to supplier	Part does not identified as urgent and need to ship back to supplier	10	3	10	300
	5		lack of communication or unclear communication	10	3	10	300
	6		Does not know the requirement of the component control	10	2	9	180
SQE commu nicate SQE	1	delay to get Return Material Authorization from Supplier	Does not know that supplier has a form to fill in	9	4	10	360
	2		Contact to wrong channel	9	4	10	360
	3		Carelessness for alert on urgent case	9	3	10	270
	4	cannot return part back to supplier	Part does not buy direct from the authorize distributor	10	2	8	160
	5	supplier cannot duplicate the failure and identify root cause	Less information on test step and test environment to supplier	9	4	10	360
	6		some information cannot share to supplier due to customer confidential	9	2	1	18
	7		Lack of technical information	9	3	10	270

	8	delay to ship part out	Information that supplier provide is not enough for shipping part out	9	3	8	216
	9		lack of communication and information to supplier for getting approval	9	2	8	144
Raise RSN Planner /Buyer	1	delay to ship part back to supplier	Too many people need to approve	9	6	10	540
	2		Authorize approval people does not come to work	9	2	10	180
Move part Production	1	cannot ship part out	Concern people sign the document does not clear to identify the location	10	2	8	160
	2		Shipping team put the part to the wrong location	10	2	9	180
	3		lack of communication	10	2	10	200
ship part shipping team	1	Delay to ship part back	Supplier does not provide the Forwarder Acc	9	7	10	630
	2	supplier cannot analyze and perform failure analysis	carelessness to check the actual component after re-work	9	3	10	270
	3		Carelessness to save-component while	9	3	10	270

		reworking				
4	supplier cannot analyze and perform failure analysis	Rework center provide the wrong part	9	2	10	180
5		packing team pack the wrong part	9	4	10	360
6		packing team does not know the supplier logo on the component	9	2	10	180
7		carelessness to check the actual component before arrange shipment	9	2	10	180
8		Unclear labeling on the packing box	9	2	10	180

Table 32 : Summary of potential failure analysis in overall process

After scoring and analyze on the RPN which represent to the high potential of failure, we found 70% of total RPN will be 50% of potential cause of failure.

Figure24 will show the RPN for all of the process by ranking from highest RPN until lowest.
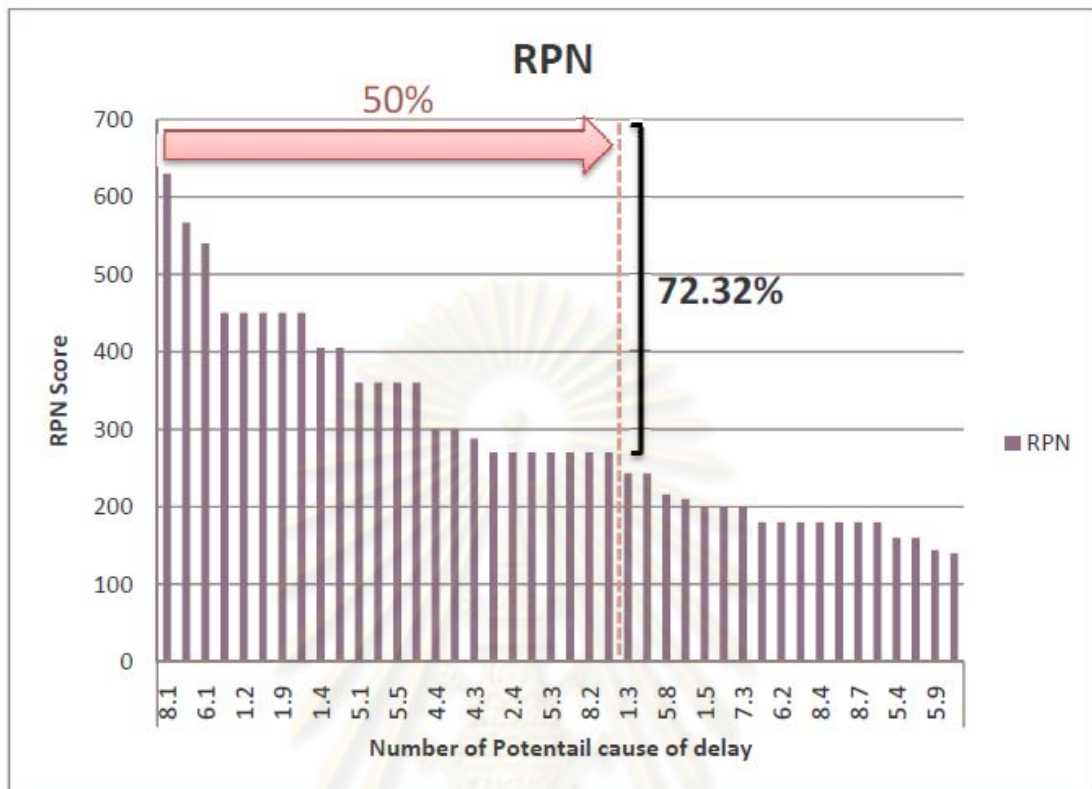
Figure 24 : Analysis of RPN

After analyze on the RPN, the summarize of the critical possible cause of delays shows in Table 34,

No.	Possible Effect	Possible Cause	RPN
8.1	Delay to ship part back	Supplier does not provide the Forwarder Acc	630
4.1	wrong part ship to supplier	pack too many part in the same time	567
6.1	delay to ship part back to supplier	Too many people need to approve	540
1.1	ship good component back to supplier	Carelessness from debug to analyze	450
1.2	ship good component back to supplier	Carelessness to check the history of the board and component level	450
1.7	delay to ship part back to supplier	Resource is not enough	450

1.9	delay to ship part back to supplier	Debug does not know which one is the urgent case	450
1.10	delay to ship part back to supplier	new hire employee	450
1.4	ship good component back to supplier	New hire employee	405
4.2	wrong part ship to supplier	wrong part picking from storage area	405
5.1	delay to get Return Material Authorization from Supplier	Does not know that supplier has a form to fill in	360
5.2	delay to get Return Material Authorization from Supplier	Contact to wrong channel	360
5.5	supplier cannot duplicate the failure and identify root cause	Less information on test step and test environment to supplier	360
8.5	supplier cannot analyze and perform failure analysis	packing team pack the wrong part	360
4.4	cannot ship part to supplier	Part does not identified as urgent and need to ship back to supplier	300
4.5	cannot ship part to supplier	lack of communication or unclear communication	300
4.3	this can create other failure and damage the component	ship the small quantity and does not have the proper package	288
1.8	delay to ship part back to supplier	Debug does not set priority for the urgent case	270
2.4	delay to ship part out	Debug and Analyzer does not understand well on the form	270
3.2	delay to sign loop for component movement to the right location	carelessness to set priority for the urgent case	270
5.3	delay to get Return Material Authorization from Supplier	Carelessness for alert on urgent case	270
5.7	supplier cannot duplicate the failure and identify root cause	Lack of technical information	270
8.2	supplier cannot analyze and perform failure analysis	carelessness to check the actual component after re-work	270
8.3	supplier cannot analyze and perform failure analysis	Carelessness to save-component while reworking	270

Table 33 : Critical potentail failure from analysis

The column no will refer to the Process number, the main of the potential cause which shows the high RPN can be summarize and analyze that which process is very need to take action to prevent that cause of delays.

Table 35 shows the number of critical potential failure which we had been analyzed which has a high RPN.

Process Number	Process Name	Responsibility	No.
Process 1	Debug Process	Debug Team	7
Process 2	Trigger/RPI	Debug & PQE	1
Process 3	MRR Create	Production	1
Process 4	Pack part Production	Production	5
Process 5	SQE communicate	SQE	5
Process 6	Raise RSN	Planner/Buyer	1
Process 7	Move part	Production	0
Process 8	ship part	shipping team	4
Total			**24**

Table 34 : Number of critical potential failure of each process

The Table35 shows that Debug Team, Production and SQE need to be take action due to it shows high number of process which creates the High RPN.

Due to we had already known on the potential root cause since we performed the FMEA process and calculate for the RPN to identify the potential affect and root cause which should take action. The action to reduce the occurrence and get the better detection need to be thinks about. Preventive action also identify by brainstorming, observation in the process by line tour. The main preventive action that we had already listed to prevent and reduce on occurrence consist of

- Training

For new hire and new member which have to learn about the ABC Company system, training for each department is necessary to help the new hire employee to know well on the ABC company system and reduce time to learn by themselves. Some training and flow chart will show in Appendix.

This training document also need the new hire employee knows on the customer application and customer product. It will help the new hire more

understand for all application of the board that they need to analyze and knowing well on the design.

- Creating the standard from and documents

The standard form and documents will help operators to cross-check and reduce on the human-error. It is also be a guideline. Due to every people does not know well on the component requirement and control. So, this guideline will be help for other people to take care the component more easily and reduce on the error for the handling.

It's also help for the new hire to follow the guideline. Everybody who does not know on the component and product also can handle the component which does not know in the same way and correctly. Example of the guideline will show in Appendix.

After analyze and identify on the action, the main action that we got is the training and various document. Because almost of critical potential failure depends on the human behavior which is difficult to control. The main corrective action and preventive action will help to cross-check and reduce on the human error.

Table36 is a summary action of each critical potential failure.

No.	Failure Mode	Possible Effect	Possible Cause	Action
8.1	Delay to ship part out	Delay to ship part back	Supplier does not provide the Forwarder Acc	agree to use our internal freight
4.1	pack wrong part	wrong part ship to supplier	pack too many part in the same time	Update WI to pack only one part in the time and create Checklist to ensure
6.1	Delay to ship part out	delay to ship part back to supplier	Too many people need to approve	Set up Guideline and only one person to approved
1.1	wrong component ship to supplier	ship good component back to supplier	Carelessness from debug to analyze	Set up guideline and process flow

1.2	wrong component ship to supplier	ship good component back to supplier	Carelessness to check the history of the board and component level	Set up guideline and process flow
1.7	Delay to identify the suspect component	delay to ship part back to supplier	Resource is not enough	set up training
1.9	Delay to identify the suspect component	delay to ship part back to supplier	Debug does not know which one is the urgent case	Using the internal system to alert
1.10	Delay to identify the suspect component	delay to ship part back to supplier	new hire employee	set up training
1.4	wrong component ship to supplier	ship good component back to supplier	New hire employee	set up training
4.2	pack wrong part	wrong part ship to supplier	wrong part picking from storage area	Update WI to pack and create Checklist to ensure
5.1	Delay to get RMA	delay to get Return Material Authorization from Supplier	Does not know that supplier has a form to fill in	set up guideline
5.2	Delay to get RMA	delay to get Return Material Authorization from Supplier	Contact to wrong channel	set up guideline
5.5	supplier cannot duplicate the failure	supplier cannot duplicate the failure and identify root cause	Less information on test step and test environment to supplier	set up guideline
8.5	wrong part ship to supplier	supplier cannot analyze and perform failure analysis	packing team pack the wrong part	Update WI to pack and create Checklist to ensure
4.4	non-standard packing	cannot ship part to supplier	Part does not identified as urgent and need to ship back to supplier	Using the internal system to alert
4.5	non-standard packing	cannot ship part to supplier	lack of communication or unclear communication	set up guideline
4.3	non-standard packing	this can create other failure and damage the component	ship the small quantity and does not have the proper package	set up guideline

1.8	Delay to identify the suspect component	delay to ship part back to supplier	Debug does not set priority for the urgent case	Using the internal system to alert
2.4	Delay to ship part out	delay to ship part out	Debug and Analyzer does not understand well on the form	set up training
3.2	Create MRR slowly	delay to sign loop for component movement to the right location	carelessness to set priority for the urgent case	Using the internal system to alert
5.3	Delay to get RMA	delay to get Return Material Authorization from Supplier	Carelessness for alert on urgent case	Using the internal system to alert
5.7	supplier cannot duplicate the failure	supplier cannot duplicate the failure and identify root cause	Lack of technical information	set up guideline
8.2	ship damage part to supplier	supplier cannot analyze and perform failure analysis	carelessness to check the actual component after re-work	set up guideline and checklist
8.3	ship damage part to supplier	supplier cannot analyze and perform failure analysis	Carelessness to save-component while reworking	set up guideline and checklist

Table 35 : Action for critical potential failure mode

After taking action, it improves on the occurrence and creates the detection to detect the possible cause of delay. The next process is re-scoring for the occurrence and detection to see the new RPN.

Table37 shows the new occurrence and detection after implementing and shows on the new RPN.

No.	Possible Effect	Possible Cause	Severity	Occurrence	Detection	RPN (n)
8.1	Delay to ship part back	Supplier does not provide the Forwarder Acc	9	1	1	9
4.1	wrong part ship to supplier	pack too many part in the same time	9	2	5	90
6.1	delay to ship part back to supplier	Too many people need to approve	9	1	3	27

1.1	ship good component back to supplier	Carelessness from debug to analyze	9	3	9	243
1.2	ship good component back to supplier	Carelessness to check the history of the board and component level	9	3	6	162
1.7	delay to ship part back to supplier	Resource is not enough	9	3	9	243
1.9	delay to ship part back to supplier	Debug does not know which one is the urgent case	9	2	3	54
1.10	delay to ship part back to supplier	new hire employee	9	3	9	243
1.4	ship good component back to supplier	New hire employee	9	3	9	243
4.2	wrong part ship to supplier	wrong part picking from storage area	9	2	6	108
5.1	delay to get Return Material Authorization from Supplier	Does not know that supplier has a form to fill in	9	2	9	162
5.2	delay to get Return Material Authorization from Supplier	Contact to wrong channel	9	2	9	162
5.5	supplier cannot duplicate the failure and identify root cause	Less information on test step and test environment to supplier	9	2	5	90
8.5	supplier cannot analyze and perform failure analysis	packing team pack the wrong part	9	2	5	90
4.4	cannot ship part to supplier	Part does not identified as urgent and need to ship back to supplier	10	2	3	60
4.5	cannot ship part to supplier	lack of communication or unclear communication	10	2	5	100

4.3	this can create other failure and damage the component	ship the small quantity and does not have the proper package	9	2	5	90
1.8	delay to ship part back to supplier	Debug does not set priority for the urgent case	9	2	3	54
2.4	delay to ship part out	Debug and Analyzer does not understand well on the form	9	3	9	243
3.2	delay to sign loop for component movement to the right location	carelessness to set priority for the urgent case	9	2	3	54
5.3	delay to get Return Material Authorization from Supplier	Carelessness for alert on urgent case	9	2	3	54
5.7	supplier cannot duplicate the failure and identify root cause	Lack of technical information	9	2	5	90
8.2	supplier cannot analyze and perform failure analysis	carelessness to check the actual component after re-work	9	2	5	90
8.3	supplier cannot analyze and perform failure analysis	Carelessness to save-component while reworking	9	2	5	90

Table 36 : Re-scoring of critical potential failure

After taking action and re-scoring, the new RPN had been calculated to analyze on the effective of the corrective and preventive action that we had already implemented in each critical potential failure.

