



Analysis of the Purchasing Process

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Abstract <p>The aim of the thesis was to determine the purchasing activities of the consumable materials at Finnish Aircraft Maintenance, and to compare them to the models presented in literature.</p> <p>Most of the theoretical information for the thesis was gained from books related to purchasing, and the practical information from working as a purchasing trainee for the company.</p> <p>The commissioner, located in Helsinki-Vantaa airport, is a maintenance company that has been maintaining ATR-aircrafts since 2008. The fact that it was a young company in aviation industry in question brought some special features to the research. For example, the lack of price history prevented the categorization of the consumables. In addition to Kraljic's model, the thesis was limited to process mapping by using process charts and a theory called Six Steps of Purchasing, and introducing few purchasing models that could not be adapted as such due to aviation regulations.</p> <p>The result of this thesis was a process chart stating the stages of a purchase, analysis using the theory of six steps of purchasing and presentation of a couple of purchasing models that could be adapted partly, such as Kanban and Vendor Managed Inventory.</p>		
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<p>Tiivistelmä</p> <p>Opinnäytetyön tarkoituksena oli määrittää kulutusmateriaalien ostotoiminnot Finnish Aircraft Maintenancessa ja verrata niitä kirjallisuuden tarjoamiin hankintateorioihin.</p> <p>Tutkimuksessa käytetty tieto tuli teorian osalta suurimmaksi osaksi ostoon liittyvästä kirjallisuudesta, käytäntö työkokemuksista toimeksiantajan ostoharjoittelijana.</p> <p>Helsinki-Vantaan lentoasemalla sijaitseva FAM on vuonna 2008 toimintansa aloittanut ATR-koneita huoltava yhtiö. Toimeksiantajan ollessa nuori organisaatio lentoteollisuudessa tutkimuksessa tuli huomioida joitain erityispiirteitä. Esimerkiksi hankintahistorian puuttuminen vaikutti työhön estämällä kulutusmateriaalien luokittelun hintaryhmiin. Kraljicin mallin lisäksi opinnäyte rajoittui prosessien määrittämiseen prosessikarttoja ja oston kuuden vaiheen teoriaa apuna käyttäen, sekä muutamien hankintamallien esittelyyn.</p> <p>Tutkimuksen tuloksina voi mainita prosessikaavion, joka kuvaa yksityiskohtaisesti oston eri vaiheet, analyysin kuuden askeleen teoriaa käyttäen sekä muutamien osittain sovellettavien hankintamallien esittelyn, mm Kanban, VMI.</p>		
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Abbreviations

AOG	Aircraft on Ground
CAA	Civil Aviation Authority
CBM	Condition Based Maintenance
COC	Certificate of Confirmation
EASA	European Aviation Safety Agency
FAM	Finnish Aircraft Maintenance
FC	FinnComm
FH	Flight hours
HM	Heavy Maintenance
JAA	Joint Aviation Authorities
JIT	Just-In-Time
MOC	Maintenance Operations Control
MOQ	Minimum Order Quantity
MRP	Material Requirements Planning
PO	Purchase Order
RFI	Request for Information
RFQ	Request for Quotation
SCM	Supply Chain Management
VMI	Vendor managed inventory

1. Introduction

1.1. Aim of the Study

In this study the purpose was to help a young, growing aviation company, Finnish Aircraft Maintenance (FAM), to map its purchasing operations and to compare those activities with the provided theoretical models in order to find an effective strategy to be applied for the purchasing department. The special requirements of aviation industry result in the need of evaluating interesting models found from literature more critically and giving recommendations bearing the limitations on mind.

The first goal of the project was to determine the purchasing actions of the consumables, something that has not yet been done due to the short history of the company. The second step was to find a purchasing model from literature which has possibly similarities with current situation and could because of that be implemented with only small effort and disturbance. The possibility to make savings in both money and time without compromising flight-safety was also given some attention but the main focus was on analysis of the processes in purchasing.

1.2. Research Methods

The primary goal was to map the current purchasing processes and to see if there was a possibility to change the purchasing activities of consumable materials to resemble a purchasing model from literature. This means combining empirical and theoretical research into something useful.

The empirical research was done by working as a purchaser for the commissioner and by interviewing other employees for developing an overall picture of the purchasing practices.

1.3. Object of the Study

Finnish Aircraft Maintenance (FAM) is located in a strategically important Helsinki-Vantaa airport area. Recently constructed facilities in Öljykuja are shared with Finnish Commuter Airlines and Inter Handling, and they enable large maintenance tasks to be performed for three planes at a time.

Finnish Aircraft Maintenance was established on paper in 2003, and after long preparations the company gained the part-145 approval 2008 and was able to provide maintenance services as an independent company. The ownership of the company was divided between Finnair and Finnish Commuter Airlines (FinnComm). The main business idea was to maintain all aircrafts used by FinnComm and make maintenance contracts with foreign airlines for their ATR planes. All employees from FinnComm's maintenance department were assigned as old employees to the new company and new ones were hired to enable a rapid growth for the company. Becoming an independent company and not being just a maintenance department of FinnComm did not result in radical changes in the working environment of the employees. Co-operation with FinnComm remained close, from sharing a building to having a common IT-department. Finnair became more or less a silent partner, giving advice to engineers and managers, but not being regularly part in everyday work of employees.

FAM started providing heavy maintenance in full scale after moving into new facilities in the beginning of 2009. The company already had contracts with

foreign airlines for maintaining their planes when moving into new hangar, this meaning that business started off strongly.

For the customers buying maintenance services from FAM, it is possible to buy a long term maintenance service with all the necessary checks and overhauls, just one operation, or something in between. The price for each maintenance operation is calculated individually depending on what is done and what materials are required. The first maintenance visit also includes the costs that become from creating an account for an aircraft to the company's ERP-system.

2. Purchasing as a Strategic Action

2.1. Definition of Purchasing and Procurement

Purchasing itself is a very wide concept, defined differently by almost every author of different purchasing books. As for procurement, definitions can vary a lot or the two terms can even be used interchangeably. Donald Waters states in his book that "Procurement and purchasing are often taken to mean the same thing. Usually, though, purchasing refers to the actual buying, while procurement has a boarder meaning." (2003, 228)

He reminds that in purchasing not all transactions are simple purchases, but it includes rental, leasing, contracting, gifts etc. In his opinion, procurement includes, in addition to purchasing, also supplier selection, negotiations, quality assurance, materials handling, transport, warehousing and so on. It is an important link between organizations, largely concerned with information processing and distributing it to the supply chain.

Arjan J Van Weele's opinion of purchasing defines it as

"The management of the company's external resources in such a way that the supply of all goods, services, capabilities and knowledge which are necessary for running, maintaining and managing the company's primary and support activities is secured at the most favorable conditions" (2005, 12).

Water's describes purchasing only as a message informing the supplier that the company is ready to receive the goods on the terms discussed. Wheele's description of purchasing covers almost the whole process starting with determining the need. His definition for procurement only adds to the definition of purchasing actions needed for getting the items from supplier to its final destination, actions in stores, traffic and transport, incoming inspection and quality control and assurance.

There is one definition seeing the difference not in material handling but in relationship management. Elliott-Shircore and Steele defined the difference in 1985 in the following way:

"Purchasing is more concerned with establishing and managing a commercial relationship, whereas procurement is also concerned with the more physical material or service delivery control aspects after the contract has been let or the order placed. " (Quayle 2006, 3)

In short, the best way to combine all these definitions is to describe procurement as a function including everything from planning the purchases and material needs to checking the received item and taking it into inventory. Purchasing, instead, includes the chain of events from planning the time for each purchase and choosing the supplier, keeping in mind the required quality and quantity of goods, to placing the order, whether it is actual buying, rental or something else, and agreeing on the form of the transportation.

