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Map and explain a position in the PC supply chain

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We hope the reader enjoys the reading as much as we did enjoy the writing!

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Abstract

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Background Supply chains in low margin, high innovation speed industries with strong customers generate a highly competitive environment. The conditions for such environment are continuously changing and put high demands on its actors.

FlatFrog is a case company, which was founded in 2007 and develops a unique touch technology targeting a wide range of screens sizes and applications. External capital from Intel capital, among others, has enabled FlatFrog to aim for integrating their touch solution in the PC market. In order to be able to enter this low margin, highly competitive market, FlatFrog wants to analyze the alternative business models available, e.g. uses a licensing model or taking full product ownership and the risk of initial investments in terms of material and production facilities. The PC value chain and supply chain are tense and there is no space for decreasing economic margins in exchange for additional features. The result is highly competitive environment, which is extremely hard for new actors to enter. Hence, FlatFrog has an interest in investigating their initial position in the supply chain and which possible solutions there are in order to gain good profitability.

Purpose The purpose of this thesis is to map and explain FlatFrog´s position in the PC touch supply chain and how it implies corresponding ways of making business and enter the market. By research create an understanding of the market, its actors and characteristics.

Method In this thesis, a combination of the system approach and the actors approach was used as scientific approach. The data was collected by interviews, observations, focus groups, a literature review and continuous market research. The analysis was approached by an inductive approach where real life observations, by participating in meetings and studies of the latest trends in the consumer electric market, has been adopted after suitable models and accepted research to create a trustworthy analysis.

Conclusion The choice of business model and supply chain set up not only should consider the characteristics of the specific company. It should also be based on the conditions of the market and the improvement of competition. The choice of model should always be challenged since these conditions continuously are changing. From a theoretical standpoint, a license model would be the optimal choice due to less risk and a fast market entrance. After increased insights and experience of the market and its supply chain it may not be realizable because of the characteristics of the market. Operational reality will always beat best theoretical strategy and a product owner model could even be a requirement to enter the market. Even if it not may result in short term profitability, future benefits generated by greater control could be enjoyed. Hence, it is difficult to determine the most optimal business model and supply chain set up for a specific company. It is in large extent dependent of the current status and agility of the market which will change over time.

Keywords Business Development, Supply Chain Mapping, Supply Chain Enablement

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Concept Description

AIO	All-In-One PC
ASSP	Application Specific Standard Product, an integrated circuit that implements a specific purpose and is available by off-the-shelf components.
SCAN IC	Application Specific Integrated Circuit, an integrated circuit (IC) customized for a specific use.
IP	Intellectual Property
MOU	Memorandum of understanding, a document describing a mutual agreement between two parties. It expresses that some interaction will occur between the two parties, used in cases where a legal commitment cannot be implied.
NRE	Non-recurring engineering is the initial one-time occurring cost to research, develop, design and test a new product.
ODM	Original design manufacturer refers to the platform designer and manufacturer of consumer electric devices.
OEM	Original equipment manufacturer refers to brand PC vendor. No manufacturing capabilities, but puts its brand on the produced and sell to end customer.
PCT	Projected capacitive touch or technology, the dominating touch technology on the market
PSD	Planar Scatter Detection, Flat Frog's optical-based in-glass touch technology
TMI	Touch module integrator, offer touch modules, i.e. glass with touch components integrated/added
Wintel	The Microsoft Corp and Intel Corp. alliance.
BOM	Bill of material, the list of raw materials, components and their quantities of each needed to produce and end product.

1. Introduction

1.1 Background

1.1.1 The PC Market

The personal computer (PC) market has during the last ten years experienced a great period of growth with the personal computer becoming a mandatory feature among the average consumer. Lately, competition has risen in the horizon as low-cost tablets are starting to reinvent the consumer computing (Gardiner et al. 2012). The entire consumer electronic market is currently converging various handheld electronic devices and computers, putting powerful and versatile mobile devices in the spotlight. Especially high-end smartphones and tablets are getting wider adoption among the average consumer. Consumer devices originally designed for a specific purpose are expanding and cover wider areas of use as supplementary features increase. The PC must add additional value on top of this, in order not to become irrelevant and lose market shares to the more innovation focused smartphone and tablet vendors (MarketLine, 2012 Tsai, 2013). PC vendors has stagnating in innovation, comparing a laptop and a mobile phone three years ago, the laptop looks almost the same while the phone is today a completely new device. Simultaneous, the PC vale chain and supply chain are tensed and there is no room for decreasing economic margins in exchange for additional features. The result is a highly competitive environment, which is extremely hard for new actors to enter.

Among many upcoming requirements, two major challenges are facing the conventional PCs to stay competitive in the new and tougher environment. First, to start compete with the nimbler handheld devices adoption to a group of new hardware features such as touch, NAND storage and higher resolution display must be done. Secondly, they need to get much more affordable. These two factors set requirements to keep cost drivers low in the PC supply chain and at the same time starting to add new features to stay competitive against tablets which contains a larger portion of commodity components (Gardiner et al. 2012).

The touch function has been one of the drivers in the convergence, but has now become a mandatory feature which consumers are not willing to pay substantially extra for. The PC supply chain is strained and for a new player, an entrance is more about offering a cost reductive alternative rather than presenting superior features. (Internal FlatFrog material, 2013)

1.1.2 FlatFrog AB

FlatFrog was founded in 2007 and develops a unique touch technology targeting a wide range of screens sizes and applications. FlatFrog's technique is an optical solution which measures how the flow of light in the glass panel changes as an object touches it. The technology, called Planar Scatter Detection (PSD) enables a multiple touch solution which offers an extraordinary performance and is setting a new standard for optical in-glass technology. By using a large amount of standard components FlatFrog offers a simpler supply chain which means a lower cost for the OEM brand customer (www.flatfrog.com, 28-02-2013). In the spring of 2013, the company is the end of the sourcing process and will in the near future start to ramp up for large scale production (Internal FlatFrog material, 2013).

Until the summer of 2012 the focus of FlatFrog has been on larger touch screens targeting rather low volume, but high margin markets as interactive touch tables in offices, casinos etc. External capital from Intel capital, among others, has enabled FlatFrog to aim for integrating their touch solution in the PC market. In order to be able to enter this low margin, highly competitive market, FlatFrog wants to analyze the alternative business models available, e.g. uses a licensing model or taking full product ownership and the risk of initial investments in terms of material and production facilities. Hence, FlatFrog has an interest in investigating their initial position in the supply chain and which possible solutions there are in order to gain good profitability.

1.1.3 Planar Scatter Detection

FlatFrog's touch technology is called Planar Scatter Detection (PSD) and differs from the dominating technology on the market, projected capacitive (PCT), in the way that it is an optical in-glass solution. The light is injected into the glass by multiple IR LEDs with an angle that creates total internal reflection within the glass. The light wave is disturbed when an object (e.g. finger or pen) touches the glass, see figure 1. The light is then scattered from the touch point but since only a small part of the light in the glass is scattered a multitude of touches may be present on a given line. The remaining light in the glass is detected at the edges of the glass by IR detectors placed alongside the LED's. Very advanced algorithms are then calculating the positions of the touching objects using the detected and remaining light. Besides the lower cost due to simple and standardized components, the PSD technology also offers a greater performance in terms of pressure detection and multiple touch (www.flatfrog.com, 2013).

Figure 1, Planar Scatter Detection

1.1.4 Windows 8

As touch becoming a mainstream feature among consumer electric devices, Microsoft has in the recent years started developing a reimagining of their operating system which resulted in the release of Windows 8 in October 2012 (Foley, 2012). Windows 8 is a completely re-invention of the operation system from the smallest chip to the interface. A PC with Windows 8 becomes a new kind of device; it handles touch from small to large screens with or without a keyboard and mouse (Larson-Green, 2011).

Figure 2, Windows 8 Interface (Windows, 2013)

The introduction of Windows 8 creates an availability of software which really enables the touch function to make entrance in PC devices. This support for the hardware in terms of integrating touch has not existed before but gets access to the software Windows demand certain requirements. Among these requirements, there are certain which demands additional efforts from developing, design and manufacturing in order to fully utilize the touch function (Windows, 2013).

- Multi-touch support
- Edge-to-edge glass solution

These are both requirements which create opportunities for FlatFrog's touch technology which supports both multi-touch and a more compressed mechanical solution.

1.2 Problem Description

1.2.1 General

The PC market is a high volume, low margin business with a supply chain that consists of a numerous tiers of suppliers and customers constantly trying to improve and cut cost which create a highly competitive environment. Already established actors prefer to play it safe and are generally hesitant to take any risk with new ventures offering innovate technologies. Hence, to reach the market it is more about offering a lower cost alternative than a superior feature. A general, simplified illustration of the material flow in the PC supply chain is illustrated in figure 3.

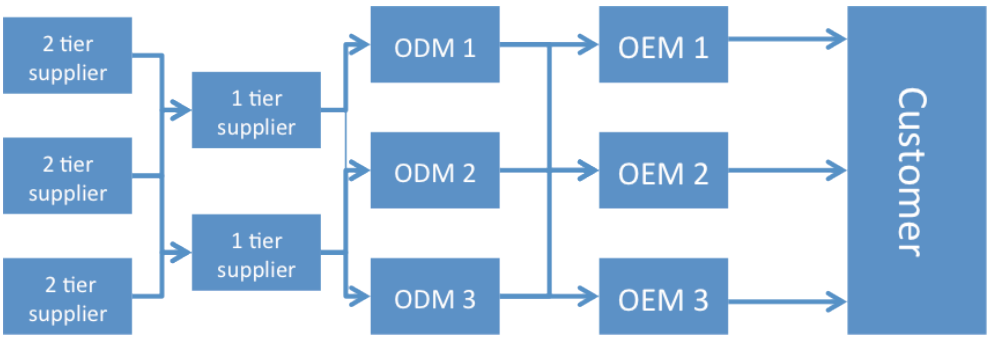


Figure 3, The general PC supply chain

A number of upstream suppliers, in different tiers, deliver single components or assembled modules to the ODMs (original design manufacturer). Different suppliers could deliver the same type of component to the same ODM. The ODMs assembly and manufacture the computers according to the OEMs (original equipment manufacturer i.e. Dell, Toshiba and Lenovo etc.) specification. The OEMs does not have any own production and usually only sell the branded product to the customer.

Generally, an OEM has its production on several ODMs to create competitiveness among its suppliers as well as spreading the risk. Final delivery is to the consumer, i.e. the user of the computer, with the OEM brand on the device.

1.2.2 Touch

As a touch has become a common feature in personal computer, the touch supply chain has become a part of the PC supply chain. Currently, projected capacitive (PCT) is the touch technology which dominates the market, with 56 % in all market segments including smartphones, PC, healthcare and hospitality displays, as well as high-volume retail environments. In smartphones, tablets and PC, PCT is almost exclusively used (IDTechEX, 2012). But, PCT suppliers struggling to reach profitable cost, one of the main obstacles are the low yield in the manufacturing process. As FlatFrog's technique consist of a larger amount of standardized components which enablers a simpler manufacturing process, they can offer a much higher yield than projected capacitive. Together with a lower cost and a higher performance, it creates a window of opportunity for FlatFrog to make an entrance on the market.