Figure25 show the comparison between old RPN after taking any action and new RPN. This will help us to know on the effective of the corrective and preventive action that we implement and show how much of improvement.
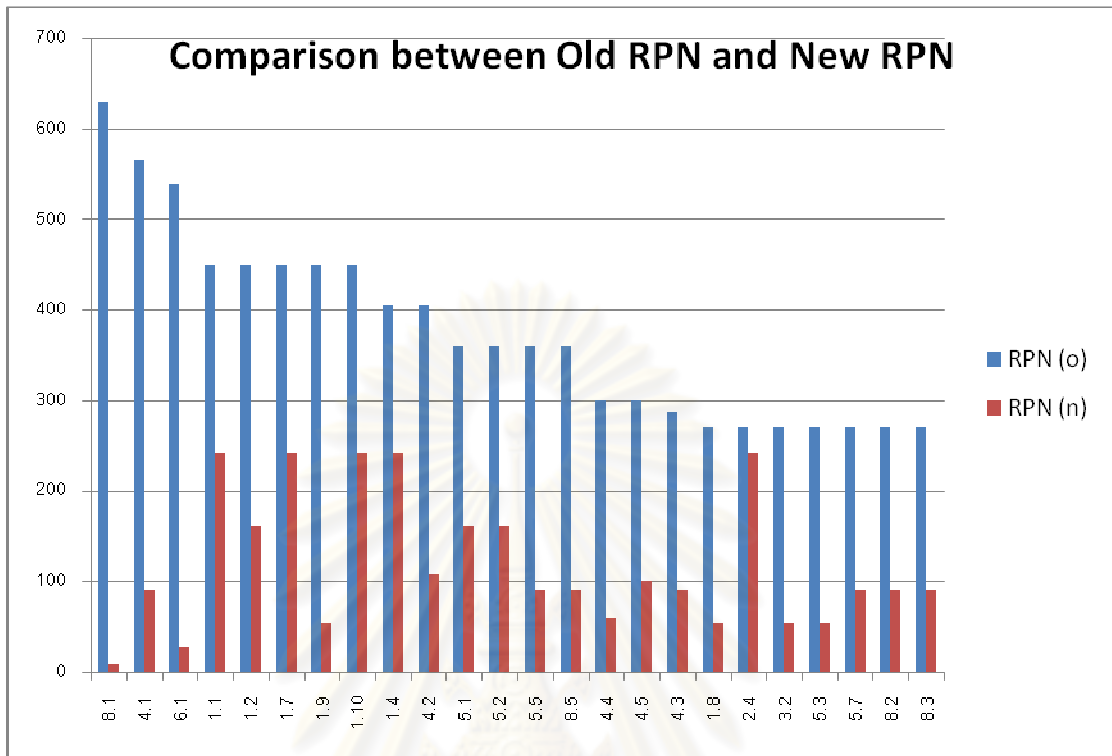
Figure 25 : Comparison between old RPN and New RPN

After we rescoring, we need to analyze the percentage of improvement on each RPN to check that how much of improvement that we got after take the corrective and preventive action.

We are calculating percentage of corrective by using the formula

Corrective Percentage = $\dfrac{\text{RPN (o)} - \text{RPN (n)}}{\text{RPN (o)}}$

After re-scoring the new RPN shows not over than 250. This means all critical potential failure reduce to the RPN which does not require taking any corrective action. After all the new RPN is calculated, comparing the old and the new RPN into percentage will shows as table38

No	Failure Mode	Possible Effect	Possible Cause	RPN (o)	RPN (n)	Corrective Percentage%
8.1	Delay to ship part out	Delay to ship part back	Supplier does not provide the Forwarder Acc	630	9	98.6%
4.1	pack wrong part	wrong part ship to supplier	pack too many part in the same time	567	90	84.1%
6.1	Delay to ship part out	delay to ship part back to supplier	Too many people need to approve	540	27	95.0%
1.1	wrong component ship to supplier	ship good component back to supplier	Carelessness from debug to analyze	450	243	46.0%
1.2	wrong component ship to supplier	ship good component back to supplier	Carelessness to check the history of the board and component level	450	162	64.0%
1.7	Delay to identify the suspect component	delay to ship part back to supplier	Resource is not enough	450	243	46.0%
1.9	Delay to identify the suspect component	delay to ship part back to supplier	Debug does not know which one is the urgent case	450	54	88.0%
1.10	Delay to identify the suspect component	delay to ship part back to supplier	new hire employee	450	243	46.0%
1.4	wrong component ship to supplier	ship good component back to supplier	New hire employee	405	243	40.0%
4.2	pack wrong part	wrong part ship to supplier	wrong part picking from storage area	405	108	73.3%
5.1	Delay to get RMA	delay to get Return Material Authorization from Supplier	Does not know that supplier has a form to fill in	360	162	55.0%
5.2	Delay to get RMA	delay to get Return Material Authorization	Contact to wrong channel	360	162	55.0%

		from Supplier				
5.5	supplier cannot duplicate the failure	supplier cannot duplicate the failure and identify root cause	Less information on test step and test environment to supplier	360	90	75.0%
8.5	wrong part ship to supplier	supplier cannot analyze and perform failure analysis	packing team pack the wrong part	360	90	75.0%
4.4	non-standard packing	cannot ship part to supplier	Part does not identified as urgent and need to ship back to supplier	300	60	80.0%
4.5	non-standard packing	cannot ship part to supplier	lack of communication or unclear communication	300	100	66.7%
4.3	non-standard packing	this can create other failure and damage the component	ship the small quantity and does not have the proper package	288	90	68.8%
1.8	Delay to identify the suspect component	delay to ship part back to supplier	Debug does not set priority for the urgent case	270	54	80.0%
2.4	Delay to ship part out	delay to ship part out	Debug and Analyzer does not understand well on the form	270	243	10.0%
3.2	Create MRR slowly	delay to sign loop for component movement to the right location	carelessness to set priority for the urgent case	270	54	80.0%
5.3	Delay to get RMA	delay to get Return Material Authorization from Supplier	Carelessness for alert on urgent case	270	54	80.0%

5.7	supplier cannot duplicate the failure	supplier cannot duplicate the failure and identify root cause	Lack of technical information	270	90	66.7%
8.2	ship damage part to supplier	supplier cannot analyze and perform failure analysis	carelessness to check the actual component after re-work	270	90	66.7%
8.3	ship damage part to supplier	supplier cannot analyze and perform failure analysis	Carelessness to save-component while reworking	270	90	66.7%

Table 37: Percentage comparison beteen old and new RPN

To check on the improvement after implement the preventive action, the percentage shows that it help to improve the potential delay process around 68.37%. This number shows the percentage to reduce the potential cause of delay and wrong part ship back to supplier which waste a lot of resource to solve on the wrong part ship.

3.4.5 Define details of agreement.

Once we publish the customer requirement and supplier needs to follow. Some supplier process has already met the failure analysis turnaround time already but some still cannot meet the target due to their internal process. So, some topics need to discuss and define the scope.

As below table, we also including for the Return Material Authorization from supplier. Without RMA, material cannot return back to supplier. This is agreement for an urgent case that they need to provide the RMA# to return material within 24 hrs. Then it will be our side to expedite the process to meet customer target as above flow chart and timeline.

For supplier site, time will start counting once part had been received at supplier site. Supplier need to response within 24 hrs for the initial response. This is exclude component as Ball Grid Array (BGA) due to supplier need time to re-ball before testing. For BGA, time will start count once they complete re-ball process.

Although BGA will start count later than normal, timeline and committed date for re-ball still required.

For both initial response and preliminary failure analysis, the report does not require but need the update on failure analysis progress per customer requirement. Document can wait until final report as 8D.

Almost supplier can provide the RMA# within 24 hours and also can meet the customer requirement for initial response and preliminary report after discussed that they can provide as an e-mail update and some picture of the Curve trace, data testing, optical image, and etc.

3.4.6 Monitor status and modify strategies.

To monitor on the status, the web tracking had been created for monitoring supplier performance especially for the Quality support. This web tracking also can generate that matrix which can use for submitting to customer to review as weekly. For each items, customer will set up weekly meeting to discuss and follow up in every Wednesday.

This web tracking consist of

1. Customer tracking

2. Internal tracking failure information

3. RMA/FA sample shipment tracking

4. Supplier FA and RC analysis

5. NDF return tracking

6. Performance FA TAT

7. Report

Figure26 show the front page of the action tracker on web which help to tracking the status of each failure and can export into the excel form for report to the customer. The entire customer requirement items which identify and specific into this webpage.

Figure 26 : Tracker action page

This tracking report does not use only for reporting to customer, it also use for remind the case and tracking for the supplier performance on the Failure Analysis Turnaround time as the circle.

This tracking will keep the record on the case for our internal as figure 27, the benefit to share the report to team is when one person on leave, the other still can follow up and know on the history of the case from the detail in the report that we fill in.

Export Edit	Action Log No.	Priority	Status	CTH-SQE	MRR Disposition Aging
□	11000001	High DPPM At Manufacturer	Cancel	Pornthip Chengsuebsant	0
□	10000062	N/A	CM-SQE	Cherdchai Jungsathitkul	0
□	10000061	N/A	CM-SQE	Cherdchai Jungsathitkul	1
□	10000060	N/A	CM-SQE	Cherdchai Jungsathitkul	0
□	10000059	N/A	CM-SQE	Cherdchai Jungsathitkul	1
□	10000058	N/A	CM-SQE	Cherdchai Jungsathitkul	1
□	10000057	N/A	CM-SQE	Cherdchai Jungsathitkul	0
□	10000056	Line fallout	CM-SQE	Amnat Boonchit	0
□	10000055	Line fallout	CM-SQE	Amnat Boonchit	0
□	10000054	N/A	CM-SQE	Cherdchai Jungsathitkul	5
□	10000053	N/A	CM-SQE	Cherdchai Jungsathitkul	0
□	10000052	N/A	CM-SQE	Cherdchai Jungsathitkul	1
□	10000051	High DPPM At Manufacturer	CM-SQE	Pornthip Chengsuebsant	

Figure 27 : Action tracker record

As said earlier, this tracker also can generate report in the excel file for sending to customer for review case. This action tracker also can export the report which can be selected by customer, by creator, by vendor and etc which shows in figure28.

Figure 28 : Action Tracker report

For our internal triggering the problem, we are using the tool in lotus note which we call "Request Problem Investigation" or "RPI". Below figure shows the RPI format that we using for alert team and keep the record in database for reference and traceability for our internal. This RPI also is a one preventive action that we're using for preventing on the miscommunication on the urgent case. It's help to prevent the miscommunication because after submitted RPI, it will generate automatic e-mail to concern person. The example of automatic e-mail shows in Appendix.

Due the RPI database does not allow the external to access, so the action tracker which had already explain in earlier have to been created to keep the necessary information which need to provide to customer for every case. This excel file had been separated into 4 section as

1. Customer tracking

2. Internal tracking failure information

3. RMA/FA sample shipment tracking

4. Supplier Failure analysis and Root cause analysis

All information that we are tracking in each sections had been shows in Table 39-41. This information will use to monitor the supplier performance due to almost supplier is customer control which ABC company does not have authorize to disqualify. This tracking report will also monitor on the time which customer requirement on the urgent case and normal case. All information will be prepared to customer to score the supplier score-card with accurate information.

This report information in each section also needs to discuss with customer before running the action tracker on web. All information that customer need should be add-in, so this report also get approve from customer to use and report to them.

CPAT#	Priority	P/N	Supplier Name	Defect Qty.	Qty Use for problem lot	DPPM	Failure Description	Containment Action	Root Cause	Corrective Action	CTH-SQE	Cisco CE	Date feedback Cisco CE
	NPI	15-12321-01OT	Wintegra	1	9.00	111,111.00	BGA U4 PIN A18 LOAD PIN A2 (GND) IN COMPONENT = 19.2 OHMS (NORMAL = 30 KILO OHMS)	Ship part to supplier to verify failure	Under investigate ,	Waiting Supplier result	Jaruek No.	na	

Table 39: Customer tracking information

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

MRR	MRR Register Date	MRR Disposed	SCAR	RPI	Purge	Commodity	CLB P/N	MFG p/n	Part description	Supplier Name	BU	Model	Defect Qty.	Qty Use for problem lot	DPPM	CTH Batch#	Failure Station	Failure Description	D/C, L/C,S/N	Containment Action
224967	11/5/10	11/9/10	no	22148	no	IC	15-123.21-01CT	WIN847W6 MFFI-250A1	IC MICROPROCESSOR WIN847W6 MFFI-250A1 BGA.	Wintegra	ECS SBU	ASY, EL MECH PURA-C	1	9	111.111	000753 8857	ICT	BGA UA PIN A18 LOAD PIN A2 (GND) IN COMPONENT NT = 19.2 OHMS (NORMAL = 30 KILO OHMS)	1.029	Ship part to supplier to verify failure

Table 40 : Internal tracking information

RMA/FA sample shipment tracking				Supplier FA and RC analysis							
RMA	AWB tracking	Sample return date	ETA date	Prelim FA date	Final FA date	Final FA result	FA TAT	Root Cause	Corrective Action	Status	Remark
RMA#W104601	##########	11/12/10	11/15/10	Pending	Pending	Pending		Pending	Pending	Open	

Table 41 : RMA and FA sample tracking and supplier FA and Root cause analysis tracking

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จุฬาลงกรณ์มหาวิทยาลัย

Chapter IV

Result of Supplier assessment and supplier development

4.1 Result of Supplier assessment

After qualified, this new supplier can support per our requirement. The benefits from the new supplier can listed as below,

<u>Shipment time</u>

Shipment time decrease more than 99% due to shipment arrangement to Singapore need to process approximate around 2 days. 1st day for our internal process to arrange shipment and 2nd day for the 3rd party to pick up part and will deliver to destination around 1 day from Thailand to Singapore. This new local supplier can support to bring part from company and use approximate time around 30 minutes due to they will send their people to pick up part by themselves.

<u>Shipment cost</u>

Shipment cost from Thailand to Singapore is around 1600 Bath. If we transfer component local, the local service company charge the shipment cost 250 Bath per times which reduce the shipment cost 84%.