2.2. Organization of Purchasing

In order to control and manage purchasing activities in a company it is helpful to view them divided into three different levels; strategic, tactical and operational, (Kitching 2001)

Strategic planning includes the most money worth decisions; forecasting and analyzing long term risks, choosing most important suppliers, making make-or-buy decisions, setting tactical objectives and making sure that people being responsible for them are up to the task. Strategic planning is done by managers who rarely are involved with everyday purchasing actions. (*Kitching 2001.*)

Tactical level focuses then on medium-term issues, usually approximately one year ahead. This means decisions are about major contracts, new suppliers are sought, new contracts are negotiated, big purchases are taken care of and current market analysis is made. Tactical level is handled by purchasing “supervisors”, those who answer straight to managers.

The most practical level is the operational level. It includes the day-to-day actions such as placing quotations and orders to familiar suppliers, monitoring quality and expediting. It looks ahead only weeks or a couple of months. Sometimes some areas can be even taken care of by people from different departments. (*Kicthing, 2001*)

If the staff of the purchasing department is divided into these levels, it does not require every employee to be trained fully competent to manage all responsibilities of the level. It is enough if there is one person in charge taking care that everything is given enough attention. Clear division of tasks helps making sure everything is being taken care of.

2.3. Aims

According to some experts, purchasing is nowadays considered almost as important business function as strategic management of the firm. It is easy to agree with the notion that this has not been the case for long. Through history, most of the companies have put money and effort on sales department, assuming that everyday grocery shopping has given their staff all the training they need to take care of the material flow into the company. (Quayle 2006 p)

In just a few words, the aims for purchasing department are providing the right quantity and quality of materials, negotiating competitive prices, ensuring low stock levels by planning the deliveries, building relationships with suppliers and making sure they are reliable and punctual. It is recognized that to understand the pricing methods of the supplier and being able to negotiate better deals requires more than personal super-market experiences, and attention is given to purchasing and theories of it. (Quayle 2006)

2.4. Reasons for Careful Planning

Purchasing department supplies all the material needed by the production from reliable suppliers at reasonable prices. Consolidated orders would not be possible without centralised purchasing, as different departments would only procure quantities according to their own needs and quality standards. Differences in quality issues might also have impact on final product and compromise company standards.

The risk in bigger companies is that purchasing department grows remarkably big and responsibilities become unclear. Same items are procured by several

employees with different standards and purposes. Management needs to stay on top of everything to ensure that aims for purchasing are what company desires. (Weele2003, 81-83)

If the purchasing department is not getting enough attention from the management, the risk is that the company is no longer actually purchasing anything, but allowing others to sell goods to them. This means paying too much and having lead-times longer than they should be.

With careful planning, avoiding different scams also becomes easier. For instance, fake invoices are easier to spot if they are accepted by a person who knows the items and knows their purchasing history. The reputation of the company also relays on the quality of the manufactured products and keeping up with the timetables, which both are greatly dependent on successful purchasing. (Kitching 2001.)

2.5. Supplier Relationship Management

Bargaining the cheapest price is not always the smartest thing to do. Making sure good suppliers can survive in the market is more beneficial. If suppliers are forced to lower prices for long enough, they need to make lower money consumption inside the company. This means for instance cutting down the number of employees and by this decreasing level of customer service, reducing research and development or cutting down the quality of raw material.

A long term partnership gives the advantage of getting the expertise of the supplier to the company. Determination of the best long-term solutions is done by professionals and if the supplier knows the future needs of your company

they can plan their production to meet your needs and by that they can minimize the lead times, for example.

Keeping up good relationships with the suppliers can be tricky. If wanting to meet them in person in order to discuss business you might need to travel considerable distances and if you invite them to your facilities, paying everything for their stay might be considered bribery. Accepting business-gifts needs also careful consideration to avoid accusations later on. Suppliers might also have so many other customers that it is hard or even impossible to stand out.

(Epiqtech, Supplier Relationship Management 2009)

3. Strategies and Purchasing Models

The nature of the implemented purchasing strategy is determined by the field of business. Differences in action models may differ greatly depending on whether the company is producing or reselling goods. For example, for a reseller, being out of stock may not be a critical situation, but if the machines of a production plant must be shut down even for a short period of time, costs might be significant. For production, levels of safety stocks must be calculated and different Just in Time solutions planned carefully. Resellers must think of their reputation, if they constantly run out of stock with their most popular products, customers might go to competitor or turn to substitutes. (Van Weele 2002)

Aviation industry is even more problematic, as it struggles with both of these challenges. If the purchasing department fails to provide the right spare at the right time, the worst-case-scenario is Aircraft on Ground, AOG. This means not only a grounded aircraft that cannot fly and earn money, but also angry

customers, who will tell their friends about the bad experience and think twice next time when choosing the airline.

Due to the current economic situation, price of kerosene and grown competition, airlines are already struggling with the profit margins. It is desired to make savings in all areas of business without decreasing the level of flight safety. By planning purchasing actions carefully, savings are easy to make and no big investments are required.

3.1. Purchasing Basics

3.1.1. The Five Rights

“The five rights” is a principle that gives a simple description for the traditional goals of purchasing. It is formed by the chain of events of getting the right goods, from the right suppliers, to the right place, at the right time, for the right price. In modern business life, this is not entirely accurate though, and it is hard to base your purchasing actions on it alone. For some purchases, for example, getting the goods at right time is more important than the right price. This means that the five rights are not always equally important, and for purchaser it will soon be hard to see them all as a set of things to consider when money is often the most important indicator for purchasing performance. Also it is good to remember that too early delivered goods are not on-time, but increasing warehousing expenses. (Kitching 2001)

In theory though, the five rights is a good base for purchasing. Inside the company the management might put them into order and each of them could be given an importance factor. This helps the purchasing department to make the final decisions on where to buy and at what price. (*Kitching 2001.*)

3.1.2. Kraljic's Model

Peter Kraljic presented his method of analysing the company purchasing portfolio in 1983 and the model has been very popular ever since. The whole approach consists of four steps in order to define the proper purchasing strategies for strategic products.

The first step is classifying the purchased materials of the company in two dimensions, profit impact and supply risk. This can be done either on product or product group level. Profit impact can be calculated in purchasing costs and amounts, impact on product quality or business growth; supply risk can be assessed by availability, number of suppliers and their on-time delivery rates, possible substitutions and make-or-buy opportunities. These factors create a matrix with four categories where all material can be placed (see Appendix 1). For each of these categories there is a purchasing strategy that suits the nature of the items best. (Kraljic 1983.)

Leverage products have an effect largely on the profit of the company and they are easily available with multiple suppliers and possible substitutes. For these products a good purchasing strategy is competitive bidding that targets at short-term deals with suppliers by improving knowledge of the markets, searching constantly new products and suppliers, reallocating purchasing volumes over suppliers, optimizing order quantities and target-pricing. By paying attention to supply and demand changes, prices can be followed and by making small savings in each purchase, annual savings can be remarkable. (Van Weele 2003.)

Strategic products are critical for the profit and production and the number of suppliers is low, sometimes even just one. The high tech, high volume items

can be custom-made for the buyer and play great a role in the final product. With these items, a performance based, long term partnership with a committed supplier is the most beneficial strategy to apply in order to secure on-time deliveries with a reasonable price. Activities required are careful forecasting of up-coming requirements, supply-risk analysis, thorough investigation when choosing the supplier, definition of the appropriate price, effective change-order procedure and vendor rating. (Van Weele 2003.)

Leverage product and strategic products together create eighty percent of the turnover, and therefore success in purchasing of these products can result in lower cost of the final product. (Van Weele 2003.)