FlatFrog are interested in evaluating the supply chain set up and business model, including all possible alternatives. Questions as product ownership, protection of intellectual property (IP) and defending of margins will arise due to the highly competitive character of the market. Last, FlatFrog are in the end of a sourcing process for volume production and aspects as relationship and integration with business partners are interesting and important.

1.3 Purpose and Goals

The purpose of this thesis is, with a new technology, where to take position in the supply chain to be both competitive and make long term profit. The goal of the thesis is further divided into five sub goals:

A: Understand current business model and supply model and investigate if it is suitable for entering the market and generation of optimally long term profit.

B: Evaluate alternative supply chain positions and connected business models.

C: Examine what kinds of relationships, partners and networks those are attractive in different supply chain set ups.

D: Map and explain FlatFrog's position in the PC touch supply chain and how it implies corresponding ways of making business and enter the market.

E: By research create an understanding of the market, its actors and characteristics.

1.4 Focus and Delimitations

This thesis will focus on the touch panel supply chain and will not consider the whole PC supply chain even if major parties in this environment will act in important roles and have to be mentioned. Further, the intention of this master thesis is not to develop a new business model or new ways of creating profitability. The focus is rather to analyze the current situation and from given circumstances evaluate alternative positions and if they affect the business model.

1.5 Target Group

This study primary addresses concerned parts at FlatFrog Laboratories AB, Lund. The secondary target groups are students on a higher level education with interest in purchasing, supply chain management and business development. Last, others who work or teach in the field of supply chain management or business development and strategy could use the dissertation as case study in problems related to market entrance and supply chain set up.

1.6 Structure of Thesis

The thesis is divided into seven chapters where every chapter has a brief introduction to provide understanding and simplify for the reader. Here follow the structure of the thesis:

Introduction	The first chapter presents the background and problem description of the thesis. Further, purpose and delimitations will be stated.
Methodology	The methodology chapter presents different way of approach the research, analysis and how to collect data. Choice of approach and methods are presented, explained and motivated. A discussion of how to validate the result and create credibility is ending the chapter.
Theoretical Framework	This chapter explains necessary theory and definitions to create an understanding for the reader. It will be followed of different concepts in how interpret the design of a supply chain. Last, suitable models for the analysis are presented.

Empirical Framework	The empirical study with a holistic view of the PC market and its supply chain. This will narrow down to the touch supply chain, its constraints and characteristics and end up in FlatFrog´s current status and requirements for a market entrance.
Analysis	The fifth chapter contains the analysis of the empirical study based on definitions and models stated in the theoretical framework. FlatFrog´s possibilities to enter the market with different business and supply chain set up will be explained and analyzed.
Result	The result from the analysis will briefly be presented to provide an overview of the implications of the different alternatives.
Conclusion and Follow up	Last, the thesis is ended by the final conclusion based on the results from the analysis. Both qualitative and quantitative aspects will be considered and compared to the learning from the real world experience the authors gained at FlatFrog. The chapter will end with recommendation to further research within the area of the thesis.

1.7 Roles

The distribution of roles has been evenly divided between the two authors. Johan has been slightly more responsible for the report and structure of the thesis while Tobias have had somewhat more responsibility for the collection and processing of data.

2. Methodology

This chapter presents, discuss and motivates the chosen methodology in the thesis. The level of ambition and approach of the scientific research will first be presented. A number of data collection methods followed by the characteristics of different data will be discussed. Further, reasoning concerning of both the approach of analysis and reliability of thesis will be performed. Last, a brief summary could be found of the used methodology.

2.1 Research Methodology

The choice of research methodology composes the basic foundation and direction of the thesis without in detail describing in what to be accomplished and how reach the objectives. Rather, it is an overall framework of how to approach and gain increased knowledge of the problem. The appropriateness of different research methodologies depends on the nature of the problem and the stated objectives (Höst et al, 2006). According to Höst et al. it is vital to determine an appropriate method or a combination of several in order to create a concrete plan for the continued survey.

- *Descriptive* - Main purpose of investigate "*as-is*". Gain knowledge and describe the mechanism behind and how something is performed.
- *Exploratory* - Used when basic knowledge are known and aims for in depth, without explain, describe and understand the mechanism behind and how something is performed.
- *Explanatory* - Searching for cause-and-effect relationships and explanation of underlying causes of how things relates and react.
- *Normative* - Conducted when existing wide knowledge of the problem and its cause is known. The purpose is to find a solution to the identified problem.

2.1.1 Level of Ambition

The research will start in a descriptive level as mapping and investigate of the current situation will be conducted as the first step. Further, the study will enter the level of exploratory as the basic understanding is created and deeper analysis will be carried out to understand the logic behind the system.

Lastly, the study will end in the explanatory phase as causes and roots will be analyzed to understand the relationships and incentives in the PC supply chain in order to able to analyze and compare different models.

2.1.2 Object to Study

This thesis will approach the object by performing a case study at the company. A case study focuses on a certain phenomena with purpose to provide a depth description of events, relationships, experiences or processes of a specific situation (Denscombe, 1998). Hence, the case study is a method with a narrow spectrum which allowing a detailed observation of the object or event. The detail research methodology can create opportunities to get more unique and valuable information then with other approaches (Denscombe, 1998).

The complexity of relations and processes requires a deep analysis to understand how these are connected and affects each other. Case study can offer a holistic view to solve the complexity (Denscombe, 1998). Further, it is equally important to understand the process behind the results, as it is to understand the results. Case study is a reality research and it is not based on an artificial research situation where the researcher can control variables (Denscombe, 1998).

In a case study several data collection methodologies can be used and the scientist is encouraged to use a range of methodologies. Observations, interviews and document studies are some examples that can be used. A case study is, by the researcher, chosen situation and it is crucial that this choice is made consciously and carefully considered. The first aspect is that the choice is based from known attribute and is not random as in ordinary research. The second aspect is that the case is selected first and a literature research is based on the case (Denscombe, 1998).

2.2 Scientific Approach

A paradigm is the general theoretical assumptions, laws and techniques which are commonly accepted in a certain scientific field. It concerns the researcher's view of the reality, view of science, the ideal of science and ethics (Nilsson, 2013).

A methodological framework guarantee that no specific approach is taken for granted and that it will be discussed and evaluated from time to another. Such framework is prejudiced by both the characteristics of the subject of research as well as the researcher's view of reality (Gammelgaard, 2004). According to Arbnor and Bjerke (2009) there are three existing assumptions of reality.

2.2.1 Analytical Approach

The analytical approach is a logical view based on objective and subjective facts. Objective facts are unquestionable statements as a certain person age or her address whereas subjective facts are true opinions. These facts are challenged by hypothesis and to be either falsified or verified parts (Arbnor, Bjerke, 2009).

Logic and mathematical methods has a central place in the analytical approach and is used to find cause and affect relationships. Result from such methods ends into logical models and valid facts which not is a subject of change. If the research is divided into several parts the result then is the sum of all independent parts (Arbnor, Bjerke, 2009). In order not to affect the research object, the researcher must stay outside the object and avoiding disfigures the reality (Gammelgaard, 2004).

2.2.2 System Approach

Unlikely the analytical approach, the system approach doesn´t fracture the reality into different parts. Instead, the world must be seen as a system consisting of mutually dependent components. This system has parts, links goals and feedback functions which correlate to each other. The researcher should to stay close to the research object trying to map relations, find drivers and obstacles (Gammelgaard, 2004). The result ends up in finding relations, synergy effects and general way of classifying systems (Nilsson, 2013).

2.2.3 The Actors Approach

The actors approach is based on various social constructions and the unit of analysis is the people and their interaction. The reality is not objective but rather seen as a construction which means that knowledge depends on the researcher's view of reality. Qualitative methods are preferred where the researcher are inside the process searching for relations between different parties' interpretations. The approach results in qualitative aspects such as understanding and interpretation how things connect and affect each other (Gammelgaard, 2004).

2.2.4 Used Approach

The used approach in this study will be a combination of the system approach and the actors approach, see table in chapter 2.7. The investigated system involves actors which clearly correlate and affect each other; the objectives are to map relationships and finding synergy effects. Further, the researchers are acting within the system and the unit of analysis is the actors in the PC supply chain. Much of the analysis is built on the researchers view and knowledge of different parties' incentives, incentives which not could be taken for certain as the risk of hidden information and action exists.

2.3 Data Collection

There exist several techniques to collect raw data. Different types of methods are suited for different research approaches and type of information that are requested (Höst et al, 2008). Using several data collection methods will create trustworthy data and led to increased validation of the study. Last, to create a variety of data it

is vital to use several methods, suitable for different kinds of information. To increase the validity the most common methods will briefly be described followed by a discussion of selected and used methods.

2.3.1 Interviews

An interview is a systematic questioning between the interviewer and the object of the interview (Höst et al. 2006). Personal meeting the two parts are the most common format, but it exists a variety of format to use in an interview. Selection of interview population is depending of the interview objectives (Höst et al. 2006). A representative interview will focus on random selection and a qualitative interview on stratification. There are three different levels of structure in interviews: unstructured, semi-structured and structured (Höst et al. 2006). The conversation in an unstructured interview is open with an interview guide of question areas that is interesting for the researcher (Höst et al. 2006). The goal with an open conversation is to reveal underlying beliefs and experiences. The opposite of unstructured interviews is the structured interviews. A structured interview is basically like a verbal survey, where all questions are clearly formulated in same order for each responder (Höst et al. 2006). A semi-structured interview is the intermediate between structure and unstructured interviews. It is planned with questions on different structure levels. The essential in a semi-structured interview is that if a structured question has been asked the interview object often has the chance to develop the answer (Höst et al. 2006).

2.3.2 Observations

If the researcher wants to study a specific phenomena or event, direct observations could be applied (Höst et al. 2006). Methods used to gather data in observation situations are human senses and technical tools that fit different situations. The observer can have different approach towards the observer role, either active or passive (Höst et al. 2006). The awareness of being observed is also an important aspect to consider (Höst et al. 2006). Either the observed has high or low awareness of being observed. According to Höst et al. (2006) these aspects will be combined into four different roles for the observer: observing participation, fully participation, participating observer and complete observer.

2.3.3 Survey

Survey is a questionnaire that aims to gather opinions and data from a wide range of a population (Höst et al. 2006). A survey consists of fixed questions often with a set response alternatives. The distribution of a survey can be made through postal survey, group survey, survey to visitor, computer survey and survey for the interested (Höst et al. 2006).