Figure 29 : Estimate shipping cost calculate by FedEx website

Shipment cost 250 Bath due to the local service company including on the custom clear document and they will sent their people to pick up part by themselves.

First Article test running

This supplier can support for First Article run while any other cannot support on this base on shipment time and cost concerning. This is the things that we gain 100% benefits from local supplier. This is for initial testing on the programming part which let us to be ensure that the programming is correct and does not concern for the application of the product.

This also can let us to ensure on the packaging and handling of the service company. We also can check for the MSD and ESD concern from the FA component back to service company before release PO for the bigger quantity.

4.2 Important factors in running supplier assessment

For the successful of the supplier assessment, the important factors which make this supplier assessment successes are concludes as below,

- **Good Support from management**

In term of new supplier selection, the support from management is the main key success, because to access and adding the new supplier into the listed is require involvement of many teams related in company. If there is no support from management, this new supplier selection cannot be completed and adding in the Approved Vendor list of our company as today.

- **Good Audit teams**

During audit process, audit teams are the key persons who known well in each process to verify and observation to ensure that all process will be meet the company's and including our customer's requirement. The person whom be selected are the keys person to decide and rating for this company and will be the key on the Quality topic which is one of the key point of the supplier selection. If we do not have a good audit team, the audit process will not running smooth and ensure for the company on the Quality control of this new supplier.

- **Good knowledge Management**

In term of Auditing supplier, if we do not have the knowledge on their product, we will not comment and advise them for improvement and observe for the non-conformance or weaken area. We have a good team which have a good knowledge for the IC programming flow and also tape and reel process. This made we found a lot of observation which is a good point for this service company to improve and get a lot of good recommendation from our knowledge and experience from person who known well on each point.

- **Good communication both internal and external**

To running the new supplier selection, communication is the way to run and transfer work to relate teams in our internal and also need to communicate to the new supplier for prepare for audit and visit many times. Clear communication helps our internal to clear on the time setting, prepare for audit both our internal and supplier site. Good communication will help this supplier selection process run efficiently.

4.3 Result of supplier development

After implement the supplier development process flow and timeline for each department to support for customer's requirement. Customer is also monitoring on the agreement and performance. This data logging needs to be share to customer for review that we can meet theirs requirement or not. This data logging will be discussed in the weekly meeting with our customer.

This supplier development also helps our internal improvement on the shipment process and analyzing process step to meet on the customer requirement through FMEA. This analysis shows that we got the 68.3% to reduce the potential failure of delay and wrong part ship to supplier. We also create the timeline for our internal process flow and work instruction to meet the customer requirement which help to expedite along the chain for critical events.

For the actual events that we're tracking and monitoring, the average timeline for normal we are using 5 working days to process shipment. This opportunity helps us to expedite and reduce time for shipment process to meet customer requirement which is 2 working days. This helps us to improve on the shipment process around 60% than normal.

Customer is very satisfaction on our supporting and we also got the Recognition and EMS Operational Supplier of the Year Award. This is can proof that this supplier development can make supplier more satisfy on our service and support.
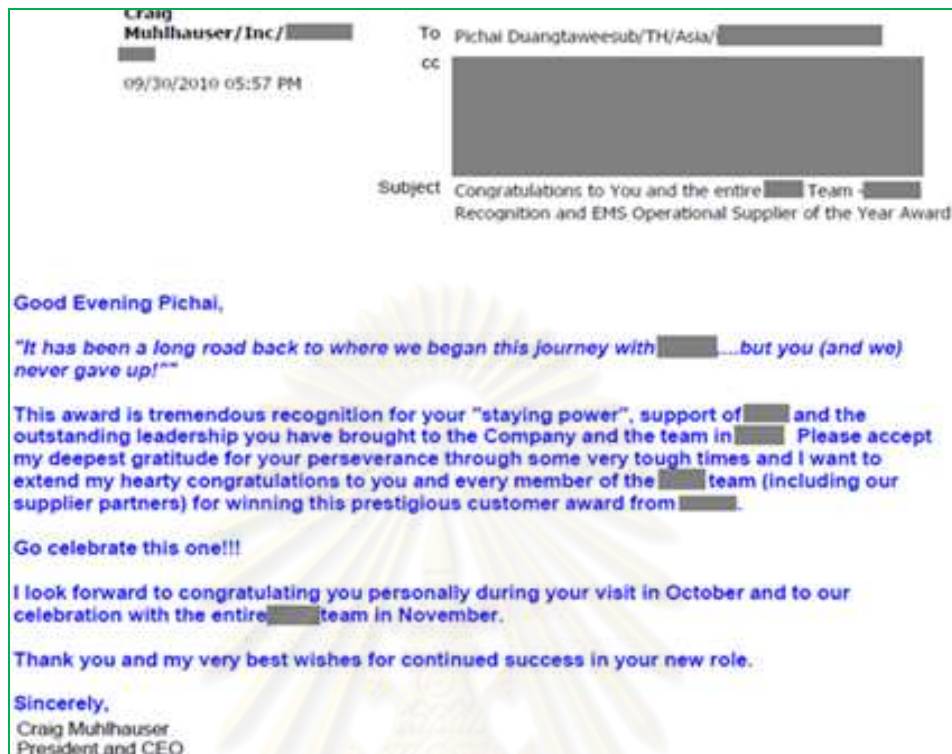
Figure 30 : E-mail recognition and EMS operational supplier of the year award

4.4 Important factors in running supplier development

In running for supplier development project, the key factors which make this project successful are listed as below,

- **Good support from management**

Management is the key person who helps to drive the man-power in his/her department to understand and pay attention for the customer requirement. Due to this may need to skip FIFO (First in First Out) job to do on this catastrophic job. If no support from management, the new process and expediting for every process will cannot be complete due to need to set up the key person for each process in case of urgent to contact with.

- **Good brainstorming among team**

To get the good team and brainstorming to get the suitable flow chart which can be a flow and get the specific time line for each concern persons. A good flow and time line which crate to support on this job is the key things to drive the good result and let the department knows well on their own jobs.

For good brainstorming among team it is also include for the FMEA process that need to get a lot of brainstorming to identify on the potential root cause and create on the preventive and corrective action. The success of improvement is possible because of good brainstorming from team.

- **Good communication both internal and external**

This project needs a lot of people in each department to support for meeting the customer requirement. Good communication is one factor which leads this project keeps running smoothly and makes the things meet the customer requirement for the Failure Analysis Turnaround time. Good communication need for one department to other department and still need to work as a team. Concern people need to know that which case is catastrophic case and need to pay attention for this urgent case.

The good communication makes concern people understand for the flow that we are setting up together as guidance for this project and each concern person also knows well for timeline of each department.

For the external communication, it makes the all supplier that we are contacting with understand and knows for our requirement. This is leading some suppliers to improve on their Failure Analysis turnaround time and considering on the time to support. It also needs the good communication to let them know that which cases are the catastrophic cases which need their truly attention and need more support.

This good communication does not only need for the agreement on Failure analysis turnaround time, but also need to explain the failure symptoms that we are facing here to let them point out on the suspected root causes which create the failure. A lot of details need to be included for them and good communication is needs for the limited time on this project.

Chapter V

Conclusion and Recommendation

5.1 Conclusion

The new supplier selection for Service Company is initiated from the incoming inspection problem due to part wrong package which cannot be use immediately after part received because of limited of the Minimum Order Quantity and IC programmed need to be out-sourced because of cost reduction on the fixture and software programmed which need to be invested. Normally for EMS Company, supplier will be selected by OEM customer. The selection process is not performing and almost electronic part is on-shelf part which requires only the document audit. So, this is a good chance to develop the supplier selection process for the service company.

In the beginning of the supplier selection process, all information of the company that you need to be a partnership in the future is necessary. Good partner will help company to gain more competitive advantages. To get the reliable supplier, it helps company to improve on cost, time, quality and delivery. Supplier information is necessary to make decision for long-term relationship. The tools and techniques were researched and the details of the supplier were studied. Many useful tools that were used in the discussion in supplier selection are pre-survey, process mapping, use of flow chart, checklist, worst practice and best practice. The tool that is being used for supplier assessment is the Checklist, which is a main tool that will help for supplier selection process and ensure on the capability, quality and technology.

After the study of the tools and techniques concerning supplier selection, all the information concerning the project is given. Supplier that we will go to audit is located in same province. This supplier can support for both programming part and re-packaging. Because of nearly location, it will increase the speed of shipment and reduce on shipment cost as well.

The process of programming part and re-packaging can be separate as 13 process steps as receiving, inventory, derolling, device reprocessing, programming, testing, product identification, in-process inspection, inspection, dry bake, tape and

reel, dry pack and shipping. After analyze on the process flow, the identification that need to focus can be separate into 8 topics as component/device control, Programming Operation, Product Identification/Logistic Control, ESD/Moisture Control Handing, Quality Systems, Quality Control of IQA-OQA, Problem Analysis and Corrective Action and Customer Satisfaction.

The audit process will be done using audit teams and meetings to discuss about the critical process and topic. The audit team will consist of the entire key person which known well in each step as quality, quality system and program IC team. The supplier selection process will be done in 4 steps, which are gathering information, pre-audit meeting, perform audit and initial test which is summarize as figure31.

	ww1	ww2	ww3	ww4	ww5	ww6	ww7	ww8	ww9	ww10	ww11	ww12	ww13	ww14
Gathering information														
study process														
supplier visit														
set-up plan														
set-up team														
Pre-audit meeting														
Identify critical process														
Create Checklist														
Audit Schedule														
Perform audit														
Audit Scoring														
Audit Report														
Follow up Audit result														
Initail test														
Readiness checking														
First Article Run														
First Article Result														
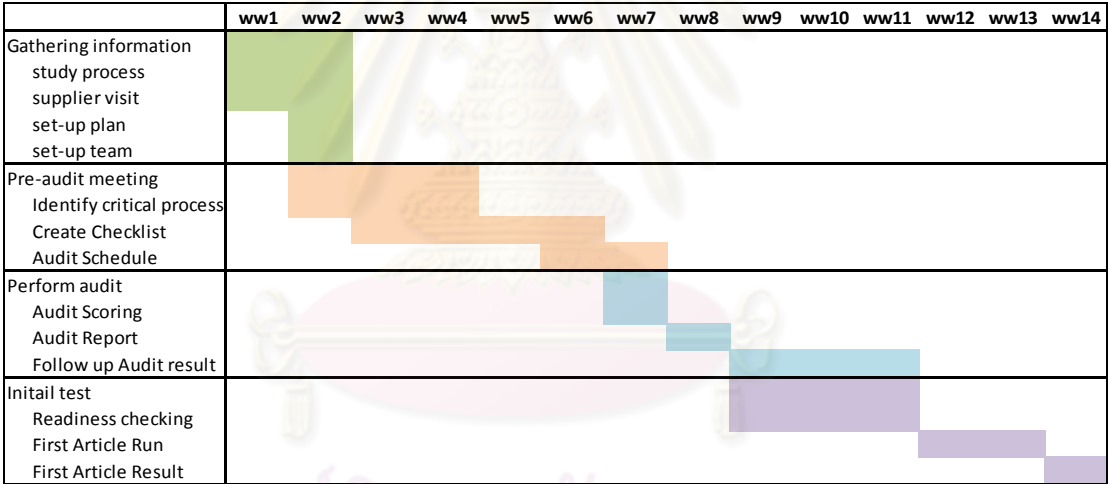
Figure 31 : Schedule for supplier selection

These meetings were set for the supplier audit team, which consist of 7 people, which are three quality people, one quality system which known well on the standard that had been use in the electronic company and three IC programming which known well on the program IC process and have many experience to cross-check that the program which program into IC is correct. These people were selected to be in the audit team to analyze process and perform audit. The people chosen will be responsible to some part of the process in every aspect to gain the best insight of the weaken point and some area which can improvement in each process.

The critical processes that need to be focused is separated into 8 processes, which can be summarized as follow:

1. Component/device control

2. Programming Operation

3. Product Identification/Logistic Control

4. ESD/Moisture Control Handling

5. Quality Systems

6. Quality Control of IQA-OQA

7. Problem analysis and Corrective Action

8. Customer Satisfaction

The weaken point and focus point of each process can be determined by considering from brainstorming and experiencing which summarize as a worst practice and best practice to create a checklist of process by process. After discussion and analysis using some techniques and tools, the checklist had been created and cross-check by quality manager and internal auditor to use for performing audit. After audit and scoring of each process, the scoring can be using for clarified and analyze on capability. This scoring will help for monitor and focus on the process which should be improved and developed supplier. Audit report had been create to set-up the timeline for supplier to improve and develop at the same point and meets the company's requirement. After supplier improve for all concern points that had been agreed in the audit report, the initial-test step had been done to ensure that the all improvement had been effective and does not create any risk in the process.

For the local supplier selection, it helps company to eliminate waste for the transferring component, costing and also give a chance to running the First Article in a small quantity to ensure on the programmed. We also gain benefits in term of audit process in case that we found the quality issue. We also go to audit for their corrective action to ensure on their improvement process which will prevent the same failure that we found. This will let us get the reliable partner in long-term and we can out-

source our non core competency to outsource and focus more on our core competency which is Print Circuit Board Assembly.

In conclusion, Local supplier can improve both shipment time and cost more than 80% as shows in figure32 and also let us focus more on our process. We will get the reliable supplier who meet for all company's requirement and also get the solid partner through the supplier selection process.
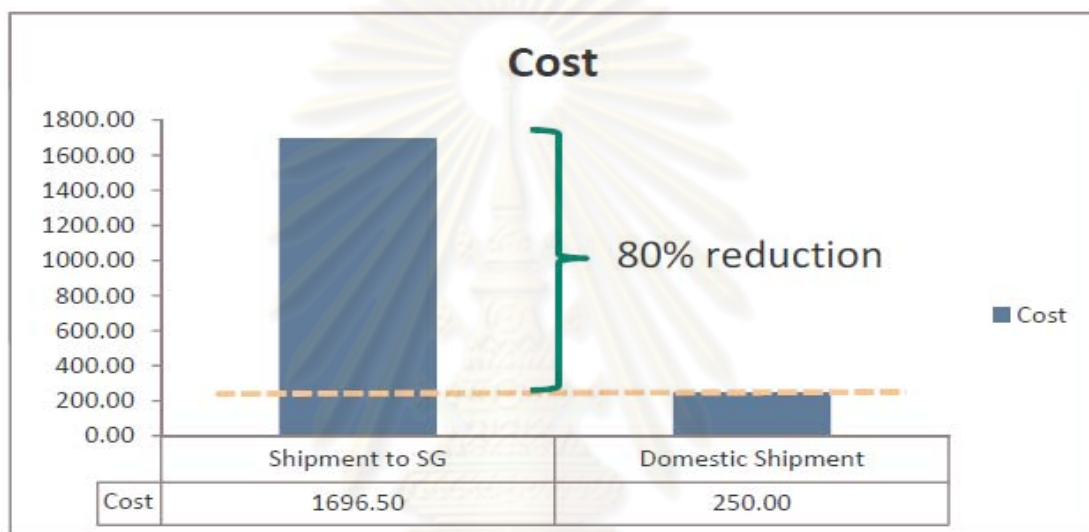
Figure 32 : Cost comparison between domestic and SG

Supplier Relationship Management does not focus on supplier selection only but supplier selection is the first step for the supplier relationship management. To select the right supplier in the first time, it helps to make a relationship in a long-term to gain benefits and advantages from each others. In long-term relationship, supplier development process is also necessary to maintain relationship to support each others.