Non-critical, so called routine products are standard quality items that have a large product variety, multiple suppliers, a small value per item and they produce few technical or commercial problems. Challenge with these products is that time spent acquiring them becomes easily more valuable than the product itself. In most cases, eighty percent of the time and energy of the purchasing department is used for products having no significant role in the final price of the product. That is why the purchasing of the items in question should be organized effectively, so that time could be spent on more essential products. Strategy to achieve this is category management and e-procurement solutions. Actions required are subcontracting per product group/product family, standardizing product assortment, designing effective internal order delivery and invoicing procedures and delegating order handling to the internal user. The most important target is to reduce logistic and administrative actions concerning low cost standard parts and gaining more time to contribute to make big savings in more expensive items. (Van Weele 2003)

Bottleneck products are rather low-cost but challenging due to the fact they can purchased only from one supplier. If the supplier faces problems in delivering their product, the buyer might be forced to even stop production

until the items are received. The situation is very supplier-dominant and results in high prices, unreliable and long lead times and bad customer service. Otherwise the impact on financial results is low. To avoid zero stocks and production stops, the right strategy to use is secure supply. It requires careful planning of materials need, supply-risk analysis, determination of ranking in the suppliers' customer list, developing preventative measures as buffer stocks and consigned stocks and constant search for alternative products and suppliers. The aim is to reduce the dependency on the suppliers by carefully defining bottle-neck products, both short-term and long-term, and making sure there are enough items available at all times.

(*Van Weele 2005*); (12manage, *Krajlic Model 2009*); (*Krajlic, 1983*)

When purchased items are classified into the four categories, the next phase, step two, is to analyse the supply markets and determine the company's overall strategic supply position. This is done by evaluating the bargaining power of the supplier and company's strength as a customer.

The third step is to position the defined strategic products into a purchasing portfolio matrix to determine whether they should use an aggressive or defensive strategy, or if the situation is balanced. The matrix has two indicators, supply market strength and company strength, and they both have three levels: low, medium and high (see Appendix 2). If the supplier has strong position and company's role is insignificant, the company should go into defensive strategy and look for substitutes. If the supplier has no special position in the market and the items have no major role a defensive role can easily become too expensive to maintain. In this case a balanced strategy is well functioning. The last possibility is if the supplier is dependent on the orders of the company. The possible strategy is exploitation. With this one the company must be careful not to exploit the supplier out of business. (*Kraljic 1983*.)

The last step in the supply strategy definition is to develop action plans for the strategic items. A short term strategy is to consolidate the orders of diversification items to one supplier and gain power over the supplier by this, even if it means paying higher prices occasionally. When becoming a more important customer for the supplier, the position of the company improves. (Krajic 1983)

3.1.3. Materials Requirement Planning (MRP)

Purchasing needs to be one step ahead of production at all times. Components and raw material need to be purchased and received before they are needed in order to secure steady manufacturing. This is why the need of material must be defined accurately. If a company wants to be able to meet the customer demand effectively and by that keep up a high level of customer satisfaction, without having huge amount of money tied up in big inventories, some planning must be done carefully. The simplest way of calculating the need of material is looking back on certain time period to see how much was consumed and relying on estimated forecasts. For small, steady companies this might work on some level, but ability to adjust on possible changes in demand is too important to risk for bigger ones. Even though forecasts can see possible increases or decreases on markets they are just what they are called: forecasts. Not accurate and likely to be wrong. (Waters)

Optimum situation for a company is to actually know precisely how much material they need and exactly when. This facilitates low inventories by just-in-time deliveries and time for purchasing department to negotiate prices with suppliers. To get the information on the needed materials is when the MRP comes in.

MRP collects a lot of data and combines it to show the actual need of material. Data comes from three different sources; master schedule, bill of materials and inventory records. Master schedule is the production plan made by

management that shows what is done and how much. Bill of materials is the specified list of different materials and components needed to produce an item telling also the order what they are needed in and inventory records give the information of what is already available.

The biggest difference between conventional planning of material need and MRP is looking at the demand as individual or depended demand. When planning is made conventionally, the overall demand is seen to be formed by many individual demands from multiple sources whereas MRP does not consider one demand independent from another. When a company uses same components to manufacture same products, the demand is seen to dependant on production plan of the final product. Basically, MRP opens up the master schedule to see each component needed and plans the deliveries do that products can be manufactured as efficiently as possible.(Waters)

Depending on whether independent on dependent demand approach is used the stock levels differ remarkably. When independent demand stock are not dependent on production plans stock level is kept high in the beginning to make sure it can answer any possible demand. When production ends, the stock is calculated and replenished to match the estimated future need.

Dependent demand approach has a low basic inventory, it calculates what is needed to manufacture what is planned to manufacture in certain planning circle and stocks up what is needed. Delivery date might even change depending on time when the components are needed. This keeps stocks low at all times, and when production ends, stock level is same low as it was in the beginning.

(Waters, Donald 2003) (Van Weele, 2005)

3.1.4. Supplier Assessment and Quality Control

For effective cooperation with the suppliers it is important to evaluate them regularly to see if there is room for improvement that require special attention.

Even though current situation might be enough to fulfil the demands in quality and quantity, situation can always change rapidly. Sometimes even the awareness of the evaluation might result in better performance of the supplier.

Assessment can be done in four different levels. The first is the narrowest, the product level. The quality of the products is checked by incoming inspections and quality controls to ensure degree of quality conformance of incoming goods. This means training the employees receiving the goods in the company to look for defects and other poor quality.

The second is the process level. In this, the product itself is not examined, but the manufacturing of it. The machinery and quality control methods of the supplier are audited to make sure they are up to the quality standards. Having state-of-the-art machinery might lower the manufacturing expenses remarkably and result in lower prices.

Third is the quality assurance system level that evaluates the whole quality organization from procedures and guidelines to development of inspections and keeping them up to date. This level evaluates the overall attitude of the company towards quality, how keen they are on keeping the level as high as possible.

The highest level of investigation is the company level. It evaluates not only quality aspects, but also the financial situation. The ultimate goal is to determine whether the company will be competitive in the future or is the management incompetent to run the company successfully. As the quality assurance system level, this level is rarely used, as the two first ones are easier to implement.

When assessing a supplier two different types of methods are used. When personal opinions of employees are used in evaluation the term subjective method is used. It does not use any concrete measures, but for example

experiences on customer service and level of co-operation and is therefore a qualitative method. Objective methods take closer look on performance issues by trying to make them quantitative.

The most used tools and techniques to assessment are spreadsheets, personal assessment, vendor rating, supplier audit and cost modelling. The three first ones are invisible for the supplier and are just for the company's own information, supplier audits and cost modelling target on improvement by co-operation with the supplier.

Spreadsheets are simple but effective way of analysing suppliers by using quotations received. The data is put into matrix with different columns of information and comparing different aspects becomes easier as data is clearly visible. The most important factors are defined inside the company and suppliers are put in order according to these requirements.

Personal assessment uses also pre-made form that is filled out; in this case the data is personal experiences of the people working with the supplier in question. The information collected might be response time to queries, assistance when possible problems occur and negotiation manners. Seeing the several opinions of employees working in different departments and positions helps defining the weakest points of the supplier.

Vendor rating is assessment tool limited to quantitative data: price, quality and delivery reliability. Making this assessment requires a lot of data analysing. If the supplier has been used considerably often, the price history, number of rejected items and the amount of deliveries late or early might consider significant amount of data that needs to be collected from number of sources and sorted in desired way. Nowadays, though, most materials planning systems keep records of all the useful information and therefore the assessment is easier and faster to carry out.

Supplier audit is an assessment with concrete actions visible to the supplier. A specialist from the company is sent to suppliers facilities to evaluate the processes and quality organization in person. Visits include discussions about the weaknesses and improvement prospects. Doing audits regularly gives the opportunity to follow up the implementation of desired improvements and helps keeping the supplier concentrated on issues at hand.

The last method of assessment is cost modelling. It takes the most work and should be done only if the buyer-seller relationship has developed to be strong enough. In short this method is carried out by having a specialist from buying company calculating the real cost of goods bought from supplier. This includes material costs, warehousing, distribution, manufacturing costs etc, in other words all direct and indirect costs. This already gives insights to be discussed with the supplier, but the analysis can be taken even further. The specialist can calculate the optimum cost of the goods, if the supplier would have state-of-the-art machinery, effective production strategy etc. This is where the need of good buyer-seller relationship comes in at the latest. Discussions for development need to include the trust that buyer will not try to cut the profit of the seller and possible investments on machinery are really profitable. Usually buyers offer long-term buying contracts in compensation to encourage the seller for improvements.