It is important to have knowledge of the research population and the selection of the population when analysis and generalisation of the result is made (Höst et al. 2006). The result in a survey is highly depending on the response rate, but the researcher should not affect the outcome of the survey by selection a new population for the research (Höst et al. 2006). Instead reward could be used if the response to the survey to increase the response rate. Survey is a quantitative data research method, but it could be used to cover complex qualitative questions if some adjustments are made (Höst et al. 2006). For example visual analogue scale could be used to determine fillings, opinions and attitudes.

2.3.4 Experiments

Experiments are to find causation and explanations of certain phenomena's and the mechanism behind them (Höst et al. 2006). For example, investigation and comparison of technical solutions of a problem could be approached by experiment. The environment is set while the parameters that are investigated can be changed. When the setup for an experiment is set, it should not be changed during the experiment due to avoid affect the outcome and the result (Höst et al. 2006). The more parameters to examine, the more combination of parameters will be possible and the extension of the experiments will increase rapidly. A solution to this is to use systematic experiment method (Höst et al. 2006). Experiments are a quantitative research method (Höst et al. 2006). But it could be supplemented with a qualitative research, for example if there are people that have been examined, the question could be how they have experienced the treatment (Höst et al. 2006).

2.3.5 Focus Groups

Focus group is a group of people with experience in a shared subject forms a group together with a moderator. The aim with the focus group is that it should be an inspiring environment and take advantages of everyone opinions and ideas (Denscombe, 1996). According to Denscombe (1996) there are three critical characteristics for a focus group: the meeting - should focus on the subject and the experience of the participants, the interaction in the group - an important tool to utilize the knowledge, and the moderator's role -facilitate the group and the interactions. If benefit from focus groups fully potential should be obtained, must the group create ethics, confidence and trust in each other (Denscombe, 1996).

2.3.6 Literature Review

A thorough literature review is the foundation of trustworthy scientific methodology. By review what is written about the research subject the thesis got a base in known learning's and avoids the risk of overlook important knowledge in the area. There is often a large number of different opinions and interpretation

about definitions, results and development in the research area. Hence, the literature provides an overall perception of present state about subject of the thesis (Höst et al. 2006).

A literature review is an iterative process where different activities repeat itself as determine key words, search, evaluation and compilation of material. Initially, the purpose of the review is for the researcher to create and build wide understanding and knowledge of the subject. Further, the focus is narrowed down and the study could be focused on literature of more specific character. During the process it is important to declare used sources so independent user can understand, investigate and further research in the area. As the result is presented, it is valuable to return to theory and compare the findings with conclusions of others (Höst et al. 2006).

2.3.7 Content Analysis

It is important to point that even though content analysis is defined as a type of observation, it also could be seen as a separate data collection approach.

The process of content analysis consists of reviewing the content of documents, interviews, websites and archival records. The review results in more structure and comprehensive resume of information over a wider time period. Typical difficulties to arise during the content analysis are the collection and finding of data as well as the independency of the researcher when selection of sources as scepticisms are important when reviewing information from the past (Frankel et al. 2005).

2.3.8 Market Research and Updates

As the authors have been a part of the investigated organization and contribute to the daily work, some of these actions have contributed to the data collection. As FlatFrog operates in a high level technological and front edge market it is important to continuously be aware of market changes and updates. This has been a permanent activity during the period of the thesis and has contributed to the data collection in terms of market knowledge and information of different actors on the market. This data has mainly been collected from newsletter and updates from trustable news bureaus and reports from analyst firms.

2.3.9 Used Data Collection Methods

The used data collection methods in this thesis were interviews, observations, focus groups, literature review and market research and updates. The interviews were conducted by unstructured to semi-structured interviews where most occasions tended to be like discussions with a couple of major subjects. Such interviews were used during the whole thesis and created great understanding and gave valuable feedback. Observations were one of the major data collection methods and were

conducted by participation in internal meetings, conference calls and external supplier meetings. Through the process of developing supply chain maps, focus groups were used. It was approached by an iterative method were the maps initially were discussed with different employees within the unit of operations, feedback was received and the cycle was repeated. A literature review was performed in the initial stage and was employed to create a theoretical foundation and finding appropriate tools for evaluation. The last data collection was market research and updates. Via reading analytical reports, scanning the news feed and deliver weekly market updates at FlatFrog this method served as a valuable source for creating an understanding of the PC market and its supply chain.

2.4 Data Type

Collected data could be of different character and should be approach in altered ways. In this part the nature of different data will be described.

2.4.1 Primary and Secondary

Primary sources are original, none-processed or filtered information. Usually, they are first presented material such as results from an experiment, a person´s original opinion or sharing of new knowledge. Examples of primary sources are journal articles published in peer-reviewed publications, newspaper articles written, patents, interviews and observations or actions from meetings (Maryland University, 2012).

Secondary sources are not classified as evidence as they are published after observation, evaluation and gained perception. Because of this character they are harder to define than primary sources and a secondary source could likewise be a primary, all about the context it is seen in. Examples of secondary sources are commentaries, criticism, journal articles (depending on the disciple can be primary), textbooks and in some cases interviews (Maryland University, 2012).

2.4.2 Qualitative and Quantitative Data

The collected data could either be of qualitative or quantitative nature. Qualitative data are characterized by their high level of concreteness and could be counted or classified as numbers, amount, weight and color etc. This kind of data could be systematically analyzed by statistical tools and methods (Höst et al. 2006).

Quantitative data is more of the descriptive character and often contains a high level of details. This data could be words, mappings or a description of a certain process. It requires categorizing and sorting methods in the analysis are often combined with a human judgement (Höst et al. 2006).

Logistics research is often dominated by quantitative methods whereas qualitative aspects often are overlooked. To obtain a high level advanced research it is necessary to combine both quantitative and qualitative data which provide wider insights in many management research problems. If the objective is to gain knowledge of the problem and its nature then this need to be done in the most valid approach which is achievable (Mangan et al. 2004).

2.4.3 Used Data Type

In this thesis all kinds of the above described data collected and used. Primary data was used mainly used in terms of observations and interviews. Secondary data was gathered through market research and reading of analytical reports. To reach a high level of research, both qualitative and quantitative data were used. Qualitative data were characterised by financial information such as cost of material and forecasts. Last, quantitative data included description of the supply chain and understanding of the flows in the PC market as well as description of the incentives and objectives behind the FlatFrog strategy.

2.5 Analysis Approach

Before starting the data collection one must be aware of how to approach and interpret the gathered information. In this part, the two most common approaches, induction and deduction will briefly be described. Last, a combination of those, which not are as equally common, called abduction, is explained.

2.5.1 Induction

An inductive approach has its foundation in real life observations and is then generalized according to theoretical framework or models. Regularities and patterns are interpreted from the gathered data which could be adapted according to suitable theory. This is a usual approach when doing research in an area where little are written about and there exist no given theory of where to build the research from (Nilsson, 2013).

2.5.2 Deduction

A deductive approach starts with the researcher who constructs a hypothesis based on accepted knowledge and assumptions. Empirical consequences are derived from the hypothesis and compared to the empirical data resulted from observation and experiments. From the comparison the conclusion, whether the hypothesis could be rejected or proved, are drawn (Johansson, 2012).

2.5.3 Abduction

Last, there is the least common approach which is a combination of induction and deduction, called abduction. In practical research a study could initial perform a

number of unstructured interviews to create a foundation of which a model or a hypothesis then is constructed from. The model is then used in a second phase, a more structured interview session which aim for reject or prove the assumed hypothesis (Nilsson, 2013).

2.5.4 Used Approach

An inductive approach has been used thorough the whole study. Since the PC market currently is the leading edge in supply chain construction and logistics it has been vital to initially create an understanding of how different actors interact and influence each other. There is very little literature directly related to the configuration of a supply chain when entering the market with a company as FlatFrog'sconditions. Hence, after creating a deeper understanding of the PC market, suitable literature has been collected and put together to a framework which aligns the purposes of the thesis.

2.6 Credibility

The credibility of the thesis and validation of results could be interpreted in several different ways, the conclusions could be well reinforced, the study addresses the pronounced purposes and that the conclusions are general. Höst et al. suggests three different categories of how to address and assure the validation of the study.

2.6.1 Validity

The concept of validity concerns how trustworthy and valid the conclusions generated from the research are (Bryman, 2008). It is related to the connection of what the purpose of the study is and what one actually measures. To increase the validity o the study, triangulation could be used which means to approach the study which more than one method (Höst et al. 2006). In this thesis this will be conducted by using methodical triangulation. With the purpose of increase the validity of the study, data will be collected and compared in different ways (i.e. qualitative and quantitative) and contribute to approach the study from different perspectives. Hence, the results could be verified or questioned by comparing results from different methods (Denscombe, 1998).

2.6.2 Reliability

Reliability is a measure of whether the study is repeatable or not. It is often used when to interpret if a measure is stable and consistent or not (Bryman, 2008). To obtain satisfying reliability the researcher must be accurate in the documentation of the data collection and analysis to create an understanding of the used method (Höst et al. 2006).

2.6.3 Representativeness

Representativeness concerns the question if the results are specific for the certain circumstances where the study has been conducted of if it could be transferred to a generalized environment. A factor which concerns the level of the representativeness is the drop-out from the selection of samples. If the drop-out is too large, then the result may not reflect the whole population and the representativeness decreases. To increase the representativeness it is important with a comprehensive and thorough description of the background and context of the study (Höst et al. 2006).

2.6.4 Authors Role

In this thesis the authors' role will be within the system and organization where the research is performed. The authors will be located at FlatFrog AB in Lund and will both doing research and data collection to execute the thesis but also interact and work within the organization. It is most likely that the authors will affect the system, and reversed, be affected of the system. To avoid this to impact the validation of the study, the authors are conscious of the situation and will act in an objective manner as possible. During the project continuous feedback has been received from the organization. This has been characterized of both discussions with the employees as well as focus groups where mappings and descriptions has been tested.

2.7 Summary

To summarize and visualize the choice of the used methodology this is finally presented in table 1.

Table 1, Summary of methodology

		Used methods
Scientific approach:	Analytical	X
	System	X
	Actor	
Data collection:	Interviews	X
	Observations	X
	Survey	
	Experiments	
	Focus groups	X
	Literature review	X
	Content analysis	
	Market research	X
Data Type:	Primary	X
	Secondary	X
	Qualitative	X
	Quantitative	X
Analysis approach:	Induction	X
	Deduction	
	Abduction	

The purpose of the table is to create an overview for the reader of the used methodology and approaches. It will further increase the reliability as comparison between existing and used approaches could be performed.

A summary of how the method has been used could be seen in figure 4. First, a theoretical framework has been developed by a thorough literature review. The framework has worked as a foundation when the data collection was performed which ended up in a descriptive empiric of the general PC market and its supply chain. Last, these two parts where combined to a analysis where both qualitative and quantitative approaches were conducted.