Supplier development that focuses on this project is Failure Analysis Turnaround Time. This point will improve for our internal process to reduce any delay to meet the customer requirement on Failure Analysis Turnaround time. The priority of failure analysis is separated into 2 cases, which are urgent case and normal case. The urgent case will be identified as catastrophic, potential safety issue, line stop, stop ship and customer requests. For the urgent case, customer sets up very tight time-line to get the root cause and take action for solving the problem due to the big impact of the failure. With a small time frame, one delay delivery back to supplier can

delay the problem solving, which can affect the production and shipment to customer. This is why failure analysis turnaround time improvement is needed.

In the beginning, all the tools and techniques were researched and the details of potential cause of delay were studied and presented. These tools and techniques are very helpful during the discussions about the potential cause of delays. Many useful tools that were used in the discussion in cause of delay identification as use of flow chart, use of surveys and use of worst practice and best practice. The tool that is being used for analyze potential cause of delay is the tool FMEA. The type of FMEA used will be process FMEA, which means that the process to ship part back to supplier will have to be separated out to be analyzed process by process.

The FMEA is the analyzing tool of the failure mode which link to the potential root cause which create the failure mode in each process. To analyze the affected level, the Risk Priority Number (RPN) consists of 3 variables, which are Severity (S), Occurrence (O) and Detection (D) rating from 1-10, need to be analyzed. The RPN calculated by multiplying these 3 variables. This score can be used to analyze the process which need to be improved and response with suitable actions.

The process to ship part back to supplier can be separated into 8 steps as shows in table42, which are debug confirmed fail, Trigger for Failure analysis and Issue document, create document for part movement, packing and create shipping document, contact supplier, prepare part for shipment, move part and ship part out.

Process Number	Process Name	Responsibility
Process 1	Debug Process	Debug Team
Process 2	Trigger/RPI	Debug & PQE
Process 3	MRR Create	Production
Process 4	Pack part Production	Production
Process 5	SQE communicate	SQE
Process 6	Raise RSN	Planner/Buyer
Process 7	Move part	Production
Process 8	ship part	shipping team

Table 42: shipment process step

The FMEA process will be done using collaboration teams and meetings to discuss about the potential cause of delay. The collaborated team will consist of debug, Process Quality Engineer (PQE), Customer Quality Engineer (CQE) production, Supplier Quality Engineer (SQE), planner/buyer and shipping team. The process will be done in 4 steps, which are failure-cause identification, failure-cause relationship, failure assessment and allocation of failure sensitivity, preventive actions and finally failure re-assessment.

The potential cause of delay of each process can be determined by discussion, brainstorming and analysis using some tools and techniques, the total number of potential cause of delay is 44 potential cause of delay in total. After the scoring of severity, occurrence and detection, the RPN can be calculated and analyze. To allocate the critical potential cause of delay according to the sensitivity, Pareto analysis is used. There are in total of 24 potential cause of delay which needs to be prevented. To prevent all the 24 critical potential cause of delay, team analyzed the cause by using 5's why for analyze cause of delay. After analyzed on the root cause, preventive actions need to be discussed and summarize into 3 acts to prevent these critical potential cause of delays. Therefore, the preventive actions that were plan out to be implemented will cover more than one critical risk. The preventive actions can be summarized in to the following:

- **Preventive action number 1**: Training
- **Preventive action number 2**: Creating standard forms and documents
- **Preventive action number 3**: Creating guideline for various process

After the preventive action analysis, all of the critical risks will have to be rated again and see the difference in result of the before and after effect of the preventive actions that influence the RPN of the risks. Comparing the new and the old RPN, the difference in the two scores is approximate 70% difference. Monitoring result after taken preventive action has been done and data shows in appendix for the shipment time improvement from 5 days to 1 day which improves around 80%.

However, to push supplier to improve on failure analysis time is very difficult due to suppliers have been controlled by OEM. In this point, OEM also gives a hand

to discussed and set agreement with supplier to support for urgent case. Nevertheless, supplier survey has been used to inform all of supplier for the turn-around time requirement. The supplier survey had been shown in Appendix. It will shows only a sample due to it contains some confidential. This survey had been done for almost 50 suppliers to ensure that all suppliers had already known on the customer requirement and have a plan to improve on their failure analysis turnaround time.

Although we cannot completely control at supplier side due to almost supplier controlled by OEM, the monitoring on the failure turnaround time had been create to support customer and ensure the effectiveness of supplier improvement. The form that will calculate since the date the failure had been informed to supplier and will track for every step of response from supplier. This will help customer get the accurate information on the supplier performance.

After implement the new process to support on the urgent case and improve on FA turnaround time, we get the award from our customer and from the company surveys, customer also ranking us as a top EMS when comparing with other EMS company. They also do more business with our company and set up the Failure Analysis Center at our company and also assign our people to be a contexture and working for them. We also create the tools for monitoring on the supplier performance with the accurate information and this will be a good evidence to discuss with customer for discussion.

In conclusion, to improve on failure analysis turnaround time which we need to get the customer satisfaction. This is quite success to get the customer satisfaction and we also have a chance to improve for our internal process to expedite and eliminate waste which make the process delay. This also helps us to improve supplier on their response time and process. If the process can complete as fast as possible, the problem will can be fix fasten and it can reduce for risk and cost of failure.

Supplier Relationship Management consists of Supplier selection, supplier assessment, supplier qualification, supplier score-card, supplier development and supplier monitoring which shown in figure33.
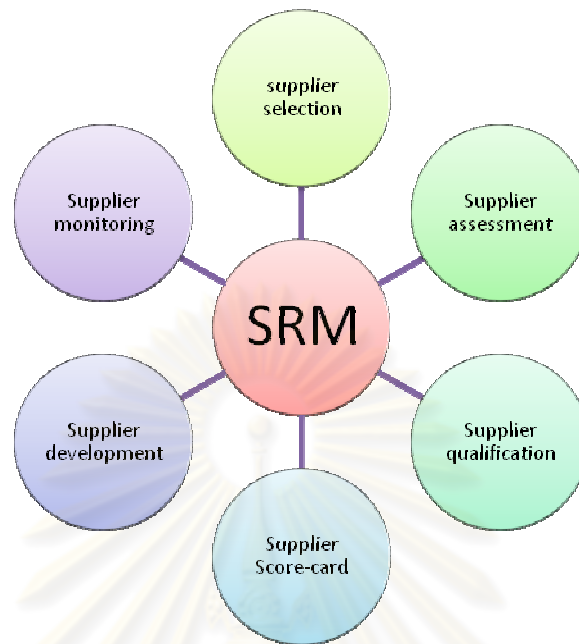
Figure 33 : Supplier Relationship Management

Suppliers Relationship Management that have been done will help to improved on 3 factors are quality, cost, and time. The improvement that have been seen after implement the supplier relationship management were summarized as below,

Quality: To measure quality, the yield tracking is used to ensure that we got the reliable supplier that should be contract as a long-term. The yield report in figure 34 shows that we got the reliable supplier from a good audit and qualification process. While yield drop, supplier development will help to push yield back to the right place and give a opportunities to supplier for improvement.

Final Pass Yield %

Month	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total Prog Qty	66	4427	2653	28196	990	6575	1980
Final Passed Qty	66	4389	2653	28190	989	6575	1980
Total Rejected Qty	0	38	0	6	1	0	0
Final Pass Yield %	100.0%	99.1%	100.0%	100.0%	99.9%	100.0%	100.0%

unit=ea
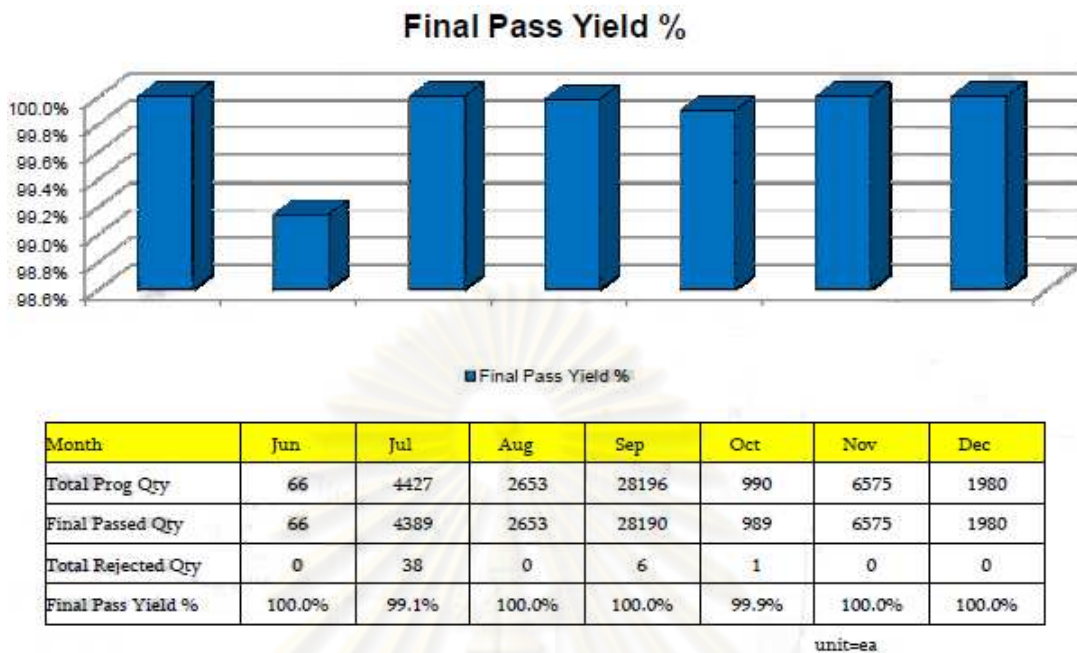
Figure 34 : Yield monitoring report

Cost: From both supplier selection and supplier development will help to reduce on delivery cost. For supplier selection, delivery cost can reduce around 80%. Supplier development and our improvement process will help to reduce on rework cost. If we can know faster on the root cause, the failure can be detect more fasten and can help for solving before the failure create more over and over. The preventive action from the supplier development will prevent wrong part shipped back to supplier. This wrong part ship will waste for both time and cost for shipment. After tacking corrective action and improvement via FMEA, wrong part ship also reduce the frequency around 80%.

Time: As explain earlier in cost improvement, the time delays to ship part is improving more than 80% and reduce from 5 days to 1 day. For the supplier selection that we get the local supplier, time for shipment also reduce from 4 days to 2 days which improve more than 50% as well.

5.2 Recommendations

Recommendations to the supplier relationship management are ways to improve it in the future with time. With the given time, the supplier relationship management could not be 100% completed because there was a lot more study deep into the factors that were influencing them. These are some of the factors that should be improved over time to gain more effective supplier relationship management.

1. Training and understanding of supplier relationship management

Supplier Relationship Management is still a very wide subject to the company, and it can easily be misunderstood. This also concern too many people for involving along the chain to make the supplier relationship management effectiveness and make the company gain the competitive advantages. To make every concern people to understand deeply in supplier relationship management is still need to be trained. Therefore, trainings and explanations about supplier relationship management and how important it should be to the staff.

2. Continuous improvement use of FMEA

The FMEA tables and criteria will need to monitor and re-allocation on the scoring as a period to get improve and get more accurate information. The criteria of the FMEA will need to be updated to fit the projects at hand and the past will need to be reviewed to gain better improvement to close gap of the projects in the future.

3. Team member

The team members will have to be updated to fit the projects in the future. The team members in this case were selected to fit this project, however this set of members cannot be running the other focus area which they does not known well in the future. Therefore, the team members will have to be selected according to the suitability of each project.

4. Increase the use of tools and techniques

There are tools and techniques used to gain better results. In the future, these tools and techniques will have to improve and selected the suitable tool and technique which more helpful to analyze and improve on the supplier relationship management. With better tools and techniques, the supplier relationship management will get more effective.

5.3 Further studies

The further studies of this can be separated out into many branches depending on the area of interests. Because supplier relationship management is such as wide topic, there are many concerning points that could be further developed. These are some of the concerning points for further studies:

1. Contract and Negotiation

Contract and Negotiation, the technique of contract and negotiation is very crucial to the result of the relationship and agreement. To study the technique of contract and negotiation for supplier selection can benefit the company.

2. Type of relationship

To decide type of relationship will be more clearly situation and how to handle and keep relationship with supplier correctly. Type of relationship also can improve and should be improve to get the reliable partnership and growth together which make the company gain more competitive advantages.

3. Management of change

To implement and any improve in the company will change the working culture and previous working method of the company. Management of change will help to handle these problems.

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APPENDIX

FMEA Criteria of FORD

Severity ranking

Effect	Criteria: Severity of Effect on Product (Customer Effect)	Rank	Effect	Criteria: Severity of Effect on Process (Manufacturing/Assembly Effect)
Failure to Meet Safety and/or Regulatory Requirements	Potential failure mode affects safe vehicle operation and/or involves noncompliance with government regulation without warning.	10	Failure to Meet Safety and/or Regulatory Requirements	May endanger operator (machine or assembly) without warning.
	Potential failure mode affects safe vehicle operation and/or involves noncompliance with government regulation with warning.	9		May endanger operator (machine or assembly) with warning.
Loss or Degradation of Primary Function	Loss of primary function (vehicle inoperable, does not affect safe vehicle operation).	8	Major Disruption	100% of product may have to be scrapped. Line shutdown or stop ship.
	Degradation of primary function (vehicle operable, but at reduced level of performance).	7	Significant Disruption	A portion of the production run may have to be scrapped. Deviation from primary process including decreased line speed or added manpower.
Loss or Degradation of Secondary Function	Loss of secondary function (vehicle operable, but comfort / convenience functions inoperable).	6	Moderate Disruption	100% of production run may have to be reworked off line and accepted.
	Degradation of secondary function (vehicle operable, but comfort / convenience functions at reduced level of performance).	5		A portion of the production run may have to be reworked off line and accepted.
Annoyance	Appearance or Audible Noise, vehicle operable, item does not conform and noticed by most customers (> 75%).	4	Moderate Disruption	100% of production run may have to be reworked in station before it is processed.
	Appearance or Audible Noise, vehicle operable, item does not conform and noticed by many customers (50%).	3		A portion of the production run may have to be reworked in-station before it is processed.
	Appearance or Audible Noise, vehicle operable, item does not conform and noticed by discriminating customers (< 25%).	2	Minor Disruption	Slight inconvenience to process, operation, or operator.
No effect	No discernible effect.	1	No effect	No discernible effect.