Being well prepared for the supplier performance assessment is really important. Knowing the facts of the company clears out the subjects needing the attention. For this financial assessment becomes handy. The information is easy to get, at least in European countries where legislation requires financial reports on regular basis. It should be kept in mind though, that these reports are based on historical data, and situation might have changed remarkably and the future could be totally different. For example when the financial report shows the company has not used money on research and development during past six months it does not mean they have not invested in it remarkably a year before and if they are investing in it currently. But it

helps to define the subjects to have a closer look on while for instance making an audit. Comparing the seller with other companies in the same field of business gives idea of the situation in the industry. (Van Weele 2003)

3.1.5. Scam-avoidance

When having remarkable amounts of goods purchased from number of suppliers it is inevitable to face a dishonest supplier at some point. Scams are easy to try to execute, invoices can be written for wrong quantities and prices, same invoice can be sent multiple times or goods might be delivered unordered. The three main types of scams are pretending to sell a service or a product non-existing, supplying goods or services at lower quality than what customer expects and persuading people to buy something they do not need or want. It is challenging for the buyer to tell whether the error has been done by accident or on purpose, one mistake should not result in ending an otherwise good supplier-buyer relationship. (Kitching 2001.)

This is why it is important that invoices are handled by personnel familiar with the products, knowing for instance if there is an “accidental” decimal mistake on the invoice. Even though the individual scams are often not very valuable, having multiple small ones can add up to be rather a big amount of money in a year. It should be also remembered that giving inexperienced purchasers spend limits up to a couple of hundreds of Euros does not mean the scams would not have an effect on the company finances. (Kitching, 2001.)

For avoiding scams purchasing department should be well organized and handle all the purchases in the company. The personnel acting as purchased only infrequently are most likely targets for scams. Clear purchasing policies for the department help employees to know the standards expected to be filled and purchasing performance stays at desired level. (Kitching, 2001.)

3.2. Reducing Traditional Purchasing

According to traditional 80/20 rule 80 percent of the time is consumed by purchasers on products worth 20 percent of the total value of all the items procured. (Cavinato, Joseph. 2001.)

3.2.1. Vendor Managed Inventory (VMI)

In many companies years of co-operation with the same supplier has resulted big, annual purchasing contracts. Usually, most common “non-critical”, low-cost consumable purchasing is centralized to one or two suppliers. This is why the option of taking off the responsibility to supply these items from the purchasing department is quite easy to carry out. In practice in this situation supplier is contracted to provide certain items and to make sure they are always available. This means for example, that supplier visits the lot regularly to stock their shelf or installs a web-camera to see when replenishment is needed. When doing this, purchasers do not need to make orders for the items; they are only paid by consumption.

This method has some risks to be considered before implementation. The vendor must be selected carefully to make sure they are devoted in keeping the stock up to date and even more precisely, they are up for it. The changes in demand are sometimes hard to estimate even inside the company, and if the supplier is not able to answer it without early notice might the situation of being out of stock become too familiar.

3.2.2. JIT and JIT II

The principle “just-in-time” is based on minimizing the dwell-time and late deliveries of material in the supply chain. When applying this method the material is delivered just before it is needed and no warehousing is needed between the supplier and production line. Compared to the traditional method when a certain amount of material is bought to stock and warehoused until it is consumed, JIT reduces the stock to almost nonexistent. Some safety stock needs to be kept due to the inevitable short-term change in demand, but the bigger the stock, the more expensive it is. (Van Weele 2003.)

Having big stocks also hides the possible problems in the material flow. Bad management when planning the production or incapability of the supplier is covered by big stocks that provide continuous production regardless the mistakes in the background. JIT sees the stocks more or less a only cure for the symptoms, not the disease. (Van Weele 2003.)

The stock levels are not the only thing JIT has affect on, though. Noticing the problems becomes easier when the visibility is not blurred with too big safety stocks and actions required are understood more easily. Quality is one thing that is seen differently, when there are not big amounts of material where one on two defects might not seem crucial. JIT sees the expenses on every improper part and it is possible to start investigating reasons for them. This supports total quality management that allows no defects in the production line. Seeing also the suppliers that can be trusted unconditionally helps gaining long-term partnerships that benefit both parties. (Van Weele 2003.)

Reduction of batch-sizes is one of the aims of JIT; by getting the sizes right the decrease in demand does not result in non-moving stock, waiting the demand to pick up. With small stocks and frequent deliveries of right sized batches, lead-times become shorter, answering the sudden changes becomes easier and no capital is tied down to material in vain.

If wanting the JIT work properly, attention on reliability issues is also crucial. Only reliability of the supplier is not enough if own machinery or employees are not trustworthy. Strikes and breakdowns must be avoided in order to keep continuous, interrupted production going. This means possible threats must be eliminated by taking care of human resources and machines.

The problem with implementing JIT is that it works perfectly only in certain types of organizations. Assembly lines with standardized products are the optimum environment for implementing the method as the materials needed keep constant and the speed of production does not vary. Changes required in order to change the produced item are in JIT point of view waste of time and material and should be eliminated. (Van Weele 2003.)

In recent years, JIT II has become more and more common in big companies. It also reduces stock and that way reduces the amount of money tied down to inventory. Difference between the original JIT and the second version is that in JIT II the responsibility of just-in-time deliveries is on the supplier's shoulders, which is positioned "in-plant". This means the supplier has an employee working on site of the customer and taking care of placing the customer's orders and ensuring the availability of materials. (Van Weele 2003.)

3.2.3. Kanban

Introduced by Toyota in 1950's Kanban, translated "signboard", has become one of the most widely used just-in-time solutions in the world. It was developed in order to reduce inventory levels and to improve availability on assembly line. It is based on an idea of visual signals to inform the need of re-stocking. In a simple example of Kanban (called Two-Bin Kanban) there are two bins of frequently needed material. Only one bin is used to provide the material for production at a time, and when it becomes empty, the signal for informing the need for more material is given forward by taking the removable

card off the bin and sending it to the store. While workers start using the other bin of material, the empty bin is fetched for re-stocking and brought back before the second bin empties. This requires calculating the need of material and evaluating lead-times once, but after that, if the consumption remains constant, re-stocking is effortless and fast. (Gross; McInnis 2003.)

Instead of sending a Kanban-card, visual signal could be given by placing a colourful Kanban-card on a special board on the wall or placing bins on specially marked floor areas. Main point is that person in charge can see with one glance what is happening and what is needed to buy more. Of course this means not a big variety of goods can be handled like this, but for managing the most used basic items the method is very effective. (Gross; McInnis 2003.)

3.2.4. E-purchasing

Business life has become more and more global during the past decades. Today, it is not unusual for a company to have all their manufacturing in Asia and only management level actions in the western world. This is possible by fast developing it-systems that carry messages from the other side of the world within seconds with practically no expenses. Good can be purchased from all over the world with a help of fast transportation and easy purchasing methods.

Electronic marketplaces are defined as places where actual transactions can happen between seller and buyer. There are four different types of these in the internet:

- Websites
- Buyer-centric portal
- Seller-centric portal
- Electronic market exchange

Websites are places for one-to-one (1-1) business, one seller meets one buyer. There is no competition between purchasers or sellers; usually very simple buy-it-or-leave-it mentality applies. Buyer-centric portals are places where one buyer can find several sellers (n-1), that can offer them a whole product line in one place. These places could be called online shopping malls. These marketplaces do not serve just one theme, but have everything from electric components to eye shadow. Seller-centric portals are places where seller finds several buyers at the same time (1-n) and buyers are aware of each other. Good examples are auction sites where buyers compete against each other to get the product. The last type, electronic market exchange, is a place that is often organized by the industry and where several buyers and sellers are present (n-m). (Van Weele 2003)

E-marketplaces are divided roughly in two by the accessibility of them. Open exchange welcomes everyone in to make business when private exchanges create user accounts for selected customers. Buying goods using either type of marketplace is usually straight forward, and especially with private exchanges save a lot of time when customer accounts are established and financial issues already agreed on when ordering. This is why it is sometimes hard to remember the disadvantages. When ordering is done by a couple of mouse-clicks it is unnecessary to have interaction with the suppliers and no supplier relationships are developed. This means suppliers know their customers only by their purchasing volumes and customer has no ability to use the expertise of the supplier when planning the purchases for the future.