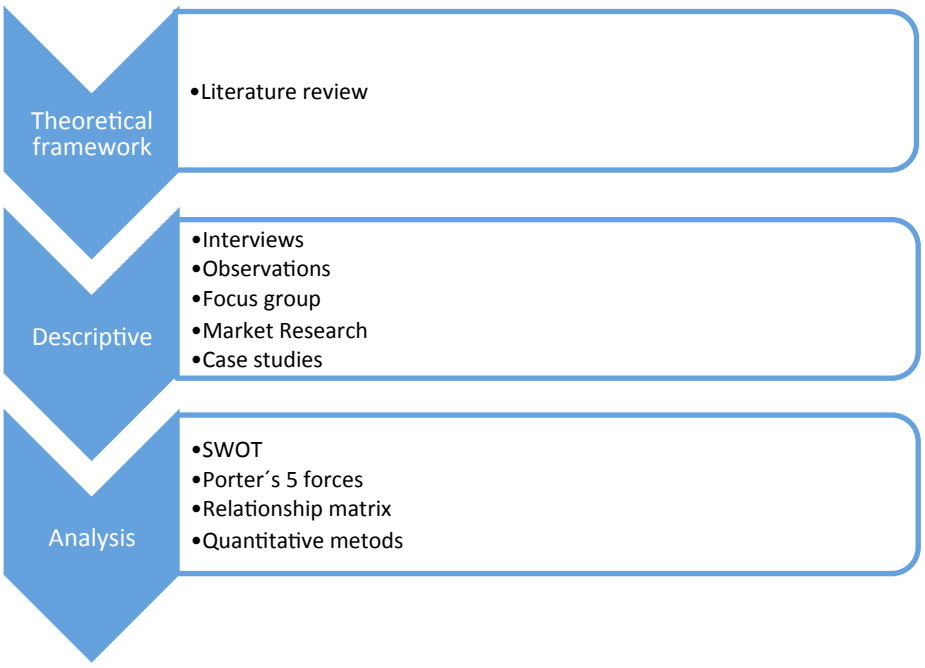


Figure 4, Summary methodology

3. Theoretical Framework

In this chapter theory and models for this thesis will be presented. The purpose with the chapter is to create a broad and theoretical foundation and then narrow it down to a detail level with match the objectives of this thesis. Focus will be on the area of supply chain management, development of relationships and development of business model in companies with focus on intellectual property. The chapter starts with definition of concept and important theories to create a theoretical foundation. Second, suitable models analyzing of problems are described and motivated.

A summary of the theoretical framework is illustrated in figure 5. The framework is based on four main areas consisting of Supply Chain, Business Relationships, Business Models and Analyzing tools. Within each area one or a number of different aspects has been described. It results in a foundation of theory and definitions which the empirics has been based on and a refined research procedure.

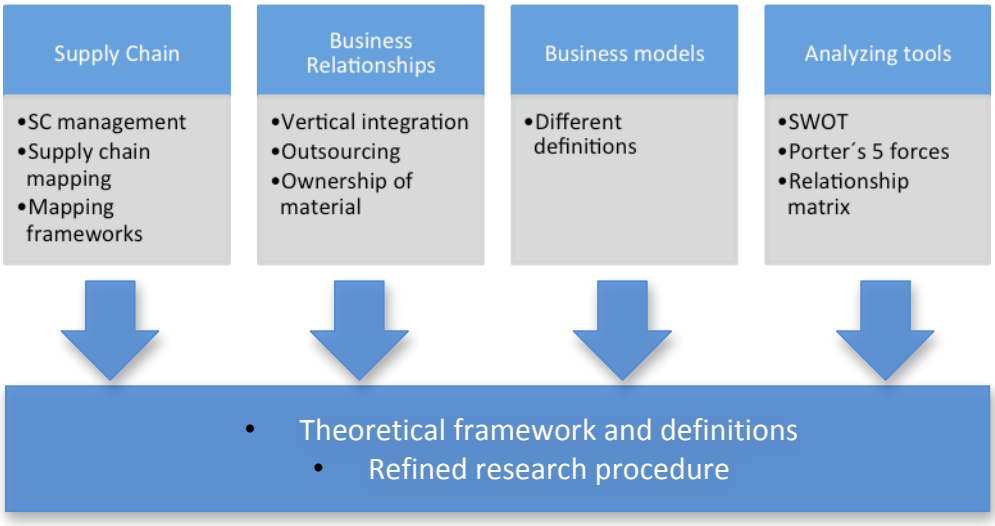


Figure 5, Theoretical framework

3.1 Supply Chain Management

The term supply chain management first occurred in the literature almost thirty years ago and has thereafter had numerous of different definitions. Academics, practitioners and professional organizations have all offered a number of different alternatives (Gibson et al. 2005). To avoid obscurity and misunderstanding it is fundamental for this thesis to define an agreed definition of supply chain/supply chain management.

Many use the term supply chain or supply chain management as a synonym for logistics or for logistics which includes suppliers and customers. Others view the terms as common name for purchasing or operations, in combination of logistics. What is important to point is that supply chain not is a chain or a combination of activities and businesses, nor a network of business and relationships. Supply chain offers the prospect of capture the full potential of external and internal company integration and management (Lambert, 2008).

The council of supply chain management professionals (CSMP) has continuously changed and evolved this definition to fit the needs of the growing global supply chain and gives an exhausting definition of supply chain management.

*"Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies." (*CSMP, *Definition of SCM*, 2013*).*

Mentzer et al. (2001) defines supply chain as *"a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer".*

Since this thesis will consider and position a numerous of players based on the material, information and financial flow in the supply chain, Mentzer´s definition from 2001 is decided to be the common agreed definition of supply chain hereinafter.

3.2 Supply Chain Mapping

In today´s global environment with a lot of different suppliers and customers it could be difficult to get an overview and understanding of one firms supply chain. Therefore supply chain mapping could be a useful tool to manage this problem. One problem with using supply chain mapping is the lack of a universal set of mapping conventions (Gardner and Cooper, 2003). The primary objective with mapping the supply chain is to show material flow, information flow, financial flow and relationships between companies. The higher number of different flows that should be visualized, the more complexity will be added to the mapping process. Lastly, there are two major categories of supply chain mapping; the describing, "what is" or prescriptive "what can be" (Gardner and Cooper, 2003).

3.2.1 Reason to Map

According to Gardner and Copper (2003) are there ten common reasons to map a supply chain:

- To link the corporate strategy to the supply chain strategy
- Cataloguing and distribution key information for survival in a dynamic environment.
- Create a base for redesign or modification.
- Map the current channel dynamics and show competitive positioning, future importance, power and relative size.
- Define the perspective of the supply chain integration effort.
- Get a common understanding of the supply chain in the organization.
- Communication tool in the organization and other parts of the supply chain.
- Clear view of supply chains progress and evaluate the progress in different steps.
- Entrances of new individuals or ventures could easily be positioned within the supply chain.
- Well-documented supply chain can lead to improvement of the supply chain management procedure.

3.2.2 Characteristics of a Functional Mapping

There are three main reasons that characterize a suitable mapping, which are interpretable, recognizable and in an easy-to-disseminate format. Interpretable of the map will prevent misunderstandings and all employees can interpret the map without any explanations. Therefore it is crucial that right information will be used in the analysis of the supply chain map and all parts know what the map should achieve. To make the map recognizable it is important to use standardized symbols which are familiar for the target group. Because the lack of a universal set of mapping, an alternative is to use specific company standards, accepted in the organization. It is also important to have a clear objective of how the map should be dissemination to concerned organization parts (Gardner and Cooper, 2003).

3.2.3 Risk of Mapping

One concern with supply chain mapping is the risk of sharing competitive information to other players in the business (Gardner and Cooper 2003). Components prices for example that competitors have interest in should not been shown in the mapping of the supply chain. There could also be supplier

information that could harm and create conflicts between players in the supply chain.

The changing of channel dynamics is also a risk in the mapping process. To see the position in a big picture of the supply chain could both be harmful for every channel member. Suppliers or customer could for example see how important they are for the company and then react on it. Supply chain mapping is a strategic tool and should not show a network model. Therefore it is crucial that companies not start to add on information after the mapping has been made. To avoid misinterpretations it is important to, before the mapping process, define which level it should address; operational, tactical or strategic and of the same reason establish the objectives of the map (Gardner and Cooper, 2003).

3.2.4 Symbolism

There are different types of framework to use when mapping a supply chain. Theodore Farris II (2010) describes a framework based on the conclusions of Gardner and Cooper (2003). He points at using a basic approach, primary focus on material. Suggesting that supply chain map should reflect flow, flows such as material (e.g. finished or return goods), financial (payments) or information (specifications, forecast, inventory data or order confirmations). He further suggest to have a top-down approach, start on a high strategic level avoid complexity and then, if necessary, break the map down into smaller pieces. Pointing that there exists more than one way to map a supply chain they suggest the symbolic in figure 6 to succeeding in map a high-level, none-complex supply chain map.

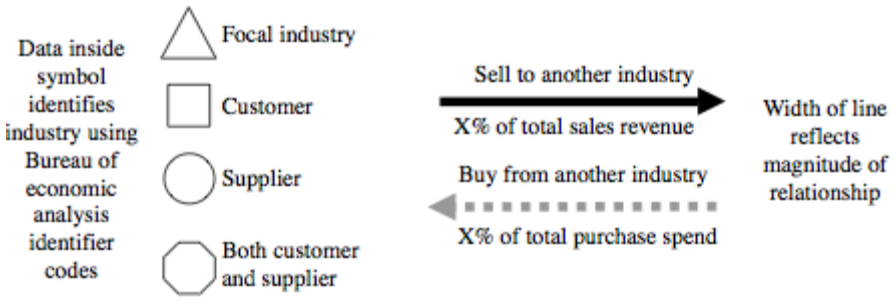


Figure 6, Theodore Farris II supply chain mapping framework (Theodore Farris, 2010)

Henkow and Norrman (2011) describe a framework for mapping which purpose is to align supply chain and tax issues. However, they suggest a basic symbolic for logistics mapping which is relevant in this context. Logisticians have a long experience of mapping and analyzed their world in terms of materials and information flow, describing stocking points with triangles and productions sites with circles. They mean this contributes to an overall understanding of the whole

system that sometimes has been complimented with financial flows but these are seldom part of the analysis. The symbolic can be seen in figure 7.

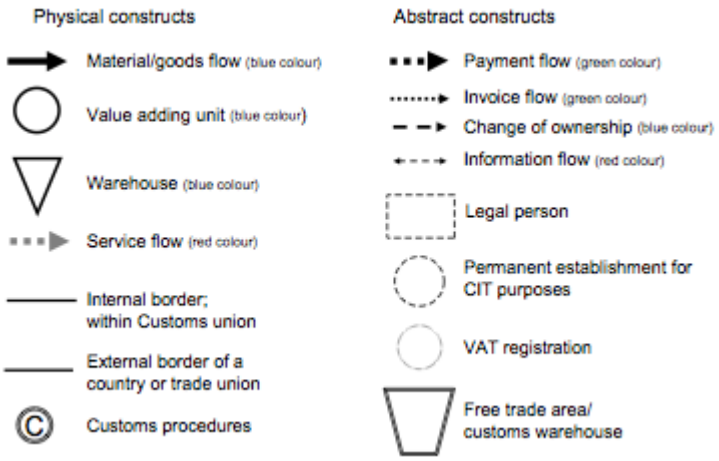


Figure 7, Henkow and Norrman supply chain mapping framework (Henkow and Norrman, 2011)

There are both advantages and disadvantages with each framework. The framework described by Henkow and Norrman (2011) have more complexity and could consider several of flows in the supply chain. This could create maps that are difficult to interpret and understand but on the other side several of flows could be taken into consideration when the analysis is made. The symbolic according to Theodore Farris (2010) have not that complexity because its only focuses on the material flow. This will be easier to understand but crucial parts could be missed when only following physical flow.