Occurrence Ranking

Likelihood of Failure	Criteria: Occurrence of Cause - PFMEA (Incidents per items/vehicles)	Rank
Very High	≥ 100 per thousand / ≥ 1 in 10	10
High	50 per thousand / 1 in 20	9
	20 per thousand / 1 in 50	8
	10 per thousand / 1 in 100	7
Moderate	2 per thousand / 1 in 500	6
	.5 per thousand / 1 in 2,000	5
	.1 per thousand / 1 in 10,000	4
Low	.01 per thousand / 1 in 100,000	3
	≤.001 per thousand / 1 in 1,000,000	2
Very Low	Failure is eliminated through preventive control.	1

Detection Ranking

Opportunity for Detection	Criteria: Likelihood of Detection by Process Control	Rank	Likelihood of Detection
No detection opportunity	No current process control; Cannot detect or is not analyzed.	10	Almost Impossible
Not likely to detect at any stage	Failure Mode and/or Error (Cause) is not easily detected (e.g., random audits).	9	Very Remote
Problem Detection Post Processing	Failure Mode detection post-processing by operator through visual/tactile/audible means.	8	Remote
Problem Detection at Source	Failure Mode detection in-station by operator through visual/tactile/audible means or post-processing through use of attribute gauging (go/no-go, manual torque check/clicker wrench, etc.).	7	Very Low
Problem Detection Post Processing	Failure Mode detection post-processing by operator through use of variable gauging or in-station by operator through use of attribute gauging (go/no-go, manual torque check/clicker wrench, etc).	6	Low
Problem Detection at Source	Failure Mode or Error (Cause) detection in-station by operator through use of variable gauging or by automated controls in-station that will detect discrepant part and notify operator (light, buzzer, etc.). Gauging performed on setup and first-piece check (for set-up causes only).	5	Moderate
Problem Detection Post Processing	Failure Mode detection post-processing by automated controls that will detect discrepant part and lock part to prevent further processing.	4	Moderately High
Problem Detection at Source	Failure Mode detection in-station by automated controls that will detect discrepant part and automatically lock part in station to prevent further processing.	3	High
Error Detection and/or Problem Prevention	Error (Cause) detection in-station by automated controls that will detect error and prevent discrepant part from being made.	2	Very High
Detection not applicable; Error Prevention	Error (Cause) prevention as a result of fixture design, machine design or part design. Discrepant parts cannot be made because item has been error-proofed by process/product design.	1	Almost Certain

Training Record

INTERNAL TRAINING RECORD

ITR. NO. _____

TOPIC/DOC. TITLE : _____

_____

DOCUMENT NO. _____ REV.NO. _____

TRAINER NAME: _____ EN. _____

TRAINING AREA : _____

DATE : _____ TIME : _____

NO.	NAME	E/N	POSITION	DEPT.	SIGNATURE

Entried By (Only Training dept.)   Checked By(Only Training dept.)

_____   _____

(Date)   (Date)

Guideline flow for failure analysis flow chart that using in debug area

Failure analysis flow chart
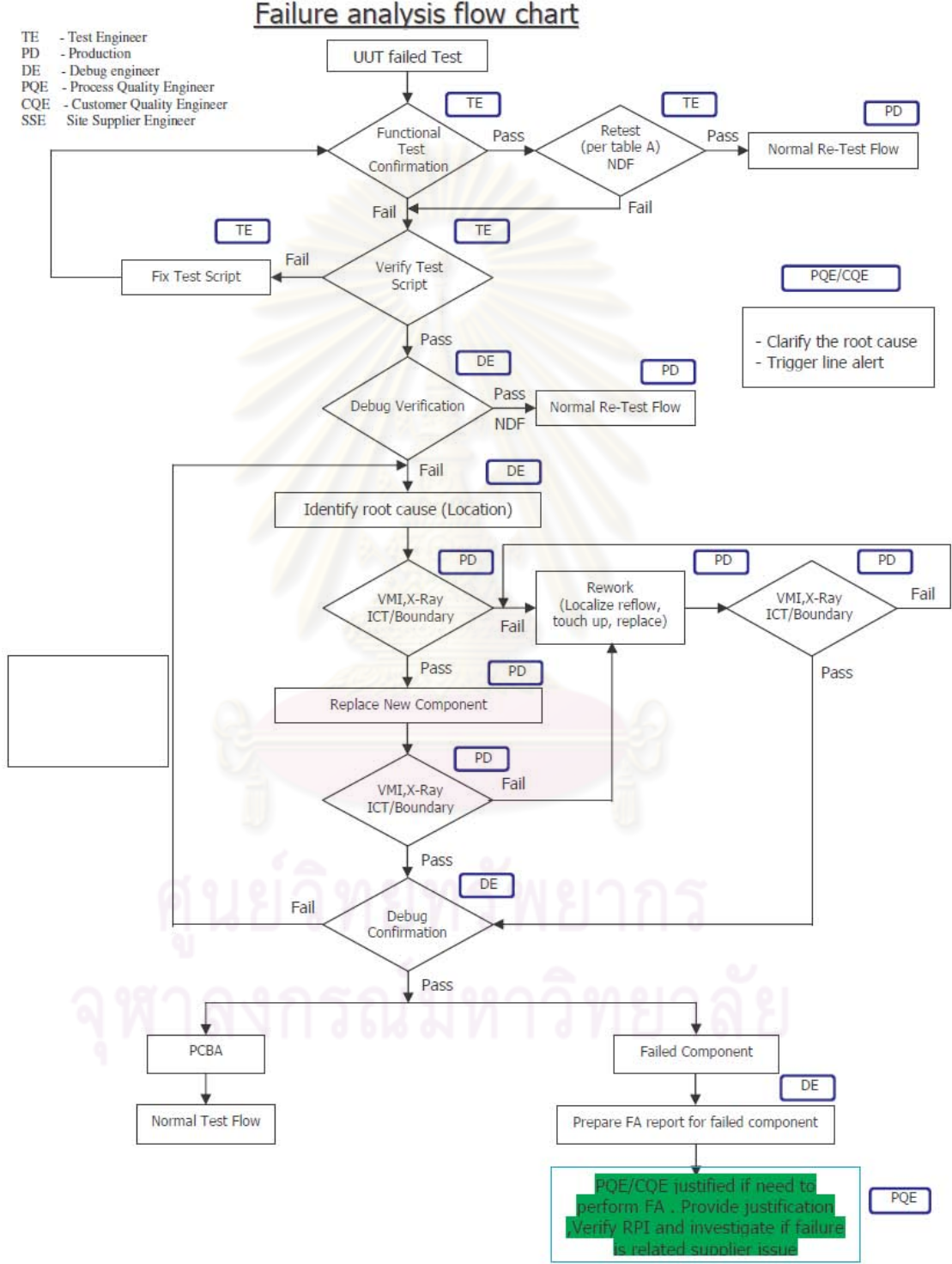
Guideline form to ensure that technical information had already provided

Component Failure Analysis Report

___ no : _____	Device Description : _____	
Manufacturer Name : _____	Manufacturing part no. : _____	
Defective Device Date Code : _____	Defective Device Lot Code (If Applicable): _____	
___ Product Model : _____	Location on board : _____	
Component failed Qty : _____	Total Board Tested : _____	
Quantity used per board : _____	RPI No. (If Applicable) : _____	
___ card serial number : _____	Device Batch no. _____	
___ Board Name : _____	Device MRR no. _____	

Testing Method/Condition : (by Test Engineer)

Failure found at :
- ☐ Incoming Inspection ☐ Functional Test (FCT)
- ☐ Prepare / Kitting Area ☐ System Test
- ☐ Assembly Process ☐ Burn-In Test
- ☐ In-circuit Test (ICT) ☐ Other , Please specify _____

- Defect fail : ☐ During power up ☐ During operation
- Test humidity dependent (for chamber) : ☐ Yes _____% ☐ No
- Test temperature dependent (at chamber/oven) : ☐ Yes _____°C ☐ No ☐ EST
- Temperature failure found : ☐ At ambient temperature ☐ At low/high temperature, pls specify_____ °C
- Temperature of failure's body during it is tested (if applicable)_____°C
- Test duration : _____ Hr, Defect found at_____ Hr
- Device's application :_____
- ___ test criteria/specification :_____
- Device criteria/specification :_____
- Any circuit diagram or device application provided ☐ Yes ☐ No
- This the first time that found device to fail in this particular application ☐ Yes, pls advise RPI no._____ ☐ No, pls advise RPI no._____
- Does failure pass any test before it failed ☐ Yes, at test station_____ ☐ No
- Site having the similar problem with other suppliers ☐ Yes, Supplier name_____ Supplier P/N_____ ☐ No

Failure Symptom : (pls provide test data log in spead sheet, if any)
- ☐ No output, pls specify pin no._____
- ☐ Low gain, pls confirm reading._____
- ☐ Short circuit, pls specify area or pin no_____
- ☐ Fail functional, pls specify_____
- ☐ Intermittance, pls explain test condition when the device pass/fail and output when it failed _____
- ☐ Please see the failure symptom at : Failure Symptom'

Verification method :
- Failure physical inspection ☐ Yes, by tool_____, result_____, pls provide picture (if any).
  ☐ No
- Failure confirm by ☐ Socket
  ☐ Replace on known good board
  ☐ Using mulimeter / CT / NetworkAnalyzer / LCR meter, pls provide result_____
  ☐ Other, pls specify_____

Failed Device handling/packaging : (by IPQE/PQE)
- Device Moisture Sensitive Level (level 1-6) :_____
- Device Original package condition :_____
- Board/Failure Baking condition : Temperature_____°C, time_____minute
- Rework/remove method : ☐ hand soldering ☐ soldering pot ☐ not rework, device assembled by socket
- Rework/remove condition : Temperature_____°C, time_____minute
- Device in ESD bag ☐ Yes ☐ No
- Device in moisture barrier bag ☐ Yes ☐ No
- Vacuum seal ☐ Yes ☐ No
- Desiccant (Silica gel) ☐ Yes ☐ No
- Humidity indicator card ☐ Yes ☐ No
- Device re-balled (for BGA) ☐ Yes ☐ No
- Packaging ☐ Tray ☐ Tube ☐ Tape/Reel ☐ Bulk/Box

Conclusion
☐ Material problem ☐ Design problem ☐ Test coverage ☐ Other, pls specify_____

Containment action (by SQE) :
_____

Test Engineer _____	Date : _____	
IPQE/PQE : _____	Date : _____	
SQE : _____	Date : _____	Component Failure Analysis
Created By : _____	Date : _____	Component Failure Analysis

Guideline for Failure Analysis

Check if the component failed on a prime or reworked board.

If it is on a reworked board, there is a need to investigate further the fallout rate between prime and rework build on this component location and the number of times the board has been reworked

Check if the problem is temperature-related.

Commercial components are guaranteed to work within 0-70oC temperature range and the component timing performance varies with temperature

Check if the problem is tester related by testing on different testers/SW version use.

For programming part, check for the correct pattern inside. Perform analysis on the programmer, if needed/available

Fault Isolation Techniques

- For programming part failing for wrong programming, need to check if on-board programming (re-flashing) is being done at Celestica.

- Pin to GND/Pin to Pin measurement needs to be done to see Pins open OR short OR low-ohm to GND. Compare against a known good component to determine the differences. If good components are not available, check the device datasheet for pin-out reference.

- In cases where the device input/output pin:

  - Dead-short to GND consistently on the same pin

  - Very low ohm reading on multi-meter when compared against a known good component consistently on the same pin.

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Then it's a "**failure signature**" of EOS damage as per "**signature analysis**" method. Barring other failure symptoms, further FA is **NOT** needed if incoming raw material does not show a similar problem

Request for Problem Investigation Form

Auto E-mail alert from Request Investigation Form

Raw Data for Analyze shipment turnaround time process after implement corrective action

Pick up date	Time	Forwarder	Flight No.	MAWB	ETD	ETA
1-Sep-10	10.00 AM	CEVA	KZ254/02	933 BKK 0704 0025	2-Sep-10	8-Sep-10
4-Sep-10	04.00 PM	CEVA	KE382/05	180 BKK 1355 2243	5-Sep-10	10-Sep-10
4-Sep-10	04.00 PM	CEVA	KE382/05	180 BKK 1355 2243	5-Sep-10	10-Sep-10
4-Sep-10	04.00 PM	CEVA	KE382/05	180 BKK 1355 2243	5-Sep-10	10-Sep-10
4-Sep-10	04.00 PM	CEVA	KE382/05	180 BKK 1355 2243	5-Sep-10	10-Sep-10
4-Sep-10	04.00 PM	CEVA	KE382/05	180 BKK 1355 2243	5-Sep-10	10-Sep-10
8-Sep-10	10.00 AM	CEVA	SQ973/09	618 BKK 6613 7713	9-Sep-10	14-Sep-10
8-Sep-10	10.00 AM	CEVA	SQ973/09	618 BKK 6613 7713	9-Sep-10	14-Sep-10