When some amount of time is saved by using e-procurement, more time is consumed when building supplier relationships and money wasted when recommendations based on company needs are not received. (Van Weele 2003.)

4. Purchasing as a Processes

Purchasing is often seen only as the actual buying action, where money is transferred and goods change owners. If purchasing is wanted to make a strategic business action it is important to see different phases of the process and improve them individually. In general, purchasing can be divided into six steps that should be taken each time.

4.1. Determining Specifications

The first step of purchasing is to determine what is needed to buy and how much, could something be made by the company itself or should something just be repaired. Estimation of the skills of the employees and the quality of equipment in the company needs to be done regularly, and comparison to the quality received from repair shops checked in order to see if there is a reason for paying for certain services. Sometimes time savings can also be remarkable if the goods do not need to be sent off the premises and repair times monitored. (Van Weele 2003).

4.2. Supplier Selection

After determining what to buy and how much, it is needed to decide from whom to buy it from. First, it must be decided if subcontracting is in order to get what is needed, and if yes, which level is the most suitable for the occasion: partial subcontracting, turnkey contracting, fixed cost, unit-price or cost-compensation. If product or service is often needed some kind of agreement might secure the future purchases.

The next thing to do then is to define possible suppliers. This requires some market research: supplier must be located, reliability must be assessed and references and qualifications made clear. For this, sending out RFI, request for information helps a lot. With the information collected with RFI's, it is possible to develop shorter list of possible suppliers. For these pre-selected suppliers the RFQ's, requests for quotations, are sent to. Quotations should be sent then in format requested, so that it is possible to compare offers and the conditions in them. There are many things purchasing department has to consider when making the selection, for instance logistical, legal, financial and technical issues, just to name few.

(Van Weele 2003)

4.3. Purchasing Contract

When the decision is made for which supplier to use, it is time to get down to the details. The purchasing contract should include everything that has been agreed of, from delivery time to warranty issues. Depending on the issues such as culture, nature of the business and the market situation, the terms can vary remarkably.

For price and terms of delivery, the most desirable situation for the buyer is fixed price. The price is set in negotiations and bidding, and both parties have accepted it. Financial obligations should be clear for both, ideally supplier is responsible for everything that is not mentioned separately.

For the bigger purchases the payment commonly takes place in several stages. For the supplier it might require big investments and capital tied to the machinery to manufacture the equipment or produce the service. This is why it

is important to define at which stages the payments are done, and what are the requirements to be met before any money gets transferred.

In the purchasing contracts it is also good to mention the requirements for the purchased items. If they for one reason or another fail to perform the tasks planned for them, it is important to get refund or have the possibility to call of the deal all together. Duration of the test time that needs to be accepted, and the time that is required to be given for the supplier to try to fix problems need to be mentioned in the contract.

Possibility of third parties should also be defined in the contract, so that the buyer does not end up with a product manufactured by a supplier that was ruled out in the supplier selection due to the bad quality management. Insurances and safety regulations are things to remember also, as well as transfer rights and obligations.

Because purchasing contract may contain many areas to agree of, it is understandable that the suppliers are not always able to meet the requirements. If they refuse of some areas of the contract, it is not valid until compromise is made. This might need a new set of negotiations, so called "war of forms".

For avoiding the situation of having to negotiate every detail separately when making a purchase, a set of international standard contracts are formed to be used as they are or modified. One good example is The Incoterms that cover all the basic issues. (Van Weele 2003)

4.4. Ordering

For some cases, usually big, one-time purchases, agreements are orders at the same time and separate order is not needed to place. If the purchases are frequent and for instance the prices are negotiated in advance, the once negotiated purchase agreement is valid for certain amount of time and orders just inform the supplier the required quantity. Often, after checking the availability, the RFQ is turned straight into purchase order, PO, and no special agreements are made.

There is some information every PO should include. For instance personal PO-number is required so that the buyer can track down their orders themselves. Other important information is for example unit price, total price, quantity needed, requested target date, description of the product, delivery address and invoicing address. Naming the courier is also worthwhile, if it is not a standard in the purchase agreement.

After receiving the order, suppliers are often required to send POA (purchase order acknowledgement) in return. This informs that they have received the order and accepted the information in it. At this stage the supplier also confirms the target date. (Van Weele, 2003)

4.5. Expediting

When the supplier has agreed on the delivery date and conditions, starts the waiting for the items. Usually the delivery time is estimated to give room for possible delays and steady working pace for workers. This means there might be room for some expediting.

There are different expediting types defined. Most used but at the same time the most ineffective is the exception expediting, where buyer starts to take action when the company faces zero-stocks. Late deliveries get no attention this way if safety stocks are adequate. If there are no actions performed every time target date is missed, supplier might think they have no need to respect the target dates. (Van Weele 2003.)

Another method is a routine status check that can work if there are not too big amount of orders active. In this method supplier is contacted certain number of days before and asked to confirm the delivery date. This gives the signal that buyer is expecting the goods and notices if they are late.

For the critical parts and suppliers there is a method called advanced status check. Critical in this case does not necessarily mean important, but might refer to problematic as well. In this method production is given a production plan, a set of “milestones” to be supervised by the buyer to be reached. This happens by making audits and inspections to the production premises. (Van Weele 2003.)

4.6. Follow Up and Evaluation

The purchasing process is not finished when the goods are delivered. Buyer has important role even after the goods are taken into use or material into production. If something is to go wrong, it is vital that someone knows the facts of the purchase, possible warranty issues and return rights. Sometimes goods might need some unexpected fixing or adjustment, resulting in expenses that must be first approved by the management and recorded to the purchasing costs for the future evaluation.

Evaluating process is important tool to see the problems that can be avoided next time and whether the supplier in question can be used again. (Van Weele 2003.)

5. Maintenance

5.1. Provided Maintenance

Aircraft maintenance has a lot of unique characteristics compared to the other industrial maintenance. All the actions are strictly defined by authorities and every step has its own precise instructions. The base of the maintenance is the weekly and daily checks and small maintenance actions between flight duties, called line maintenance that reveals possible needs for bigger actions before the scheduled overhaul.

Overhauls can be scheduled by the flight hours, calendar time or flight cycles, depending on the case. For instance, if landing gear is maintained by flight hours (FH), the number of landings performed can vary radically. If we take two aircrafts with the same FH-number the stress put on the landing gear can be totally different due to the fact that during the time it takes for the other plane to fly to Asia and land once, the other one can do several domestic flights with multiple landings.

FAM has been well able to provide heavy maintenance (HM) in addition to line maintenance after moving to new facilities in March 2009. HM requires a lot of space and cranes and racks because the aircraft must be taken apart in order to get to the inner parts. Earlier some maintenance actions were bought from

outside and that took away the complete control over the timetables from FAM. Now almost all maintenance can be done on own premises.

5.2. Condition Based Maintenance (CBM)

Sometimes time is not the factor to tell when maintenance is needed. Climate changes are one thing that might have affect on the need of maintenance actions. To be absolutely sure all the items are functioning properly, time period to replace old components to new ones is estimated carefully so that the risk of a break-down in minimum. This means that often a fully functional part is taken out and thrown out just because it has reached a certain age. This means big amounts of wasted money, when the need of repair could have been defined based on the actual condition of the item.