In this thesis a combination of these two frameworks will be used in the supply chain mapping process. The reason to use a combination is that several flows must be taken into consideration but the simplicity of Theodore Farris II framework is preferred. The framework that will be used in this thesis is shown in figure 8 and as seen in the figure tree different kinds of flow will be investigated; material, information and financial. These flows are considered to be descriptive enough to illustrate the characteristics of the supply chain as well as other aspects of importance such as ownership of material. Last, an explanation of vertical integration is added. This is thought to illustrate companies which increase in-house capabilities by mergers or acquisition and hence performs activities which usually are done by two different companies in the supply chain.

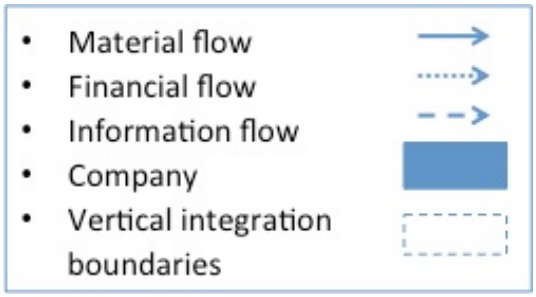


Figure 8, Chosen framework of supply chain mapping

The framework in figure 8 will be applied in the analysis chapter when mapping and illustrating FlatFrog's different alternatives for supply chain and business model.

3.3 Business Relationships

A key element when defining the supply chain is to identify the relationships among the actors. In a world when every state, from performing all activities internally to organizing everything externally, exists, the supply chain consist of a numerous of different relationships. This leaves the important question to the companies of what to buy (outsource) and what to make (vertical integration) and in the extension which relationship it brings along (Juntunen, 2010).

Gadde and Håkansson (2001) present a matrix which describes level of involvement and the nature of a relationship. The market exchange cell in figure 9 represents the situation of standardized purchasing of standardized components which need little involvement and follow up. The complex buying situation cell illustrates the situation where the buyer requests a customized product with often means specific investment from the supplier's side. The supplier is in this situation more dependent on the customer than reverse. In the "simple" relationship the opposite situation is described, where the buyer is more dependent of the supplier. There is low involvement from the supplying side whereas it is of high weight for the buyer. The last cell, complex relationships, is defined as strategic relationships where both parts gain and are highly involved in the relation and its continuity.

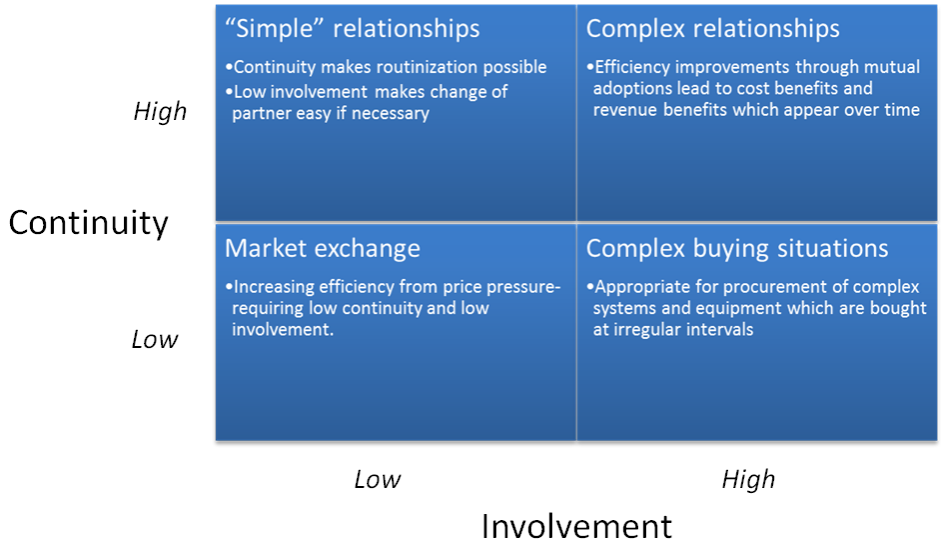


Figure 9, Relationship matrix (Gadde and Håkansson, 2001)

3.3.1 Supply Chain Relationship

Whether a company acts as a supplier or a customer they face the same challenges when trying to manage their relationships. Both parts have to search and evaluate partners, both parts have to decide on which the relationships should exist and further they have to bring their own resources to the relationship and if the cooperation excess both parts can enjoy the benefits from the counterpart resources and knowledge (Ford et al. 2011). According to Gadde et al. (2003) linking activities between two firm's enables knowledge and capabilities, that not only considers the material flow, which extends beyond the individual companies boundaries.

As mentioned earlier many relationships are not of the type of the buyer-supplier type. Many suppliers do not have any direct contact with their customer and has instead close relationships with some kind of intermediate (Ford et al. 2011). For example, the manufacturer of personal computers has no contact with the end customer and the computers are instead sold by original equipment manufacturer (OEM) as Dell and Asus (iSuppli, 2013). This kind of relationship has increased of importance since customer demand has been more complex and the need for customization is higher. At the same time the variety of components and service required to meet this demand has become wider. Further, companies have increased their grade of specialization and focus more on core competences. Firms want as few interfaces as possible and are willing to rely on a few suppliers which handle all upstream activity in terms of sourcing, assembling or/and manufacturing.

Development of Business Relationships

As any other relationship, the relationships between firms develop and change over time. Ford et al. (2011) defines the progress of customer-supplier relationships in four stages.

- *The pre-relationship stage* - Characterized by evaluation and a possible audit of the counterpart. Often consisting of many question of what will be the result from the relationship, how much investment is needed and what adoptions may be needed. Of course there are often existing trust issues, especially if the parts are unsure of each other's incentives.
- *The exploratory stage* - The stage of learning and reduction of distance between the two parts. Initial discussions are initiated concerning on which level the relationships will address, one-off business such as consultancy or longer view agreement. There are still no existing routines or commitments and the two parts still have little experience of working with each other. To the exploratory stage, commitment and trust is needed from both parties and each side has to convince the other of their intention of the relation.
- *The developing stage* - The character of the relation is changed in a positive way. In a new relationship it could be recognized by deliveries that is ramping up towards larger volumes or in older relationships when current shipped volumes are about to increase. Strengthened bonds between the parties also characterize the stage as they show trust by making adoptions and fulfillment to each other.
- *The stable stage* - A stage of stability is in terms of learning and commitment is reach. This could be achieved when deliveries and processes has become a routine. It is not possible to set a timescale when to reach this stage, some relationships reach it faster and some may not make it at all. The stage could both lead to advantages and problems. Advantages in terms of standardized working procedure and a great deal of trust to each other. On the contrary, some problems may arise, as the standardized routines may not be questioned and may not be the most efficient and cost effective way of work.

It important to notice that all relationship do not act according to these stages, some may fail after initial contact and some may jump over one or several stages in their progress. Handling relationships does not follow a certain scale or predetermined map, it much about managing different circumstances at different times with varying aims.

3.3.2 Vertical Integration

Supply chain integration could be conducted in various ways and to different degrees. The concept of integration has been defined variously. It is important to distinguish between vertical and horizontal integration. Philpott et al. (2004) defines vertical integration as upstream and downstream integration; upstream by the choice of what to buy and what to make in-house and downstream by the level of service offered to the customer. Horizontal integration is argued to be focused on how to manage the product range, the interrelationship between horizontal and vertical integration is illustrated in figure 10. Riordan (cited in Juntunen, 2010) defines vertical integration as a situation where two, separate and one firm makes consecutive processes. Further, Holmstrom and Roberts (1998) argues that vertical integration, as when two different assets have the same owner it is single integrated firm. According to Argyres (1996), vertical integration occurs when firms decide to perform an activity in-house and as the relative capability change the company boundaries are changed accordingly.

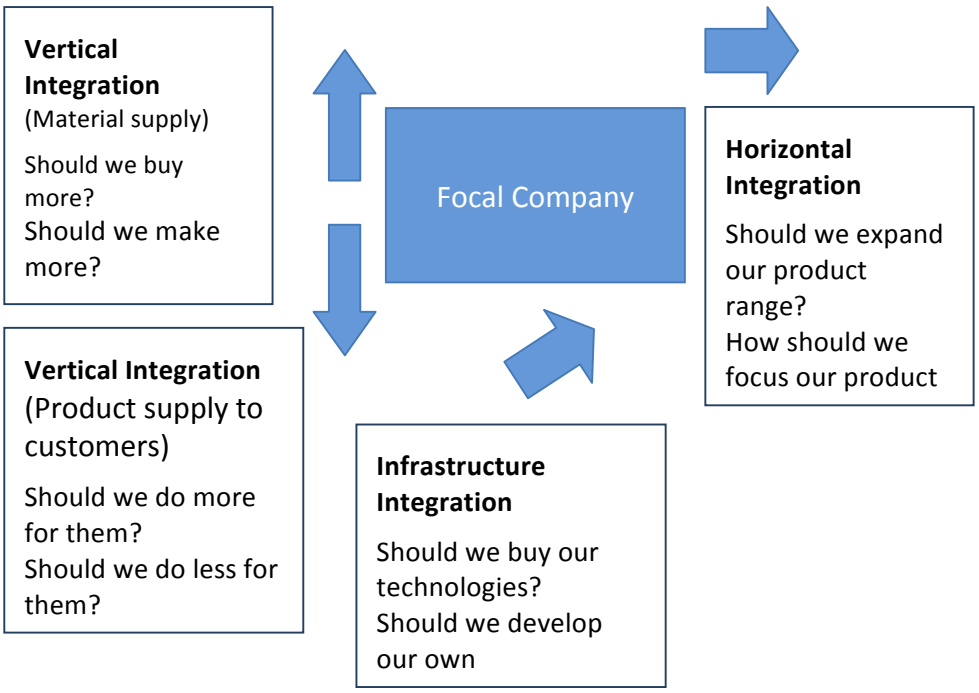


Figure 10, Vertical integration (Philpott et al. 2004)

As firms either seek to specialize within single activities or integrating a number processes it implies the strategy and further their position in the value chain. Companies that focus on upstream activities such as design and innovation need to

have different approach than those who aim for downstream processes as manufacturing and assembling. When considering innovation, there is no given position in the value chain which guarantees success. As elements in the chain continuously are changed, companies need to revaluate their position over time trying to capture the most value from their capabilities. This is particularly important when entering the market with a new technique; innovation only provides a temporary monopoly as a result from numerous reasons. First, there exist many fast followers; even if the innovation is protected there are skilled copiers who have the ability to overcome this protection. Secondly, the commercialization process often fails as capabilities for this differs from innovation capabilities and requires different knowledge, people and organization. Lastly, there often arise diffusion and disagreement concerning how and where to position the firm in the value chain (Dodgson et al. 2008).