8-Sep-10	01.00 PM	FEDEX_CMX	FX5362/08	4577 1593 9740	8-Sep-10	13-Sep-10
9-Sep-10	10.00 AM	CEVA	SQ973/10	618-6613 7735	10-Sep-10	15-Sep-10
10-Sep-10	10.00 AM	CEVA	KE382/12	180 BKK 1353 7440	12-Sep-10	17-Sep-10
10-Sep-10	10.00 AM	CEVA	KE382/12	180 BKK 1353 7440	12-Sep-10	17-Sep-10
10-Sep-10	10.00 AM	CEVA	KE382/12	180 BKK 1353 7440	12-Sep-10	17-Sep-10
11-Sep-10	04.00 PM	CEVA	UA882/13	016 bkk 1009 6424	13-Sep-10	17-Sep-10
11-Sep-10	01.00 PM	FEDEX_CMX	FX5362/11	45771 594 4175	11-Sep-10	16-Sep-10
13-Sep-10	10.00 AM	CEVA	KE382/15	180 BKK 1354 6956	15-Sep-10	20-Sep-10
13-Sep-10	01.00 PM	FEDEX_CMX	FX5362/13	4577 1594 5550	13-Sep-10	17-Sep-10
14-Sep-10	10.00 AM	CEVA	KE354/16	180 BKK 1354 7063	16-Sep-10	21-Sep-10
15-Sep-10	10.00 AM	CEVA	KE382/17	180 BKK 1354 7122	17-Sep-10	22-Sep-10
15-Sep-10	10.00 AM	CEVA	KE382/17	180 BKK 1354 7122	17-Sep-10	22-Sep-10
15-Sep-10	10.00 AM	CEVA	KE382/17	180 BKK 1354 7122	17-Sep-10	22-Sep-10
15-Sep-10	01.00 PM	FEDEX_CMX	FX5362/15	4577 1594 8126	15-Sep-10	20-Sep-10
16-Sep-10	01.00 PM	FEDEX_CMX	FX5362/16	4577 1594 9475	16-Sep-10	21-Sep-10
16-Sep-10	01.00 PM	FEDEX_CMX	FX5362/16	4577 1594 9475	16-Sep-10	21-Sep-10
16-Sep-10	01.00 PM	FEDEX_CMX	FX5362/16	4577 1594 9475	16-Sep-10	21-Sep-10
17-Sep-10	10.00 AM	CEVA	KE382/19	180 BKK 1354 7306	19-Sep-10	24-Sep-10
17-Sep-10	10.00 AM	CEVA	KE382/19	180 BKK 1354 7306	19-Sep-10	24-Sep-10
17-Sep-10	01.00 PM	FEDEX_CMX	FX5362/17	4577 1595 0516	17-Sep-10	22-Sep-10
17-Sep-10	01.00 PM	FEDEX_CMX	FX5362/17	4577 1595 0516	17-Sep-10	22-Sep-10
18-Sep-10	04.00 PM	CEVA	SQ973/20	618 BKK 6613 7820	20-Sep-10	24-Sep-10
21-Sep-10	04.00 PM	CEVA	KE354/23	180 BKK 1355 2103	23-Sep-10	28-Sep-10
23-Sep-10	01.00 PM	FEDEX_CMX	FX5362/23	4648 8761 0460	23-Sep-10	28-Sep-10

23-Sep-10	01.00 PM	FEDEX_CMX	FX5362/23	4648 8761 0460	23-Sep-10	28-Sep-10
24-Sep-10	01.00 PM	FEDEX_CMX	FX5362/24	4648 8761 3274	24-Sep-10	29-Sep-10
27-Sep-10	01.00 PM	FEDEX_CMX	FX5362/27	4648 8761 6619	27-Sep-10	1-Oct-10
27-Sep-10	01.00 PM	FEDEX_CMX	FX5362/27	4648 8761 6262	27-Sep-10	1-Oct-10
28-Sep-10	01.00 PM	FEDEX_CMX	FX5362/28	4648 8761 7832	28-Sep-10	2-Oct-10
28-Sep-10	01.00 PM	FEDEX_CMX	FX5362/28	4648 8761 7832	28-Sep-10	2-Oct-10
28-Sep-10	01.00 PM	FEDEX_CMX	FX5362/28	4648 8761 7832	28-Sep-10	2-Oct-10
29-Sep-10	10.00 AM	CEVA	KZ254/30	933 BKK 0704 0353	30-Sep-10	5-Oct-10
29-Sep-10	10.00 AM	CEVA	KZ254/30	933 BKK 0704 0353	30-Sep-10	5-Oct-10
29-Sep-10	10.00 AM	CEVA	KZ254/30	933 BKK 0704 0353	30-Sep-10	5-Oct-10
29-Sep-10	10.00 AM	CEVA	KZ254/30	933 BKK 0704 0353	30-Sep-10	5-Oct-10
29-Sep-10	10.00 AM	CEVA	KZ254/30	933 BKK 0704 0353	30-Sep-10	5-Oct-10
29-Sep-10	10.00 AM	CEVA	KZ254/30	933 BKK 0704 0353	30-Sep-10	5-Oct-10
29-Sep-10	10.00 AM	CEVA	KZ254/30	933 BKK 0704 0353	30-Sep-10	5-Oct-10
29-Sep-10	10.00 AM	CEVA	KZ254/30	933 BKK 0704 0353	30-Sep-10	5-Oct-10
29-Sep-10	01.00 PM	FEDEX_CMX	FX5362/29	4648 8761 9478	29-Sep-10	4-Oct-10
30-Sep-10	01.00 PM	FEDEX_CMX	FX5362/30	4648 8762 0600	30-Sep-10	5-Oct-10
30-Sep-10	10.00 PM	CEVA	KE354/02	180 BKK 1355 7213	2-Oct-10	7-Oct-10
30-Sep-10	10.00 PM	CEVA	KE354/02	180 BKK 1355 7213	2-Oct-10	7-Oct-10
30-Sep-10	10.00 PM	CEVA	KE354/02	180 BKK 1355 7213	2-Oct-10	7-Oct-10
30-Sep-10	10.00 PM	CEVA	KE354/02	180 BKK 1355 7213	2-Oct-10	7-Oct-10
30-Sep-10	11.00 PM	CEVA	KE382/03	180 BKK 1355 7224	3-Oct-10	8-Oct-10
30-Sep-10	11.00 PM	CEVA	KE382/03	180 BKK 1355 7224	3-Oct-10	8-Oct-10
30-Sep-10	11.00 PM	CEVA	KE382/03	180 BKK 1355 7224	3-Oct-10	8-Oct-10

2-Oct-10	10.00 AM	CEVA	JL708/03	131 BKK 3267 5635	3-Oct-10	8-Oct-10
5-Oct-10	10.00 AM	CEVA	KE382/06	180 BKK 1355 7246	6-Oct-10	11-Oct-10
7-Oct-10	10.00 AM	FEDEX_CMX	FX5362/06	4648 8762 5521	6-Oct-10	11-Oct-10
8-Oct-10	01.00 PM	FEDEX_CMX	FX5362/8	4648 8762 7432	8-Oct-10	13-Oct-10
9-Oct-10	01.00 PM	FEDEX_CMX	FX5362/09	4648 8762 9089	9-Oct-10	14-Oct-10
9-Oct-10	10.00 AM	CEVA	UA882/10	016 BKK 1009 7113	10-Oct-10	15-Oct-10
9-Oct-10	10.00 AM	CEVA	UA882/10	016 BKK 1009 7113	10-Oct-10	15-Oct-10
9-Oct-10	01.00 PM	FEDEX_CMX	FX5362/09	4648 8762 9284	9-Oct-10	14-Oct-10
11-Oct-10	01.00 PM	FEDEX_CMX	FX5362/11	4648 8763 0119	11-Oct-10	15-Oct-10
11-Oct-10	01.00 PM	FEDEX_CMX	FX5362/11	4648 8763 0119	11-Oct-10	15-Oct-10
11-Oct-10	01.00 PM	FEDEX_CMX	FX5362/11	4648 8763 0119	11-Oct-10	15-Oct-10
11-Oct-10	01.00 PM	FEDEX_CMX	FX5362/11	4648 8762 9663	11-Oct-10	15-Oct-10
11-Oct-10	01.00 PM	FEDEX_CMX	FX5362/11	4648 8762 9663	11-Oct-10	15-Oct-10
12-Oct-10	01.00 PM	FEDEX_CMX	FX5362/12	4648 8763 1229	12-Oct-10	16-Oct-10
12-Oct-10	01.00 PM	FEDEX_CMX	FX5362/12	4648 8763 2291	12-Oct-10	16-Oct-10
13-Oct-10	01.00 PM	FEDEX_CMX	FX5362/13	4648 8763 3910	13-Oct-10	18-Oct-10
13-Oct-10	01.00 PM	FEDEX_CMX	FX5362/13	4648 8763 3910	13-Oct-10	18-Oct-10
13-Oct-10	01.00 PM	FEDEX_CMX	FX5362/13	4648 8763 3910	13-Oct-10	18-Oct-10
14-Oct-10	10.00 AM	CEVA	KE354/16	180 BKK 1356 2043	16-Oct-10	21-Oct-10
14-Oct-10	10.00 AM	CEVA	KE354/16	180 BKK 1356 2043	16-Oct-10	21-Oct-10
14-Oct-10	01.00 PM	FEDEX_CMX	FX5362/14	4648 8763 4835	14-Oct-10	19-Oct-10
14-Oct-10	01.00 PM	FEDEX_CMX	FX5362/14	4648 8763 4835	14-Oct-10	19-Oct-10
14-Oct-10	01.00 PM	FEDEX_CMX	FX5362/14	4648 8763 4938	14-Oct-10	19-Oct-10
16-Oct-10	01.00 PM	FEDEX_CMX	FX5362/16	4648 8763 8040	16-Oct-10	20-Oct-10

16-Oct-10	10.00 AM	CEVA	SQ975/18	618 BKK 6726 9171	18-Oct-10	21-Oct-10
16-Oct-10	10.00 AM	CEVA	SQ975/18	618 BKK 6726 9171	18-Oct-10	21-Oct-10
16-Oct-10	10.00 AM	CEVA	SQ975/18	618 BKK 6726 9171	18-Oct-10	21-Oct-10
18-Oct-10	01.00 PM	FEDEX_CMX	FX5362/18	4648 8763 8451	18-Oct-10	22-Oct-10
18-Oct-10	01.00 PM	FEDEX_CMX	FX5362/18	4648 8763 8587	18-Oct-10	22-Oct-10
18-Oct-10	01.00 PM	FEDEX_CMX	FX5362/18	4648 8763 8587	18-Oct-10	22-Oct-10
18-Oct-10	01.00 PM	FEDEX_CMX	FX5362/18	4648 8763 8587	18-Oct-10	22-Oct-10
18-Oct-10	01.00 PM	FEDEX_CMX	FX5362/18	4648 8763 8966	18-Oct-10	22-Oct-10
19-Oct-10	01.00 PM	FEDEX_CMX	FX5362/19	4648 8764 1105	19-Oct-10	23-Oct-10
19-Oct-10	01.00 PM	FEDEX_CMX	FX5362/19	4648 8764 0153	19-Oct-10	23-Oct-10
19-Oct-10	01.00 PM	FEDEX_CMX	FX5362/19	4648 8764 0598	19-Oct-10	23-Oct-10
20-Oct-10	01.00 PM	FEDEX_CMX	FX5362/20	4648 8764 3093	20-Oct-10	25-Oct-10
21-Oct-10	01.00 PM	FEDEX_CMX	FX5362/21	4648 8764 4825	21-Oct-10	26-Oct-10
22-Oct-10	4:00 PM	CEVA	KZ254/23	93307046281	23-Oct-10	29-Oct-10
22-Oct-10	4:00 PM	CEVA	KZ254/23	93307046281	23-Oct-10	29-Oct-10
22-Oct-10	4:00 PM	CEVA	KZ254/23	93307046281	23-Oct-10	29-Oct-10
22-Oct-10	4:00 PM	CEVA	KE382/24	180 13557401	24-Oct-10	29-Oct-10
22-Oct-10	4:00 PM	CEVA	KE382/24	180 13557401	24-Oct-10	29-Oct-10
22-Oct-10	4:00 PM	CEVA	KE382/24	180 13557401	24-Oct-10	29-Oct-10
22-Oct-10	01.00 PM	FEDEX_CMX	FX5362/22	4675 5713 0124	22-Oct-10	27-Oct-10
22-Oct-10	01.00 PM	FEDEX_CMX	FX5362/22	4675 5713 0260	22-Oct-10	27-Oct-10
23-Oct-10	01.00 PM	FEDEX_CMX	FX5362/23	4675 5713 1874	23-Oct-10	28-Oct-10
23-Oct-10	01.00 PM	FEDEX_CMX	FX5362/23	4675 5713 1922	23-Oct-10	28-Oct-10
23-Oct-10	01.00 PM	FEDEX_CMX	FX5362/23	4675 5713 2068	23-Oct-10	28-Oct-10

25-Oct-10	01.00 PM	FEDEX_CMX	FX5362/25	4675 5713 2333	25-Oct-10	29-Oct-10
25-Oct-10	01.00 PM	FEDEX_CMX	FX5362/25	4675 5713 2333	25-Oct-10	29-Oct-10
25-Oct-10	4:00 PM	CEVA	ke354/26	180 98553206	26-Oct-10	1-Nov-10
26-Oct-10	01.00 PM	FEDEX_CMX		467557133307	26-Oct-10	1-Nov-10
27-Oct-10	01.00 PM	FEDEX_CMX	FX5362/27	4675 5713 5090	27-Oct-10	1-Nov-10
27-Oct-10	01.00 PM	FEDEX_CMX	FX5362/27	4675 5713 5090	27-Oct-10	1-Nov-10
27-Oct-10	01.00 PM	FEDEX_CMX	FX5362/27	4675 5713 5090	27-Oct-10	1-Nov-10
28-Oct-10	01.00PM	FEDEX_CMX	FX5362/28	4675 5713 7092	28-Oct-10	2-Nov-10
28-Oct-10	01.00PM	FEDEX_CMX	FX5362/28	4675 5713 7092	28-Oct-10	2-Nov-10
28-Oct-10	01.00PM	FEDEX_CMX	FX5362/28	4675 5713 7092	28-Oct-10	2-Nov-10
29-Oct-10	10.00AM	CEVA	KE354/30	180 BKK 9855 6216	30-Oct-10	3-Nov-10
29-Oct-10	10.00AM	CEVA	KE354/30	180 BKK 9855 6216	30-Oct-10	3-Nov-10
29-Oct-10	10.00AM	CEVA	KE354/30	180 BKK 9855 6216	30-Oct-10	3-Nov-10
29-Oct-10	01.00PM	FEDEX_CMX	FX5362/29	4675 5713 8824	29-Oct-10	3-Nov-10
29-Oct-10	01.00PM	FEDEX_CMX	FX5362/29	4675 5713 8824	29-Oct-10	3-Nov-10
29-Oct-10	01.00PM	FEDEX_CMX	FX5362/29	4675 5713 8824	29-Oct-10	3-Nov-10
30-Oct-10	01.00PM	FEDEX_CMX	FX5362/30	4675 5714 1110	30-Oct-10	5-Nov-10
30-Oct-10	01.00PM	FEDEX_CMX	FX5362/30	4675 5714 1110	30-Oct-10	5-Nov-10
30-Oct-10	01.00PM	FEDEX_CMX	FX5362/30	4675 5714 1110	30-Oct-10	5-Nov-10
1-Nov-10	01.00PM	FEDEX_CMX	FX5362/01	4675 5714 2702	1-Nov-10	5-Nov-10
1-Nov-10	01.00PM	FEDEX_CMX	FX5362/01	4675 5714 2702	1-Nov-10	5-Nov-10
1-Nov-10	01.00PM	FEDEX_CMX	FX5362/01	4675 5714 2702	1-Nov-10	5-Nov-10
2-Nov-10	10.00AM	CEVA	KE354/04	180 BKK 1357 1316	4-Nov-10	9-Nov-10
2-Nov-10	01.00PM	FEDEX_CMX	FX5362/02	4675 5714 4911	2-Nov-10	6-Nov-10