For instance, if a bearing is estimated to last one year in every possible environment and climate, it most likely could function longer under optimum conditions. But if it said that the bearings must be changed every year, they usually are without any hesitation. It would be easy to estimate the condition of them if having proper tools for it. The lubrication of the bearing for instance can be defined by measuring the temperature changes while in operation. If the temperature rises clearly, it means friction is high due to bad lubrication. Also vibration measurement analysis can show changes in condition.

5.3. Practice

Maintenance in done in three shifts; morning, day and night shift seven days a week. Mechanics work three days and then have two days off. Team leaders supervise the actions maintenance operations control (MOC) and engineering

have decided to perform and maintenance planning has scheduled between flight operations. Night time is the time for line maintenance; there are no regional flights then. Aircrafts are also washed during night time. Heavy maintenance is done mostly during the daytime when other planes are performing their flight duties. For instance aircraft in C-check is taken out of duty for several weeks so that every task required gets performed.

Maintenance crew is divided into teams taking care of certain actions on certain days. Each team has a team supervisor in charge and for instance trouble shooting is done as ordered. Only selected number of mechanics is allowed to sign maintenance tasks as done and it is their responsibility to ensure everything is done as ordered.

5.4. MRP in Maintenance

Aircraft maintenance consists of series of scheduled maintenance tasks and checks. Aircrafts are tested and components monitored closely to ensure flight safety.

Often the flaws, or reasons for malfunction, are found during the maintenance actions and this makes it difficult to forecast the material need. Ability to provide the right parts at the right time is not even possible in reasonable means. Scheduled component changes and modifications are planned so early that materials arrive at the right time, but sometimes surprising critical findings force purchasing department to order parts in with priority C (critical) or AOG. Critical is order with estimated delivery in two-three days, AOG order should be received during the same day or the next day at the latest, in any means possible.

For purchasing basic consumables MRP is essential. To know quantities required in certain period of time helps when negotiating discounts. Bigger batches can be ordered without having to fear the items will never leave the warehouse. Suppliers also have considerable price breaks with some of their routine items. The unit price can change radically and it might not make any difference on the line price whether you buy 10 or 100 pieces.

6. Purchasing for Aviation Maintenance

6.1. Aviation Requirements and Limitations

Aviation is strictly monitored by authorities. In 2003 EASA (European Aviation Safety Agency) was founded to control the airworthiness in Europe with legal power given by European Union. European countries not in EU follow the rules of the Agency voluntarily. JAA (Join Aviation Authorities) represents aviation authorities from number of European countries that have agreed to follow the guidelines it sets in order to developed safety regulatory standards and procedures. The supervising is done by national authorities; JAA has no legal power itself.

Finnish Civil Aviation Authority (Ilmailuhallinto) that operates under Finnish Ministry of Transport and Communications was founded in 2006 and it takes care of monitoring and developing civil aviation in Finland. For instance, permits for civil aviation are requested from this authority.

In purchasing, regulations are a part of everyday business. No part can be put on an aircraft if the manufacturer and the part are not approved by EASA and supplier has not delivered Certificate of Conformity (COC) along with the part.

If something goes wrong, there must be an absolute traceability for the parts involved, so that for instance defected batch of screws can be removed from other planes having them installed. This prevents Kanban to be used for hardware in maintenance. It is too hard to keep track on which batch of consumables are in which bin and when they ran out and new batch was taken into use. For non-aircraft material this might work, but for items that must be traceable risks are too high.

Choosing a supplier has also special characteristics compared to other industrial purchasing. The suppliers need to be accepted by aviation authorities and they need to provide certificates and pass audits made by authorities. This helps purchases to estimate quality and reliability of the supplier without having to work for it by themselves.

6.2. Purchasing Expectations

Due to the limited number of possible suppliers it is important that cooperation is developed to be as seamless as possible. Items must be purchased early enough to minimize the effect of long lead times and avoid high AOG-order costs. If maintenance staff cannot work on an aircraft of a customer due to the lack of some item, expenses are high and reputation might suffer a great deal.

For parts this special it is clear that no great bargains can be found, and negotiations can never result in extremely low prices. The main task for the purchasing department is to provide the needed items in reasonable prices and to keep the money invested in inventory at an optimum level.

6.3. Nature of the Department

Purchasing is performed during office hours from Monday to Friday. Only the purchasers are qualified to make purchasing for aircraft materials.

The main responsibilities are divided between workers in the department.

Basically one takes care of the rotatable parts, items in pooling agreements and repairable items; sending goods to repair shop and supervising the repair-times. Other one takes care of chemicals and consumables of contract customers' aircrafts and one makes sure there are consumables for FinnComm planes available. Department works closely with the warehouse and all have access to warehouse to see the items on the shelves.

7. FAM Purchasing Meets Theory

7.1. Purchasing in Practice

Aircraft maintenance is based on checks scheduled by authorities; line maintenance and heavy maintenance, and possible trouble shootings if something is found malfunctioning. Timetable for possible modifications for FinnComm planes are ordered by Part M- department that takes care of the airworthiness. Engineering department decides what to do with the special findings in the planes and maintenance planning plans the dates to perform these overhauls. Each maintenance action is planned carefully and work orders are created. The work orders include the information of the task and required parts and materials. The availability of the needed items is checked by using the ERP-system and if the required quantity is not available the system sends an automatic notification to purchasers and warehousemen

informing which work order lacks system quantity and what is the target date. This starts off the purchasing process presented in appendix 3.

Receiving the zero-stock message results an evaluation of the required item. The part number tells a lot for an experienced purchaser in one glance, others check the part administration application to see whether the item is a rotatable part in repair and needed to get back quickly. It might also be a chemical, consumable or only purchasable from a certain vendor. Some parts for FinnComm's Embraers have a pooling contract with the aircraft manufacturer, and they should be procured using certain procedures.

If the item is consumable it is added to request for quotation (RFQ) that are usually sent to a few best suppliers once a day (if nothing urgent comes up) including part numbers that are so common they need to be held in stock at all times. From received quotations it is decided from whom the items are bought. The factors considered when making the decision are not only the price, but also the lead time, if the item has a certain target date.

The urgency also makes changes when making the order. There are three possible levels for the order: routine (R), critical (C) and Aircraft on Ground (AOG). Routine is the order that takes more than 4 days to send, critical should be received within 3 days or less, and AOG is sent as soon as possible, for instance put on the next Finnair flight departing from the city the item is located in. Also the form of transportation must be filled in, keeping in mind the urgency, one courier promises to deliver on the next weekday before 4 pm, one before noon. One might take three days; one might leave to get the parcel from the supplier immediately when informed and deliver within hours, and some might not have permission to transport for instance chemicals and dangerous goods cannot be transported at all.

Problems occur when findings are surprising and the items needed are rare and hard to track down. These create unavoidable AOG situations that cannot

be used when measuring purchasing performance. Sometimes parts consumption forecast (created from work orders by the ERP-system) contains items not really needed to buy. This might happen when some parts are possible to repair on the premises or some paint is needed by two different work orders 0.1 litres each and one 5 l can is in the warehouse. The system might be put to calculate the quantity in pieces, not in volume.

One problem is also the possibility of overlapping orders or false assumptions of someone else taking care of some items. For instance, during the slow times the division between responsibilities might be harder to make and sometimes two persons might include the same part number in RFQ and in order without noticing it. If RFQ is made using only e-mail it is hard to say what the others have queried even though most of the mails are sent as cc to everyone involved. The reason RFQs are not made using the ERP system is, in addition to the need for the extra three minutes, the fact that the suppliers are able to copy/paste part numbers from the messages easily and to add prices straight to the messages.

7.2. Purchasing for a Maintenance Organization

As all the consumables purchased are for maintenance, many things are dependent on each other. Good information flow is crucial to ensure successful business. For instance, depending on whether the maintenance is critical or not, the timing for it can be changed. When the time for overhaul is flexible, purchasing department has more time to ask quotation for the items and get them at low price. If the purchasers think they are in a hurry, the price is no longer the most important factor. This means purchasing department should be well informed of what kind of maintenance is done, what parts might be needed and which parts can possibly be repaired in-house in order to save money on routine items.