3.3.3 Outsourcing

The global markets are continuously growing and an increased level of abroad sourcing of material and moving production to low cost countries has led to more complex supply chains. As outsourcing now a day exists at almost every company, there exist a lot of definitions (Deepen, 2007). Gartner (2013) defines IT outsourcing as *"the use of external service providers to effectively deliver IT-enabled business process, application service and infrastructure solutions for business outcomes"*. The use of outsourcing could help companies to reduce cost, accelerate time to market and take advantage of external expertise and intellectual property (Gartner, 2013).

Morgan, cited Gadde and Håkansson (2005), states that outsourcing is about *"taking an operation or functionality traditionally performed in-house and jobbing it out to a contract manufacturer or third party service provider"*. Further, outsourcing could simply be defined as a firms decision of what to buy (outsource) and what to perform within the companies boundaries (Juntunen, 2010).

Several gains and benefits could be obtained by using outsourcing. Lacity et al. (2008) classifies different benefits according to their impact on operational to strategic level in figure 11.

Figure 11, Outsourcing benefits (Lacity et al. 2008)

In order to succeed with an outsourcing deal, the strategy and desired outcome must be clarified from the beginning. In some deal the goals are low value activities done more cheaply, transfer a fixed cost into a variable. In other cases the objectives are to access the third party providers' superior skill, expertise, technology or processes. As this is clarified, the deal becomes easier to structure and the risk of take the activity back in-house decreases (McKinsey Quarterly, 2005).

3.3.4 Ownership of Material

When increasing the supply chain integration, complications such as ownership and responsibilities concerning products may arise. In a market where relations and supply chains are developing towards increased complexity such concerns may reach new levels. Except from the traditional situation where the customer buys the material from the supplier and at the same time take over the responsibility there is a number, more or less complex, of managing transfer of ownership.

Wallin et al. (2006) describes four general approaches of how to handle the ownership of material and inventory. These four strategies can be addressed by the two questions of who owns the purchased item and where the item is physically held.

Inventory Speculation

The far most common way of handling inventory, a firm purchases the item and hold it within its own warehouse until demand are known with certainty. Brings many advantages in terms of quickly responsiveness to demand, protect from fluctuation in prices and greater visibility and control. On the contrary leads to disadvantages such as high amount of tied up capital, material handling cost and bearing all the risk for the item.

Inventory Postponement

When using an inventory postponement strategy the purchasing firm gets the item delivered when the actual demand is certain. Acting in this way reduces amount of tied up capital, risk of inventory obsolescence and the cost of material handling. Of course this approach brings disadvantages, inability to meet fluctuations in demand and higher transportation and ordering cost when purchasing in smaller batches.

Inventory Consignment

A firm acting under an inventory assignment strategy holds the purchased item within it owns storage facility but the ownership stays with the supplier until the item is either used in production or has been sold. This approach benefits the purchasing firm by accessing them to material to immediate demand without having the expenses of investing capital or risking obsolescence goods. On the contrary, the firm is risking price fluctuations as the price of the item could vary between the points of delivery to the point of use.

Reversed inventory Consignment

Opposite to the inventory consignment approach, a firm using the reversed approach purchases the item but does not take it under physically possession. The item remains in the supplier storing facility until a request from the buying part of transfer the item either to production or directly to the firm's customer. The benefit of this rare used approach is that the buying part does not suffer from price fluctuations and all storage-related cost reduces. On the backside they take responsibility for material they do not possess and could meet expenses of inventory obsolescence.

3.3.5 Technology Licensing

Traditionally, most industrial companies have aimed for developing technologies with the objective to integrate them in their own products. Later, research provides information that there is an increasing trend of licensing out technologies (e.g., IBM and ARM). For example, when entering a new market licensing could be a valid option on the way to becoming an industry standard (Lichtenthaler and Frishammar, 2011). Except the income of the license in terms of royalties,

licensing out your technologies can generate other strategic and competitive advantages such as access to external knowledge, establish industry standards and a kind of "freedom of movement" enabled from licensing agreements with other ventures. Even if such benefits not directly increase the firm's income it contributes to strengthen the market position and its competitive advantage which may have a positive effect on the long term performance (Lichtenthaler and Frishammar, 2011). Of course licensing also involve potential risks, transferring knowledge could lead to a weaker market position when sharing core competences with possible competitors. Based on these threats, Lichtenthaler and Frishammar (2011) suggest the concept of *integrated technology exploitation strategy*. The concept of integrated technology refers to an alignment of product development and technology licensing and that the two areas are complements rather than substitutes. It may not be beneficial to manage licensing as a standalone activity, in order to fully capture the potential value from active licensing it must be combined with the overall market strategy of the firm. Furthermore, when deciding about licensing out a technology, one of the first aspects to be considered is the protection of patent and intellectual property. It is more appropriate to use licensing when having a strong protection due to harder challengers for license customer to copy and reproduce under their own name while it may be inappropriate to license if having poor protection (Lichtenthaler and Frishammar, 2011). This theory is strengthens by the "fundamental paradox" formulated by Nobel Memorial Prize winner in Economics, Kenneth Arrow. When two parties try exchange information, the buyer must be given the opportunity to put a value on the information. But when getting access to this information from the seller, the buyer can use it without paying. The solution to this paradox is intellectual property, if the information is protected by a patent the seller can be assure that the buyer cannot use it in other purposes than reviewing it (Holgersson, 2011).

Additionally, Davenport et al. (2003) describes three major ways to exploit a technology in their *Technology Strategy Framework (Figure 12);*

- *Intellectual property,* IP protection is a factor which will depend on both strategy and the approach to market entrance. If both time to market and the product cycle is short, then a strong IP protection may not be the best strategy. In the same way if the innovation firm is small and fight with large more influencing competitors it could be hard to protect the company's IP.

- *Technology lock – in,* in the case of a smaller company, technology lock-in could be a better alternative. Secure product exploitation by making it to the market standard and create a dependence of the product.
- *Continuous innovation,* an aspect connected to technology lock-in. When succeeding in making the product to the market standard, the sustainability of this advantage heavily depends on continuous innovation. To keep the customers locked-in there is a need for the next generation of products to achieve higher level than the previous.

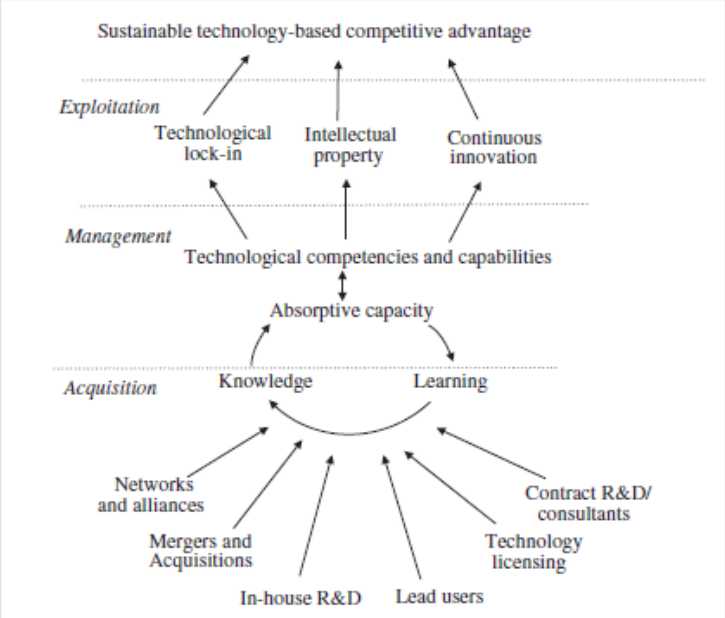


Figure 12, Exploiting technology strategy (Davenport et al. 2003)

3.4 Business Models

A first-class business model is vital for every successful organization, independent if it is a new company or a long term business. Before starting developing models it is essential to define what a business model is. A good business model answers the following fundamental questions (Magretta, 2002):

- *Who is the customer?*
- *What creates customer value?*
- *How do we make money in this business?*
- *What is the underlying economic logic which clarifies how we are creating value to the right cost?*

According to Johnson et al. (2008), a business model consists of four related elements which together create and deliver value:

Customer Value Proposition (CVP): This is the first and the far most important aspect to succeeding with when developing a business model. Every company need found a create value for the customer and help them to satisfy a need. First when there is an understanding of the job and how to perform it, it is possible to design the customer offering.

Profit formula: The profit formula is the map of how the company creates and designs the revenue stream. It consists of pricing the product, cost structure and the margin model which determines the amount o margin needed to achieve greatest possible profit.

Key Resources: Describes the company's key resources in terms of people, technology, products and brands, and focus on how they interact to create value for both the customer and the company.

Key Processes: Every successful company have designed processes that allow them to deliver value in a way that is repeatable and could be done in greater volumes. They include training, development, manufacturing and service but also rules, metrics and norms.

As simple as this framework may seem it all ends up in the execution and interaction between the building blocks. Changes in one area may indirect influence the others and affect the whole model.

Osterwalder and Pigneur (2010) define a business model as *"a model describes the rationale of how an organization creates, delivers and captures value".* Further they point out that the concept behind a business model must be simple, relevant

and intuitively understandable but not oversimplifying the characteristics of the venture. A business model could be defined by the four main areas of the company´s customers, offer, infrastructure and financial viability. The model works as a common language of the logic how a company intends to make money.

The strength of a well-working business model is that it focuses attention on how all elements of a system or organisation works together as a whole. Further it is important to the difference between the business model and the strategy. The business model describes how the whole business, piece by piece, works together as a system. However, there is one factor missing in the description of a business model, the competition. A strategy, on the other hand, describes how you will perform better and most of all differentiate or create competitive advantage against the competitors (Magretta, 2002).

A well-know example of the difference between a business model and strategy is the story of Dell. Dells business model was to sell personal computer directly to the end customer while their competitors sold through distribution channels via retailers to the end customer. Dell´s model reduced one level of the margin stack, gave Dell valuable information needed to manage inventory which released money to put on innovation to maintain competitiveness. This model helped Dell to outperform their competitors. The strategy, on the other hand, was an equally important factor beyond Dells success. While most PC vendors focused on the consumer market, Dell made the decision to head for the corporate which were a much more profitable alternative with larger margins than the consumer equivalent (Magretta, 2002).