2-Nov-10	01.00PM	FEDEX_CMX	FX5362/02	4675 5714 4911	2-Nov-10	6-Nov-10
2-Nov-10	01.00PM	FEDEX_CMX	FX5362/02	4675 5714 4911	2-Nov-10	6-Nov-10
3-Nov-10	01.00PM	FEDEX_CMX	FX5362/03	4675 5714 6384	3-Nov-10	8-Nov-10
3-Nov-10	01.00PM	FEDEX_CMX	FX5362/03	4675 5714 6384	3-Nov-10	8-Nov-10
4-Nov-10	01.00PM	FEDEX_CMX	FX5362/04	4675 5714 8137	4-Nov-10	9-Nov-10
5-Nov-10	10.00AM	CEVA	KZ254/06	933 BKK 0705 0083	6-Nov-10	11-Nov-10
5-Nov-10	10.00AM	CEVA	KZ254/06	933 BKK 0705 0083	6-Nov-10	11-Nov-10
5-Nov-10	10.00AM	CEVA	KZ254/06	933 BKK 0705 0083	6-Nov-10	11-Nov-10
5-Nov-10	10.00AM	CEVA	KZ254/06	933 BKK 0705 0083	6-Nov-10	11-Nov-10
5-Nov-10	10.00AM	CEVA	KZ254/06	933 BKK 0705 0083	6-Nov-10	11-Nov-10
5-Nov-10	01.00PM	FEDEX_CMX	FX5362/05	4675 5714 9199	5-Nov-10	10-Nov-10
6-Nov-10	01.00PM	FEDEX_CMX	FX5362/06	4675 5715 1590	6-Nov-10	11-Nov-10
6-Nov-10	01.00PM	FEDEX_CMX	FX5362/06	4675 5715 1590	6-Nov-10	11-Nov-10
6-Nov-10	01.00PM	FEDEX_CMX	FX5362/06	4675 5715 1590	6-Nov-10	11-Nov-10
7-Nov-10	01.00PM	FEDEX_CMX	FX5362/08	4675 5715 0230	8-Nov-10	13-Nov-10
7-Nov-10	01.00PM	FEDEX_CMX	FX5362/08	4675 5715 0230	8-Nov-10	13-Nov-10
8-Nov-10	01.00PM	FEDEX_CMX	FX5362/08	4675 5715 2585	8-Nov-10	12-Nov-10
8-Nov-10	01.00PM	FEDEX_CMX	FX5362/08	4675 5715 2585	8-Nov-10	12-Nov-10
8-Nov-10	01.00PM	FEDEX_CMX	FX5362/08	4675 5715 2585	8-Nov-10	12-Nov-10
9-Nov-10	10.00AM	CEVA	KL254/10	933BKK07050116	10-Nov-10	15-Nov-10
9-Nov-10	10.00AM	CEVA	KL254/10	933BKK07050116	10-Nov-10	15-Nov-10
9-Nov-10	01.00PM	FEDEX_CMX	FX5362/09	4675 5715 4886	9-Nov-10	15-Nov-10
10-Nov-10	10.00AM	CEVA	SQ973/11	618 6748 9752	11-Nov-10	17-Nov-10
10-Nov-10	10.00AM	CEVA	SQ973/11	618 6748 9752	11-Nov-10	17-Nov-10

10-Nov-10	10.00AM	CEVA	SQ973/11	618 6748 9752	11-Nov-10	17-Nov-10
10-Nov-10	01.00PM	FEDEX_CMX	FX5362/10	4675 5715 6168	10-Nov-10	15-Nov-10
10-Nov-10	01.00PM	FEDEX_CMX	FX5362/10	4675 5715 6168	10-Nov-10	15-Nov-10
11-Nov-10	10.00AM	CEVA	KE382/12	180 BKK 1357 1493	12-Nov-10	17-Nov-10
11-Nov-10	10.00AM	CEVA	KE382/12	180 BKK 1357 1493	12-Nov-10	17-Nov-10
11-Nov-10	10.00AM	CEVA	KE382/12	180 BKK 1357 1493	12-Nov-10	17-Nov-10
11-Nov-10	01.00PM	FEDEX_CMX	FX5362/11	4675 5715 7760	11-Nov-10	16-Nov-10
11-Nov-10	01.00PM	FEDEX_CMX	FX5362/11	4675 5715 7760	11-Nov-10	16-Nov-10
11-Nov-10	01.00PM	FEDEX_CMX	FX5362/11	4675 5715 7760	11-Nov-10	16-Nov-10
13-Nov-10	10.00AM	CEVA	UA882/14	016 BKK 1010 3634	14-Nov-10	19-Nov-10
13-Nov-10	10.00AM	CEVA	UA882/14	016 BKK 1010 3634	14-Nov-10	19-Nov-10
13-Nov-10	10.00AM	CEVA	UA882/14	016 BKK 1010 3634	14-Nov-10	19-Nov-10
13-Nov-10	10.00AM	CEVA	UA882/14	016 BKK 1010 3634	14-Nov-10	19-Nov-10
13-Nov-10	01.00PM	FEDEX_CMX	4675 5716 2781	4675 5716 2781	13-Nov-10	18-Nov-10
13-Nov-10	01.00PM	FEDEX_CMX	4675 5716 3332	4675 5716 3332	13-Nov-10	18-Nov-10
14-Nov-10	01.00PM	FEDEX_CMX	4675 5716 2016	4675 5716 2016	15-Nov-10	19-Nov-10
14-Nov-10	01.00PM	FEDEX_CMX	4675 5716 2016	4675 5716 2016	15-Nov-10	19-Nov-10
14-Nov-10	01.00PM	FEDEX_CMX	4675 5716 2016	4675 5716 2016	15-Nov-10	19-Nov-10
15-Nov-10	01.00PM	FEDEX_CMX	4675 5716 3814	4675 5716 3814	15-Nov-10	19-Nov-10
15-Nov-10	01.00PM	FEDEX_CMX	4675 5716 3814	4675 5716 3814	15-Nov-10	19-Nov-10
15-Nov-10	01.00PM	FEDEX_CMX	4675 5716 3814	4675 5716 3814	15-Nov-10	19-Nov-10
16-Nov-10	10.00AM	CEVA	933BK 07050186	50876451	18-Nov-10	23-Nov-10
16-Nov-10	10.00AM	CEVA	933BK 07050186	50876451	18-Nov-10	23-Nov-10
16-Nov-10	10.00AM	CEVA	933BK 07050186	50876451	18-Nov-10	23-Nov-10

16-Nov-10	01.00PM	FEDEX_CMX	4675 5716 5791	4675 5716 5791	16-Nov-10	20-Nov-10
16-Nov-10	01.00PM	FEDEX_CMX	4675 5716 5791	4675 5716 5791	16-Nov-10	20-Nov-10
16-Nov-10	01.00PM	FEDEX_CMX	4675 5716 5791	4675 5716 5791	16-Nov-10	20-Nov-10
17-Nov-10	01.00PM	FEDEX_CMX	4675 5716 7408	4675 5716 7408	17-Nov-10	22-Nov-10
17-Nov-10	01.00PM	FEDEX_CMX	4675 5716 7408	4675 5716 7408	17-Nov-10	22-Nov-10
18-Nov-10	10.00AM	CEVA	695BKK69496862	50880813	19-Nov-10	24-Nov-10
18-Nov-10	10.00AM	CEVA	695BKK69496862	50880813	19-Nov-10	24-Nov-10
18-Nov-10	01.00PM	FEDEX_CMX	4675 5716 8974	4675 5716 8974	18-Nov-10	23-Nov-10
19-Nov-10	04.00PM	CEVA	180BKK13571703	50886015	20-Nov-10	25-Nov-10
19-Nov-10	04.00PM	CEVA	180BKK13571703	50886015	20-Nov-10	25-Nov-10
19-Nov-10	04.00PM	CEVA	180BKK13571703	50886015	20-Nov-10	25-Nov-10
19-Nov-10	04.00PM	CEVA	180BKK13571703	50886015	20-Nov-10	25-Nov-10
19-Nov-10	04.00PM	CEVA	180BKK13571703	50886015	20-Nov-10	25-Nov-10
19-Nov-10	01.00PM	FEDEX_CMX	4675 5717 2500	4675 5717 2500	19-Nov-10	24-Nov-10
24-Nov-10	10.00AM	CEVA	933BKK07050234	50895406	25-Nov-10	30-Nov-10
24-Nov-10	10.00AM	CEVA	933BKK07050234	50895406	25-Nov-10	30-Nov-10
25-Nov-10	10.00AM	CEVA	695BKK69496991	50899875	26-Nov-10	1-Dec-10
25-Nov-10	10.00AM	CEVA	695BKK69496991	50899875	26-Nov-10	1-Dec-10
25-Nov-10	10.00AM	CEVA	695BKK69496991	50899875	26-Nov-10	1-Dec-10
25-Nov-10	10.00AM	CEVA	695BKK69496991	50899875	26-Nov-10	1-Dec-10
26-Nov-10	04.00PM	CEVA	695BKK69496910	50903902	27-Nov-10	2-Dec-10
26-Nov-10	04.00PM	CEVA	695BKK69496910	50903902	27-Nov-10	2-Dec-10
26-Nov-10	04.00PM	CEVA	695BKK69496910	50903902	27-Nov-10	2-Dec-10
27-Nov-10	04.00PM	CEVA	180BKK13571961	50905416	28-Nov-10	3-Dec-10

27-Nov-10	04.00PM	CEVA	180BKK13571961	50905416	28-Nov-10	3-Dec-10
27-Nov-10	04.00PM	CEVA	180BKK13571961	50905416	28-Nov-10	3-Dec-10
27-Nov-10	04.00PM	CEVA	180BKK13571961	50905416	28-Nov-10	3-Dec-10
27-Nov-10	04.00PM	CEVA	180BKK13571961	50905416	28-Nov-10	3-Dec-10
27-Nov-10	04.00PM	CEVA	180BKK13571961	50905416	28-Nov-10	3-Dec-10
27-Nov-10	04.00PM	CEVA	180BKK13571961	50905416	28-Nov-10	3-Dec-10
29-Nov-10	04.00PM	CEVA	933BKK07050271	50907531	30-Nov-10	3-Dec-10
29-Nov-10	04.00PM	CEVA	933BKK07050271	50907531	30-Nov-10	3-Dec-10
29-Nov-10	04.00PM	CEVA	933BKK07050271	50907531	30-Nov-10	3-Dec-10
29-Nov-10	04.00PM	CEVA	933BKK07050271	50907531	30-Nov-10	3-Dec-10
29-Nov-10	04.00PM	CEVA	933BKK07050271	50907531	30-Nov-10	3-Dec-10
29-Nov-10	04.00PM	CEVA	933BKK07050271	50907531	30-Nov-10	3-Dec-10
29-Nov-10	04.00PM	CEVA	933BKK07050271	50907531	30-Nov-10	3-Dec-10
30-Nov-10	04.00PM	CEVA	180BKK13575800	50911263	1-Dec-10	6-Dec-10
30-Nov-10	04.00PM	CEVA	180BKK13575800	50911263	1-Dec-10	6-Dec-10
30-Nov-10	04.00PM	CEVA	180BKK13575800	50911263	1-Dec-10	6-Dec-10
30-Nov-10	04.00PM	CEVA	180BKK13575800	50911263	1-Dec-10	6-Dec-10
30-Nov-10	04.00PM	CEVA	180BKK13575800	50911263	1-Dec-10	6-Dec-10
1-Dec-10	04.00PM	CEVA	933BKK07058520	50913116	2-Dec-10	7-Dec-10
1-Dec-10	04.00PM	CEVA	933BKK07058520	50913116	2-Dec-10	7-Dec-10
1-Dec-10	04.00PM	CEVA	933BKK07058520	50913116	2-Dec-10	7-Dec-10
2-Dec-10	10.00AM	CEVA	180BKK13575822	50914170	3-Dec-10	7-Dec-10
2-Dec-10	01.00PM	FEDEX_CMX	4675 5718 4786	4675 5718 4786	2-Dec-10	7-Dec-10
3-Dec-10	04.00PM	CEVA	180BKK13575833	50918053	4-Dec-10	9-Dec-10