When having multiple work orders in process at the same time, alongside with the basic purchasing for storable items, it is good to have clear division what should be done by who. Risk of misunderstanding is created if every time when a zero-stock message arrives it is needed to agree on who will start tracking the part down. The division however is not easy to do. If it is said that one handles the big operations made on a certain aircraft when someone else takes care of line maintenance and all the chemicals, the division can be time-to-time very uneven. This might result in the other one helping the other one and eventually mixing something up.

To avoid uneven workload it is more efficient to make sure everyone knows what the other one is doing. When RFQ's are sent by e-mail it is impossible to say what parts others have in process before the order is made on ERP-system. Crowding up the e-mail with carbon copy- emails help up to a one point, but if this is forgotten, no information is available. Taking the extra three minutes when making the RFQ resolves this issue. Using the ERP system to create RFQ at the side of e-mail leaves a mark on the system telling the item is taken care of. And the information not only reaches the fellow purchasers, but the maintenance staff also, planners and engineers.

When planners are making the decisions on when to do what, they need to know when the required material is at hand. This is when they look for the target dates on purchase orders in the ERP-system. If the target date is the estimation of the buyer and the item is not in stock at the supplier, it is often wrong. It should be checked from the purchase order acknowledgement. This also helps when making supplier rating, it is seen right away how reliable suppliers are with their deliveries.

Compared to traditional industrial purchasing, aviation maintenance brings some differences. One of the biggest one is that minimum stocks are impossible to maintain. There needs to be big enough stock of consumables

to ensure that overhaul does not remain undone because of missing screw worth 50 cent. Challenge at the moment is the lack of consumption history. Quantities are hard to predict and because of this, purchases are mostly based on the price.

7.3. Six Steps of Purchasing at FAM

The first step, determining the specifications, is easy for purchasing department to execute at FAM. It is either the ERP-system or a maintenance employee who informs what is needed and how much. Every aircraft item has their individual part number approved by authorities and used by everyone handling them. Some of the items might have alternative part numbers shown by tables approved by aircraft manufacturer. All purchasing department needs to determine is the final quantity of the purchase, should the items be purchased to stock also, or just the quantity needed. For this, price is a big indicator as the consumption history is not yet available for most parts.

The second step, supplier selection is mostly based on quotations. Some parts have special part numbers that show they are to be procured only from one supplier, but most parts are standard and bought from multiple sources. To keep the purchasing process simple enough, the RFQ's are sent to approximately three suppliers and answers are compared in order to decide where to buy. Sometimes timetables forbid waiting for all the answers, and the supplier who answers the quickest gets the sale. If some items remain unquoted, new RFQ's are created and sent to other suppliers. Using new supplier might get laborious because of the need for internal approving and getting all the certificates, resulting that the number of suppliers is not that wide.

The third and fourth steps go hand in hand. An international standard is used as a purchasing contract, so basically every order is a contract. This saves a lot of time and keeps the process simple. The order is made using the ERP-system, including the information of the courier, priority of the order, quantity, price, target date and condition.

The fifth and sixth step, are not performed as such. Expediting appears only if something is wrong: if the situation of the aircraft changes, or the target date of the purchase has passed and the item is needed urgently. With stock-items the reliability of the deliveries is not monitored and the suppliers are not encouraged for better performance.

7.4. Analysing with Kraljic's Model

First step to take when making an analysis using Kraljic's method is to categorize purchased items according to supply risk/ profit impact matrix. Taking account the special nature of aviation business this has some special features. There are not that many products that can be considered as low-cost routine products. Due to the standardization costs and the need of several certificates and qualifications, manufacturers are forced to increase the price of products they sell, even simple screws, if they want to make profit. And because it is forbidden to install any item on aircraft without having them accepted by authorities, aviation maintenance is forced to pay a multiple price for a nut that could be purchased from local hardware-store without the stamp that says it has been accepted as aircraft spare.

The number of suppliers in aviation is limited, which also prevents the categorizing in the most efficient way. The supply risk is not as clear as it is in traditional industrial purchasing. Most of the time there is no room for compromises, for instance when choosing a paint to use, as there is for

regular business. Every part of an aircraft, as well as every maintenance task, is precisely defined and if one item is not available when needed, might the finishing of the overhaul be delayed.

The categorizing can be made from multiple perspectives. Are we looking the purchasing as any industrial action or from aviation point of view, is the profit considered to be for airliner owning the aircrafts or for the maintenance company selling repair services. Most useful analysis is done by considering the business as any maintenance in the market, and taking into consideration the airlines needs for maintenance. For instance even though there is no affect on airworthiness with the fact if the seats in the fuselage are the same colour, but marketing value for airliner might be considerable.

In aviation maintenance each item used has an impact on profit. If the item is not available, maintenance task cannot be finished. This results profit impact to be high for every product, big or small, that cannot be replaced by alternative product that is available easier. The categorizing of the goods can be seen in Appendix 4.

Step two is to define the situation of the company in the market, whether it has any bargaining power or not. It is easy to understand that a company founded six months earlier with less than one hundred employees has no significant position in the markets. However, aviation being rather small industry and ATR planes being manufactured a little over 800 by March 2009 (www.atr.fr) FAM has potential to grow to be well known expert in its field. Having Finnair as an owner might sometimes also create remarkable advantage when acquiring certain materials or services.

The third step concentrates on the items classified as strategic in step one. For FAM this means interiors, components and electrical products. They are placed in purchasing portfolio, a matrix with two factors, company strength and supply market strength. (See Appendix 2). The position in the matrix

informs the recommended strategy to use to acquire the products. The challenge in aviation is that a certain product only has one supplier and it does not matter what strategy you use, you cannot speed up the process much. Trying too hard might even make the situation worse.

Step four is to plan the development of acquiring these items. More strength over suppliers is gained by consolidating orders to one supplier even if it means paying sometimes a bit more.

7.5. Suggestions for the Future

After gaining information of annual consumption to the ERP-system, bigger batches can be purchased with agreed number of deliveries in one year. Price can be negotiated in the beginning of the year and one annual negotiated price could be established. Other option is to ask supplier who has delivered items to estimate consumption for a certain period of time and the company only pays for goods consumed, if the number of maintenance actions remains almost constant. Also consolidated once-a-week deliveries could be agreed with some suppliers for routine items and pooling contracts made for ATR parts also.

Kanban could be applied at some level. For instance, for basic chemicals used a lot a card could be created, similar to a Kanban card. Being located in a different warehouse the chemicals are hard to keep track of, as they are used only some amount and then returned to shelf. If there was a card including the information of product and the vendor attached to the last or second last bottle in the shelf, the mechanic taking the bottle could bring the card to purchasers to inform them the chemical is running low. This would prevent running out of the material, without having to check the warehouse on regular basis.

8. Conclusion

In this thesis the goal was not to discover something new or change the procedures remarkably. The aim was to see what is currently happening in purchasing processes and to see if there should be some changes done in order to make sure the purchasing is capable of handling the growing volumes. Comparing the situation at hand to the purchasing models in literature helps to see the future development possibilities, although the special aviation requirements prevent most of them to be adapted as such. Challenge was the lack of purchasing history in a new company with a new ERP-system. Thesis was therefore very practical when determining the processes.

The result of the thesis was clarification of the processes for the employees and the management and showing the improvement possibilities in processes and giving some ideas for the future in consumable purchasing. Although the purchasing models from literature are not completely adaptable, they might give an inspiration to make something differently. Also realizing that even if some procedures might have been very effective some years ago, when business was smaller, it does not mean they would work in the future as well.

For the author, making of the thesis and applying the things learned at school to real life has shown how things are not as simple as they seem, how theories and models cannot be used as such, and how sometimes going by the book might be impossible. It has also shown how purchasing is much more complicated than one might think. Reading purchasing books for fun does not seem such a bad idea anymore.