It is not a necessity for new, breakthrough products to emerge from a new innovative way of doing business. To enter the market, radically new product sometimes needs a new business model. Further, when becoming an established products or service the current business model may need to be reinvented; "*one secret to maintaining a thriving business is recognizing when it needs a fundamental change"* (Johnson et al. 2008).

3.5 SWOT - Analysis

The objective with a SWOT-analysis is to identify strengths and weaknesses, which often are internal factors in the organization, and set them in the context which they are relevant to. Opportunities and threats are to be recognized, generally generated by external factors, and evaluated of how they may impact the development of strategy. A SWOT-analysis in itself is seldom of much use in its absolute context, it is relative to competitors or different strategic alternatives. It is

a comparative model and is only useful if strengths, weaknesses, opportunities and threats are set in relation to other alternatives.

Even though a SWOT-analysis is great tool for a holistic evaluation of a firm's capabilities or strategic focus, there exist two major dangers. First, the exercise of a SWOT may result in a long list of internal capabilities and external factors. The risk is to get lost in too many details and lose focus of what really is important. Second, there is a risk of overgeneralization and forget about the underlying reason for the capabilities which is needed to obtain the fully understanding for the object of analysis (Johnson et al. 2009).

3.6 Porter´s five forces

Porter's five forces is a tool to analyze the attractiveness of different industries. According to Johnson et al. (2009) the five forces that affect how attractiveness a market/industry are: *the threat of entry into a industry; the threat of substitutes to the industry's products or services; the power of buyers of the industry's products or services; the power of suppliers into the industry; and the extent of rivalry between competitors in the industry,* see figure 13. The objective with using Porter's five forces is to analyze the competition and attractiveness of a potential market (Johnson et al. 2009). If all five forces are high the market will then not be of interest to compete in because there are too many players and it will be hard to obtain profit.

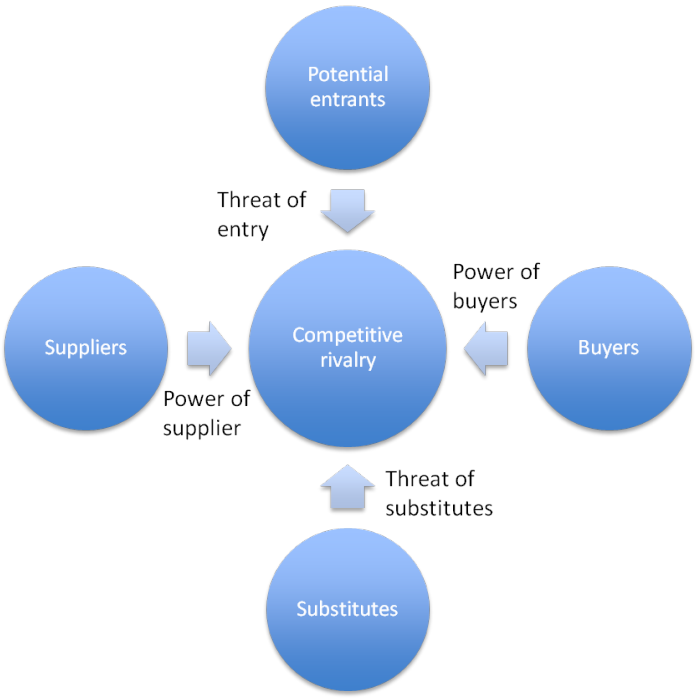


Figure 13, Porter's five forces (Johnsson et al. 2009)

The threat of entry is how easy an entrance would be and the existing competition in the industry. Companies that already have entered the industry want high and extent barriers for an entrance (Johnson et al. 2009). Typical barriers to entry a market according to Johnson et al. (2009) are: scale and experience; access to supply or distribution channels; expected relation; legislation or government action; and differentiation.

The threat of substitutes is how well similar products or services perform on the market. Substitute products or services are not only considered in the market of interest; it could also be in other market segments. According to Johnson et al. (2009) are there two important points of threat for substitutes: the price/performance ratio; and extra industry effects.

The power of buyers is if the customers have high bargaining power on the market and could put pressure on its supplier. The effect of this alternative could be a under pressure supplier not making any profit at all (Johnson et al. 2009). According to Johnson et al. (2009) buyer power is depending on three conditions that could prevail on the market: concentrated buyers; low switching cost; and buyer competition threat.

The power of suppliers is how supplier could affect the organization which they serve (Johnson et al. 2009). These factors are the converse to those for the power of buyers. According to Johnson et al. (2009) supplier power appears when there are: concentrated suppliers; high switching cost; and supplier competition threat.

The competitive rivalry is those companies that compete on the same market with similar products or services that aims for same customer group (Johnson et al, 2009). For example in the food industry, food stories are rivals while fast food restaurants are substitutes to food stores. According to Johnson et al (2009) factors that affect the competitive rivalry are: competitor balance; industry growth rate; high fixed cost; high exit barriers; and low differentiation.

When Porter's five forces are used there are three main issues related to the model which one has to be aware of. These issues are *defining the "right" industry*, *converging industries* and *complementary products*. The problem with *defining the "right" industry* is that each industry often is divided into several segments (Johnson et al. 2009). These segments have likely different competitive forces and should be analyzed separately to create an overall view. *Converging industries* aims on the industry boundaries that are constantly changing (Johnson et al. 2009). New markets or industries can be merge into one market or begin to overlap current market because of activities, technologies, products or customers (Johnson et al. 2009).

Complementary products are products or services customers buy from another supplier and have a higher value together than separately (Johnson et al. 2009). It is important to point that Porter`s Five Forces will not be used according its original purpose which is to analyze the attractiveness of entering different markets. Rather, it will be use to analyze the entrance of the same market but with different models and supply chain set ups.

4. Empirical Framework

In this chapter the empirics of the PC supply chain and the position of FlatFrog will be described. First, a holistic view over the PC supply chain will be considered. Secondly, the focus will be narrowed to the touch supply chain and different actors and their characteristics will be described. Third, business model of FlatFrog and their position in the supply chain will be explained. Last, two case studies, ARM respectively Qualcomm, where similarities with situation of FlatFrog could be recognized, are presented. All data and information are, if nothing else is indicated, gathered during meeting, discussions and observations at FlatFrog and are referred to as FlatFrog internal material. The PC market is highly dynamic business with short product cycles, hence, it is vital to point that information gathered in the beginning of the project may not be of the same validity in the end. Therefore, the empirical framework has been developed as general as possible to make the study more generic.

4.1 The PC Supply Chain

In this part, the characteristics of different players in the supply chain will be described followed by an overview of the largest actors. To get an idea of how the PC supply chain acts and what the drivers are, the material flow is illustrated in figure 14. The original equipment manufacturers (OEM) such as Dell, HP and Asus are the ones creating a pull effect and are setting the standards of the market. They are selling consumer electric devices under their own brand but has almost no own production. As seen in the figure, OEMs divide their production on a number of different original design manufacturers (ODM) to spreading the risk and create competitiveness among its suppliers. The ODMs are sourcing components from different tiers of the supply chain.

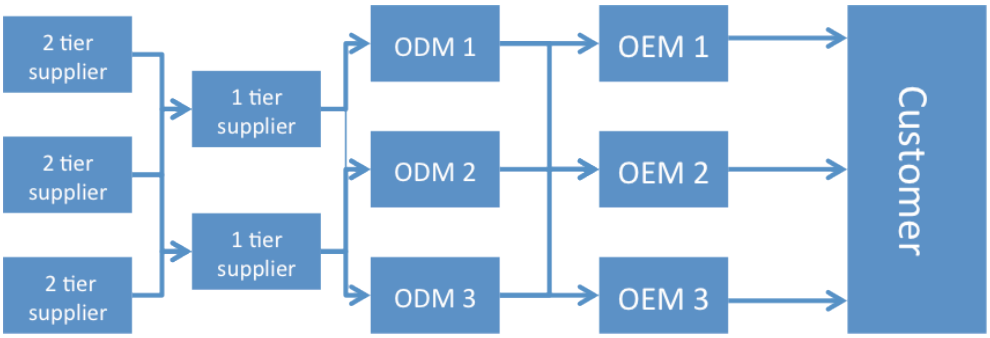


Figure 14, The general PC supply chain

The OEM/ODM notebook split, which illustrates how OEMs spreading the production among different ODMs, could be seen in table 2 (Yang et al. 2012). The

table consists of the ODM total production divided on the different OEMs. It summarizes the total amount of ODM production and hence not the actual OEM shipments.

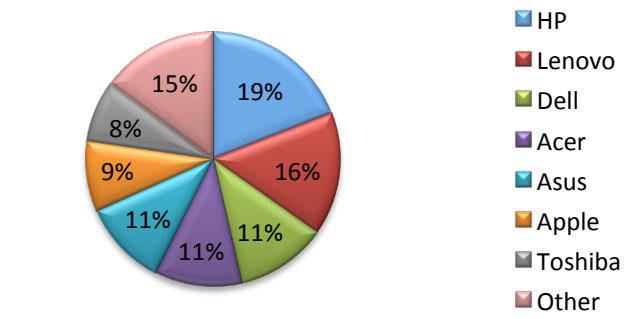
Table 2, The OEM/ODM notebook split

OEM\ODM	Quanta	Compal	Wistron	Pegatron	Inventec	Foxconn
HP	25.5 %	2.3 %	19.4 %	2.1 %	50 %	81 %
Acer	14.4 %	33.3 %	17.6 %	5.2 %	0 %	0 %
Lenovo	5.7 %	18.6 %	27.8 %	6. 3 %	0 %	0 %
Dell	5.5 %	33.3 %	19.1 %	0 %	0 %	0 %
Asus	9.6 %	6.8 %	3.1 %	49. 5 %	0 %	0 %
Toshiba	7.2 %	3.3 %	0 %	29.7 %	50 %	0 %
Apple	24 %	0 %	0 %	0 %	0 %	0 %
Other	8.1 %	2.4 %	13 %	7.2 %	0 %	19 %
Total	100 %	100 %	100 %	100 %	100 %	100 %

4.1.1 Original Equipment Manufacturer

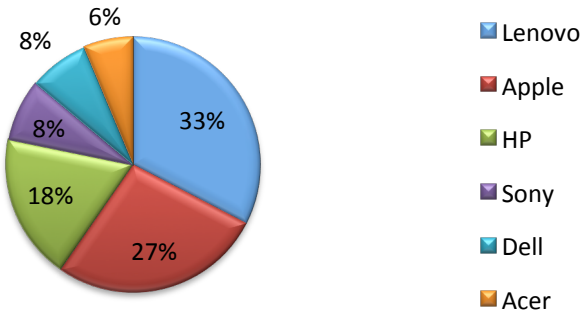
An original equipment manufacturer (OEM) function is usually to rebrand the product and selling it to the end customer. The term original refers to that the company initially made the original product but decides not to manufacture it in-house and instead procures the finished products, usually from an original design manufacturer (ODM). Examples of OEMs are HP, Acer, Lenovo, Dell, Asus and Toshiba (PC Magazine, 2013). Chart 1 shows the notebook shipment split in fourth quarter 2012 where HP possessed the largest market share followed by Lenovo and Dell, (Chien 2013).