3-Dec-10	04.00PM	CEVA	180BKK13575833	50918053	4-Dec-10	9-Dec-10
3-Dec-10	04.00PM	CEVA	180BKK13575833	50918053	4-Dec-10	9-Dec-10
3-Dec-10	04.00PM	CEVA	180BKK13575833	50918053	4-Dec-10	9-Dec-10
3-Dec-10	04.00PM	CEVA	180BKK13575833	50918053	4-Dec-10	9-Dec-10
3-Dec-10	04.00PM	CEVA	180BKK13575833	50918053	4-Dec-10	9-Dec-10
3-Dec-10	04.00PM	CEVA	180BKK13575833	50918053	4-Dec-10	9-Dec-10
3-Dec-10	04.00PM	CEVA	180BKK13575833	50918053	4-Dec-10	9-Dec-10
3-Dec-10	01.00PM	FEDEX_CMX	4675 5718 6366	4675 5718 6366	3-Dec-10	8-Dec-10
3-Dec-10	01.00PM	FEDEX_CMX	4675 5718 6366	4675 5718 6366	3-Dec-10	8-Dec-10
4-Dec-10	04.00PM	CEVA	933BKK07058553	50924854	5-Dec-10	9-Dec-10
4-Dec-10	04.00PM	CEVA	933BKK07058553	50924854	5-Dec-10	9-Dec-10
4-Dec-10	01.00PM	FEDEX_CMX	4675 5718 7524	4675 5718 7524	4-Dec-10	9-Dec-10
7-Dec-10	04.00PM	CEVA	180BKK13575866	50928656	8-Dec-10	13-Dec-10
7-Dec-10	04.00PM	CEVA	180BKK13575866	50928656	8-Dec-10	13-Dec-10
7-Dec-10	01.00PM	FEDEX_CMX	4675 5718 8406	4675 5718 8406	7-Dec-10	13-Dec-10
8-Dec-10	01.00PM	FEDEX_CMX	4675 5719 0726	4675 5719 0726	8-Dec-10	13-Dec-10
8-Dec-10	01.00PM	FEDEX_CMX	4675 5719 0726	4675 5719 0726	8-Dec-10	13-Dec-10
8-Dec-10	01.00PM	FEDEX_CMX	4675 5719 0726	4675 5719 0726	8-Dec-10	13-Dec-10
8-Dec-10	04.00PM	CEVA	695BKK69497330	50929975	9-Dec-10	14-Dec-10
8-Dec-10	04.00PM	CEVA	695BKK69497330	50929975	9-Dec-10	14-Dec-10
8-Dec-10	04.00PM	CEVA	695BKK69497330	50929975	9-Dec-10	14-Dec-10
8-Dec-10	04.00PM	CEVA	695BKK69497330	50929975	9-Dec-10	14-Dec-10
8-Dec-10	04.00PM	CEVA	695BKK69497330	50929975	9-Dec-10	14-Dec-10
8-Dec-10	04.00PM	CEVA	695BKK69497330	50929975	9-Dec-10	14-Dec-10

8-Dec-10	04.00PM	CEVA	695BKK69497330	50929975	9-Dec-10	14-Dec-10
8-Dec-10	04.00PM	CEVA	695BKK69497330	50929975	9-Dec-10	14-Dec-10
8-Dec-10	04.00PM	CEVA	695BKK69497330	50929975	9-Dec-10	14-Dec-10
8-Dec-10	04.00PM	CEVA	695BKK69497330	50929975	9-Dec-10	14-Dec-10
10-Dec-10	04.00PM	CEVA	618BKK35765413	50934514	11-Dec-10	16-Dec-10
10-Dec-10	04.00PM	CEVA	618BKK35765413	50934514	11-Dec-10	16-Dec-10
10-Dec-10	04.00PM	CEVA	618BKK35765413	50934514	11-Dec-10	16-Dec-10
10-Dec-10	04.00PM	CEVA	618BKK35765413	50934514	11-Dec-10	16-Dec-10
10-Dec-10	04.00PM	CEVA	618BKK35765413	50934514	11-Dec-10	16-Dec-10
10-Dec-10	04.00PM	CEVA	618BKK35765413	50934514	11-Dec-10	16-Dec-10
11-Dec-10	04.00PM	CEVA	180BKK13575844	50937056	12-Dec-10	17-Dec-10
11-Dec-10	04.00PM	CEVA	180BKK13575844	50937056	12-Dec-10	17-Dec-10
11-Dec-10	04.00PM	CEVA	180BKK13575844	50937056	12-Dec-10	17-Dec-10
11-Dec-10	04.00PM	CEVA	180BKK13575844	50937056	12-Dec-10	17-Dec-10
11-Dec-10	04.00PM	CEVA	180BKK13575844	50937056	12-Dec-10	17-Dec-10
11-Dec-10	04.00PM	CEVA	180BKK13575844	50937056	12-Dec-10	17-Dec-10
13-Dec-10	01.00PM	FEDEX_CMX	467557198900	467557198900	13-Dec-10	17-Dec-10
13-Dec-10	01.00PM	FEDEX_CMX	467557198900	467557198900	13-Dec-10	17-Dec-10
13-Dec-10	01.00PM	FEDEX_CMX	467557198900	467557198900	13-Dec-10	17-Dec-10
13-Dec-10	01.00PM	FEDEX_CMX	467557198900	467557198900	13-Dec-10	17-Dec-10
13-Dec-10	01.00PM	FEDEX_CMX	467557198900	467557198900	13-Dec-10	17-Dec-10
13-Dec-10	01.00PM	FEDEX_CMX	467557198900	467557198900	13-Dec-10	17-Dec-10
13-Dec-10	04.00PM	CEVA	180BKK13576275	50874524	14-Dec-10	20-Dec-10
13-Dec-10	04.00PM	CEVA	180BKK13576275	50874524	14-Dec-10	20-Dec-10

14-Dec-10	04.00PM	CEVA	933BKK07058634	50874572	15-Dec-10	20-Dec-10
14-Dec-10	04.00PM	CEVA	933BKK07058634	50874572	15-Dec-10	20-Dec-10
14-Dec-10	04.00PM	CEVA	933BKK07058634	50874572	15-Dec-10	20-Dec-10
16-Dec-10	01.00PM	FEDEX_CMX	4675 5720 3053	4675 5720 3053	17-Dec-10	22-Dec-10
16-Dec-10	01.00PM	FEDEX_CMX	4675 5720 3053	4675 5720 3053	17-Dec-10	22-Dec-10
16-Dec-10	01.00PM	FEDEX_CMX	4675 5720 3053	4675 5720 3053	17-Dec-10	22-Dec-10
16-Dec-10	01.00PM	FEDEX_CMX	4675 5720 3053	4675 5720 3053	17-Dec-10	22-Dec-10
16-Dec-10	01.00PM	FEDEX_CMX	4675 5720 3053	4675 5720 3053	17-Dec-10	22-Dec-10
16-Dec-10	01.00PM	FEDEX_CMX	4675 5720 3053	4675 5720 3053	17-Dec-10	22-Dec-10
17-Dec-10	04.00PM	FEDEX_CMX	4675 5720 5869	4675 5720 5869	17-Dec-10	22-Dec-10
17-Dec-10	04.00PM	FEDEX_CMX	4675 5720 5869	4675 5720 5869	17-Dec-10	22-Dec-10
17-Dec-10	04.00PM	FEDEX_CMX	4675 5720 5869	4675 5720 5869	17-Dec-10	22-Dec-10
17-Dec-10	04.00PM	FEDEX_CMX	4675 5720 5869	4675 5720 5869	17-Dec-10	22-Dec-10
17-Dec-10	04.00PM	CEVA	933BKK07058936	50874782	18-Dec-10	23-Dec-10
17-Dec-10	04.00PM	CEVA	933BKK07058936	50874782	18-Dec-10	23-Dec-10
17-Dec-10	04.00PM	CEVA	933BKK07058936	50874782	18-Dec-10	23-Dec-10
17-Dec-10	04.00PM	CEVA	933BKK07058936	50874782	18-Dec-10	23-Dec-10
17-Dec-10	04.00PM	CEVA	933BKK07058936	50874782	18-Dec-10	23-Dec-10
18-Dec-10	10.00AM	CEVA	695BKK69500395	50950430	19-Dec-10	24-Dec-10
18-Dec-10	04.00PM	CEVA	695BKK69500395	50950426	19-Dec-10	24-Dec-10
18-Dec-10	04.00PM	CEVA	695BKK69500395	50950426	19-Dec-10	24-Dec-10
18-Dec-10	04.00PM	CEVA	695BKK69500395	50950426	19-Dec-10	24-Dec-10
18-Dec-10	04.00PM	CEVA	695BKK69500395	50950426	19-Dec-10	24-Dec-10
18-Dec-10	04.00PM	CEVA	695BKK69500395	50950426	19-Dec-10	24-Dec-10

18-Dec-10	04.00PM	CEVA	695BKK69500395	50950426	19-Dec-10	24-Dec-10
18-Dec-10	04.00PM	CEVA	695BKK69500395	50950426	19-Dec-10	24-Dec-10
18-Dec-10	04.00PM	CEVA	695BKK69500395	50950426	19-Dec-10	24-Dec-10
18-Dec-10	04.00PM	CEVA	695BKK69500395	50950426	19-Dec-10	24-Dec-10
18-Dec-10	04.00PM	CEVA	695BKK69500395	50950426	19-Dec-10	24-Dec-10
18-Dec-10	04.00PM	CEVA	695BKK69500395	50950426	19-Dec-10	24-Dec-10
20-Dec-10	04.00PM	CEVA	180BKK13579856	50950452	22-Dec-10	27-Dec-10
20-Dec-10	04.00PM	CEVA	180BKK13579856	50950452	22-Dec-10	27-Dec-10
20-Dec-10	04.00PM	CEVA	180BKK13579856	50950452	22-Dec-10	27-Dec-10
20-Dec-10	04.00PM	CEVA	180BKK13579856	50950452	22-Dec-10	27-Dec-10
20-Dec-10	04.00PM	CEVA	180BKK13579856	50950452	22-Dec-10	27-Dec-10
20-Dec-10	04.00PM	CEVA	180BKK13579856	50950452	22-Dec-10	27-Dec-10
20-Dec-10	04.00PM	CEVA	180BKK13579856	50950452	22-Dec-10	27-Dec-10
20-Dec-10	04.00PM	CEVA	180BKK13579856	50950452	22-Dec-10	27-Dec-10
21-Dec-10	01.00PM	FEDEX_CMX	4675 5720 8537	4675 5720 8537	21-Dec-10	25-Dec-10
21-Dec-10	04.00PM	CEVA	933BKK07058093	50950522	22-Dec-10	27-Dec-10
21-Dec-10	04.00PM	CEVA	933BKK07058093	50950522	22-Dec-10	27-Dec-10
21-Dec-10	04.00PM	CEVA	933BKK07058093	50950522	22-Dec-10	27-Dec-10
21-Dec-10	04.00PM	CEVA	933BKK07058093	50950522	22-Dec-10	27-Dec-10
21-Dec-10	04.00PM	CEVA	933BKK07058093	50950522	22-Dec-10	27-Dec-10
21-Dec-10	04.00PM	CEVA	933BKK07058093	50950522	22-Dec-10	27-Dec-10
21-Dec-10	04.00PM	CEVA	933BKK07058093	50950522	22-Dec-10	27-Dec-10
22-Dec-10	04.00PM	CEVA	618BKK35766124	50950555	24-Dec-10	29-Dec-10
22-Dec-10	04.00PM	CEVA	618BKK35766124	50950555	24-Dec-10	29-Dec-10

22-Dec-10	04.00PM	CEVA	618BKK35766124	50950555	24-Dec-10	29-Dec-10
22-Dec-10	04.00PM	CEVA	618BKK35766124	50950555	24-Dec-10	29-Dec-10
22-Dec-10	04.00PM	CEVA	618BKK35766124	50950555	24-Dec-10	29-Dec-10
22-Dec-10	04.00PM	CEVA	618BKK35766124	50950555	24-Dec-10	29-Dec-10
23-Dec-10	04.00PM	CEVA	180BKK13579882	50950636	25-Dec-10	30-Dec-10
23-Dec-10	04.00PM	CEVA	180BKK13579882	50950636	25-Dec-10	30-Dec-10
23-Dec-10	04.00PM	CEVA	180BKK13579882	50950636	25-Dec-10	30-Dec-10
24-Dec-10	04.00PM	CEVA	BKK 1357 9893	50950673	26-Dec-10	31-Dec-10
24-Dec-10	04.00PM	CEVA	BKK 1357 9893	50950673	26-Dec-10	31-Dec-10
24-Dec-10	04.00PM	CEVA	BKK 1357 9893	50950673	26-Dec-10	31-Dec-10
24-Dec-10	04.00PM	CEVA	BKK 1357 9893	50950673	26-Dec-10	31-Dec-10
24-Dec-10	04.00PM	CEVA	BKK 1357 9893	50950673	26-Dec-10	31-Dec-10
25-Dec-10	04.00PM	CEVA	BKK 1357 9893	50950695	26-Dec-10	31-Dec-10
25-Dec-10	04.00PM	CEVA	BKK 1357 9893	50950695	26-Dec-10	31-Dec-10
25-Dec-10	04.00PM	CEVA	BKK 1357 9893	50950695	26-Dec-10	31-Dec-10
25-Dec-10	04.00PM	CEVA	BKK 1357 9893	50950695	26-Dec-10	31-Dec-10
25-Dec-10	04.00PM	CEVA	BKK 1357 9893	50950695	26-Dec-10	31-Dec-10
25-Dec-10	04.00PM	CEVA	BKK 1357 9893	50950695	26-Dec-10	31-Dec-10
25-Dec-10	04.00PM	CEVA	BKK 1357 9893	50950695	26-Dec-10	31-Dec-10

Example of Supplier surveys on Failure Analysis Turnaround time

Request Supplier	A	B	C	D
1) Typically FAR process	Process Request form to supplier A	Process request with information	Process Request form to GOC	Process Request information by Mail
2) FA turn around time once part ETA	- FA request within 2 Days - FA result within30 Days.	10 Days	GUC 11 Days ASE/Amkor 13 Days TSMC 10 Days	For normal cases, it should be available within a week.
3)Cycle time to provide RMA# and address info	Standard request 2 days Line stop will always have a high priority.	RMA# for you to send out the reject on the same day but the official RMA for Credit note will only be send after the FA is done	1~2 working day	RMA# will only be issued after FA and confirmed to be component failure. If that is a case, should be able to provide within 2 days
4) Have Policy for FA and Return Part? Warranty coverage. Pls response in detail	Yes (Not discuss Warranty coverage)	Yes (Not discuss Warranty coverage)	Yes (Not discuss Warranty coverage)	Yes C
4.1) Do you provide forwarder a/c for FA shipment ?	Yes	No	Yes	No
4.2) Do you provide forwarder a/c for return FA sample backt to CTH ?	Yes	Yes	No	Yes
4.3) Do you alway provide the credit for FA sample ?	credit if the failure was caused by supplier A	Flexible	Depend on FA result	(NO) Depend on FA result
4.4) Do you provide the rwk cost concurred at your customer due to your qualtiy issue.?	Not discuss	Not discuss	Not discuss	Not discuss
5) Support replacement/credit , For non interest to perform FA.	credit if the failure was caused by supplier A	Flexible	Yes	No

6) Provide Organization (quality and FA) and contact person (With backup person)				
7) Agree with "GENERAL QUALITY AGREEMENT FOR PURCHASED PARTS				

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

BIOGRAPHY

Ms. Pornthip Chengsuebsant was born on 4 April 1984 in Bangkok. She graduated from Kasetsart University, Thailand in 2006 with a Bachelor's Degree in Electrical Engineering. Then she spent the next two years working at Western Digital Company. In 2007, she continued to study in Engineering Business Management for Master's degree at Regional Centre for Manufacturing System Engineering (RCMSE), Chulalongkorn University (Thailand) and University of Warwick (United Kingdom).