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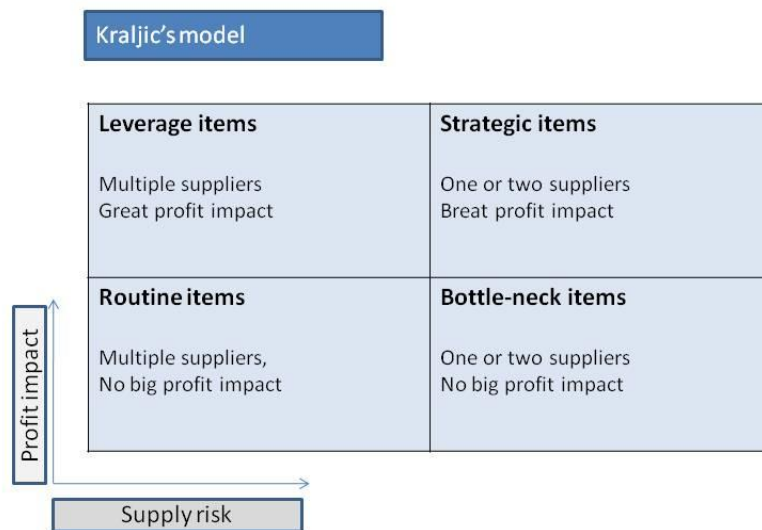
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Appendices

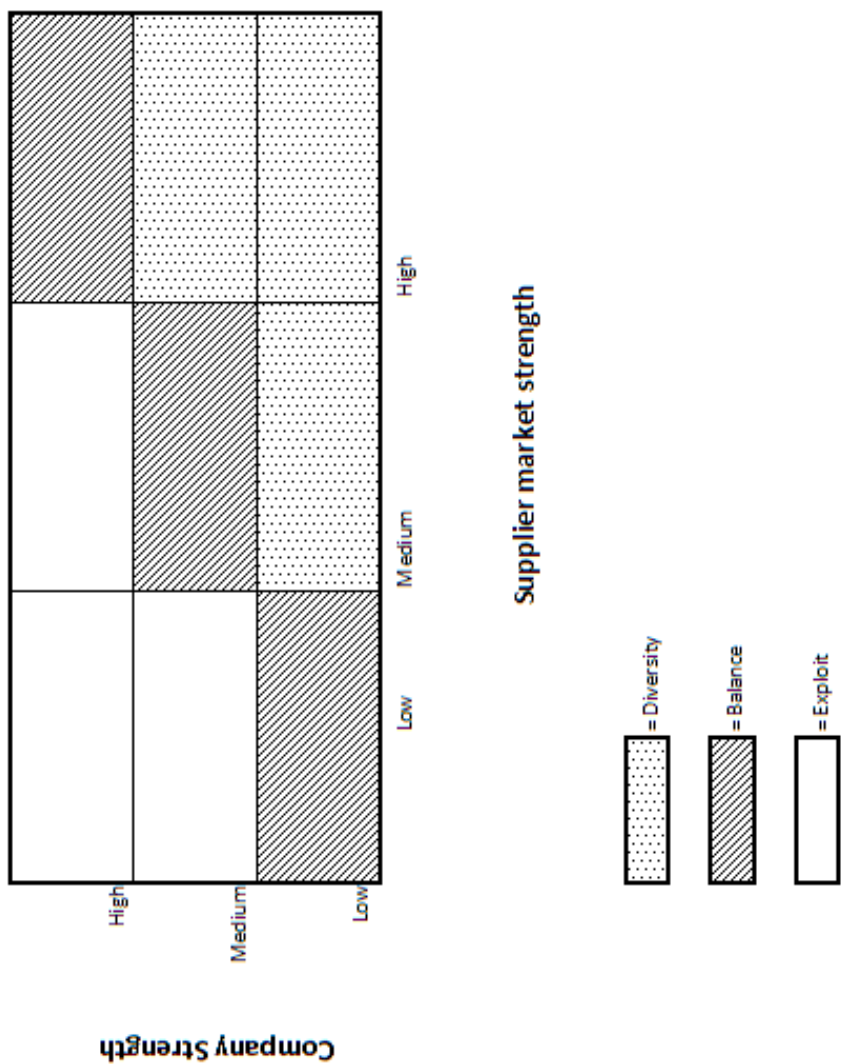
Appendix 1

Purchasing Matrix

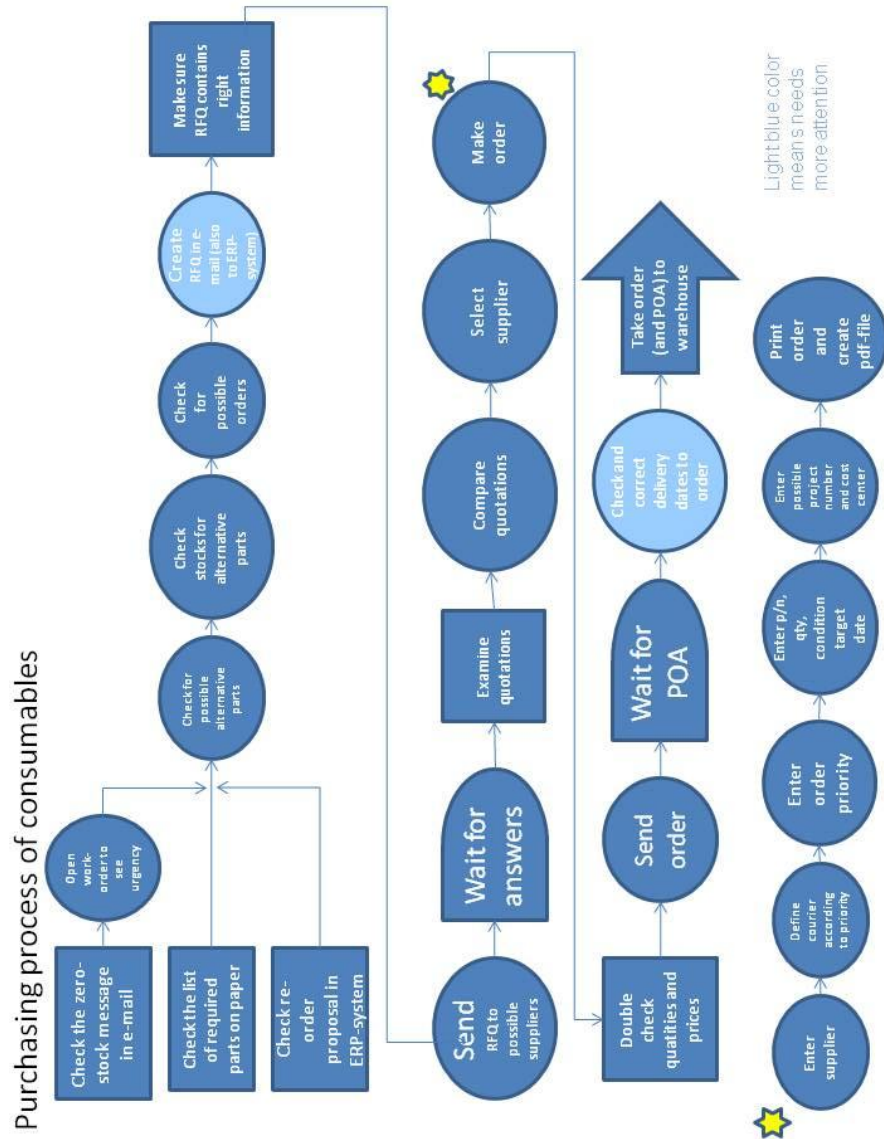


Appendix 2

Purchasing portfolio



Appendix 3



Appendix 4

Profit impact	Leverage products Greases, components	Strategic items Special aircraft type items (rods, panels), interiors, special chemicals
	Routine items Screws etc hardware with multiple alternatives	Bottle necks Special seals and screws with no alternatives Standard chemicals
Supplier risk		