Chart 1, Notebook shipment by OEM 4Q2012



China-based Lenovo was the largest AIO vendor in 2012 accounting for 33 % of shipments followed by Apple and HP, full split is showed in chart 2(Chien, 2012).

Chart 2, AIO shipment by OEM 2012



Across many industries, and especially in the consumer electric markets, original equipment manufacturer uses similar components in their end products. Instead of competing in best performance the focus is primarily on cost, design, and improved supply chain performance (Gilbert et al. 2005).

Today, the absolute majority of the OEM production is outsourced to original design manufacturers. It results in almost every end product in respectively segment is based on same platforms and produced at standardized production lines and differentiation is mainly conducted by industry design. As the pressure, in terms of maintaining low cost and integrate additional features in the devices, steadily increases the OEMs are tending to approach the way of sourcing in different ways. Some, which focus on low risk and are willing to pay a higher price, prefer to source from a *"one-stop-shop"*. This is usually an ODM which

offers a complete product on which the OEM only need to put its brand on. In this case, they neither participate in any sourcing nor contribute to product design or R&D. They pay a higher price for an overall solution and expect no complications along the way (Internal FlatFrog material, 2013).

The other approach is where the OEM focuses on product design and innovation. They have a larger share of integration in the upstream supply chain and a greater visibility in both sourcing and R&D. This often results in faster product cycles and a lower cost but the OEM has to carry a larger portion of risk (Internal FlatFrog material, 2013). The most substantial example of vertical integration is Apple, which have built a closed ecosystem where it control almost every piece of the supply chain by demanding dedicated capacity at its suppliers. Due to the large volume and sometimes ruthlessness, Apple enjoys large discount on material, production capacity and freight. Except the advantage of low prices, the tactic also ensures availability for Apple. In June 2010, before the release of iPhone 4, Apple had so many orders at screen manufacturers that rivals such as HTC could not procure as many screens as it needed (Satariano and Burrows, 2011).

To summarize, a one-stop-shop solution with little upstream visibility or a option with vertical integration are the two end positions in the OEM upstream relationships scale and of course there exist a number of intermediate situation where a hybrid of these end positions are applied (Internal FlatFrog material, 2013).

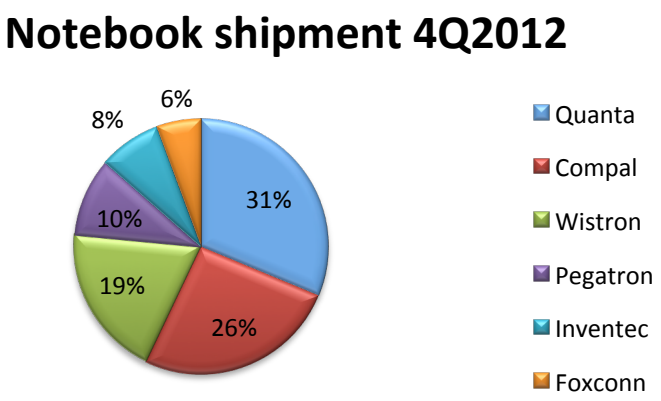
4.1.2 Original Design Manufacturer

An original design manufacturer (ODM) does not, unlike the OEM, sell any products or systems on the open market under their own brand. Their role is usually to brand and distribute their products on behalf of the OEM customers. In addition to traditional ODMs which manufacture OEM branded products, there exist so-called white box computers. White box refers to companies which produce and sell PC without a well know brand name. A white box computer is a customized computer where the customer could choose which branded internal components to use but the assembly is done by the white box company (PC Magazine, 2013).

An traditionally ODM has not generally any interest in producing electronics products for low volume, high mix niche product categories but are instead focused on high volume electronic systems markets as notebooks, computers and handset devices. Further, the ODMs are often responsible for the research and development needed to design products and systems but will adjust their standard designs to satisfy the needs of their OEM customer. In addition the ODM are often, even

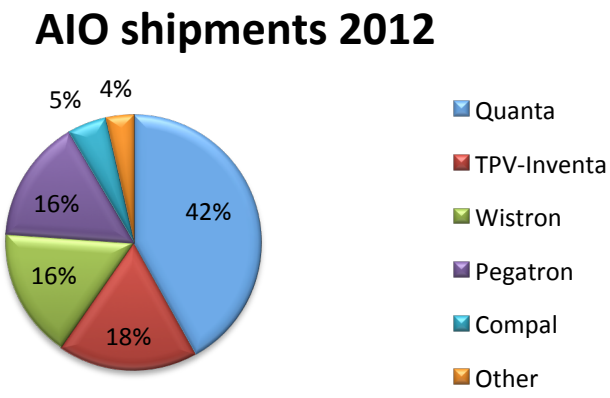
though they do not prefer it, responsible for inventory. Typical ODMs are Quanta, Compal and Wistron (iSuppli, 2013). Taiwan-based ODMs shipped 174 million notebooks in 2012, a decline of 2.8 % from 2011. The fourth quarter shipments in 2012 are shown in chart 3 with Quanta, Compal and Wistron as the top three vendors (Chien, 2013).

Chart 3, Notebook shipment by ODM 4Q2012



The global AIO shipments are showed in chart 4, with Quanta, TPV-Inventa and Wistron as market leaders (Chien, 2012).

Chart 4, AIO shipment by ODM 2012



Like the OEMs, the ODMs have different strategies when it comes to vertical integration. Some perform a majority of manufacturing activities in-house whereas others are more focus on assembly. For some companies it could be hard to define of whether they are a pure ODM player or more of an electronic manufacturing

services player (EMS), which is an even lower margin focused manufacturing player than the ODM. This could be related to the need of the OEM customer, if they want an overall solution some ODMs could offer the whole deal, often to a higher price. If the OEM wants greater visibility and give input in sourcing of certain components, some ODMs meet that need by increase their level of integration (Internal FlatFrog material, 2013).

The latest trend for the largest ODMs is to increase their level of vertical integration. By joint ventures, mergers and acquisition increase the level of work performed in-house in order to reach better control of cost in their supply chains. A trend which the ODMs more or less has been forced into because of shrinking margins, recent years ODMs gross margin typically is around 5 %. Vertical integration has especially become a factor when it comes to the integration of touch both in notebooks and AIO (Consultant interview, 2013). From being an additional feature, the touch function has increased towards becoming a mandatory element in these types of devices. Customers are not willing to pay substantially extra for these features which mean that PC-vendors must drastically cut cost to not loose competitiveness against tablets. By increasing the in-house knowledge of touch integration ODMs are hoping for capturing larger amount of touch panel value. There are particularly two areas of the touch supply chain where the ODMs focus on increasing the integration including lamination of the glass and implementation of the touch sensor (Credit Sussie, 2013*)*.

4.2 The Touch Supply Chain

The touch supply chain could generally be defined as an integrated part of the PC supply chain. However, the set up could vary in several ways. The touch module could either be delivered to the ODM as "plug-in" touch module from a touch module integrator (TMI) or, the ODM could source, assemble and integrate the module themselves by subsidiaries or vertical integration. Of course, it exist immediate stages between these two options where the ODM, for example, sources pre-assembled, minor modules which are a part of the whole touch module.

4.2.1 Touch Module Integrator

A Touch Module Integrator (TMI) produces a turnkey touch solution which is delivered to the ODM that integrates it into the PC. Typical TMIs are TPK, Wintek and AUO and a simplified illustration of their position in the supply chain could be seen in figure 15.

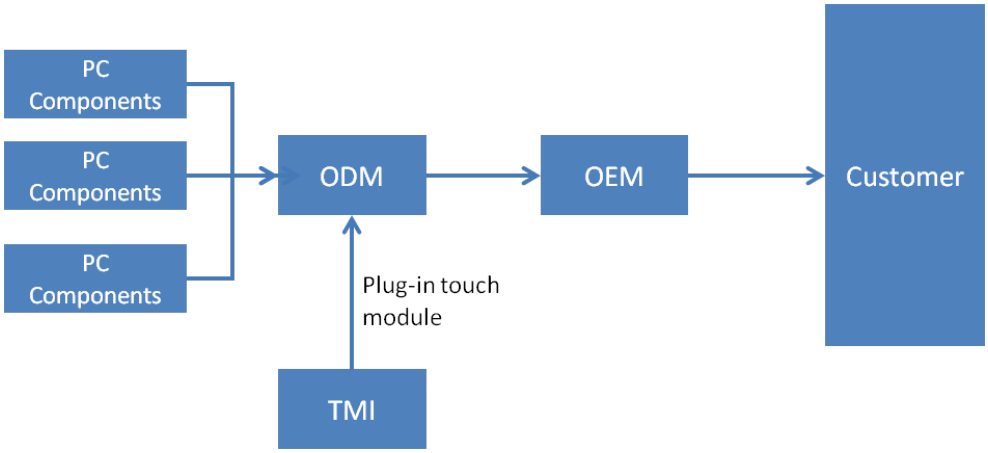


Figure 15, TMI supply chain position

A TMI is often used if the ODM does not possess the in-house knowledge of integrating touch capabilities. The TMI often possess a high level of IP, has innovation focus and general larger margins. However, the role of the TMI could vary, from being an integrator and manufacturer of the touch, this position could be filled by a contract manufacturer which only performs the assembly of components and is more of a low margin player with higher cost focus. Further, the TMI take full product ownership until the touch panel is sold and delivered to the ODM which detach it into the end product.

A majority of the TMIs are currently offering products based on the projected capacitive technology. Many actors are struggling to reach profitable yield in the production especially for notebooks and larger screen sizes, not expecting to reach 85 % until 2Q13 (Han, Chang 2013). TPK is currently most successful and dominates the market with a market share of 71 % in all touch panels used in notebook applications during 2012 (Han, Chang, 2013). Recent years, PC ODMs has made large PCT investment to start compete with TMIs and increasing vertical integration but they have been unsuccessful as they see limited ROI. This makes the ODMs sceptical to new techniques as they want to avoid risks and must see proof of working samples before making a move (Internal FlatFrog material, 2013).

4.2.2 ODM Touch Integration

The opposite to a set-up with a TMI is when the ODM take the TMI role, either by sourcing or by vertical integration procures components or whole parts of the touch panel, an alternative illustrated in figure 16. After the procurement of material the touch module is assembled and integrated at the ODM site or at its subsidiaries. In

difference to a TMI, an ODM general has lower margins, higher cost focus and less portion of IP. Of course, this could vary between different ODMs (Internal FlatFrog material, 2013).

As the ODMs currently are struggling with shrinking margins, the trend of increase the vertical integration of touch capabilities is spread among most of the largest ODMs. Although the objectives for this are plenty, the true reason is that they are forced in this direction to avoid hidden margin stacking and defend their profit (Consultant interview, 2013).

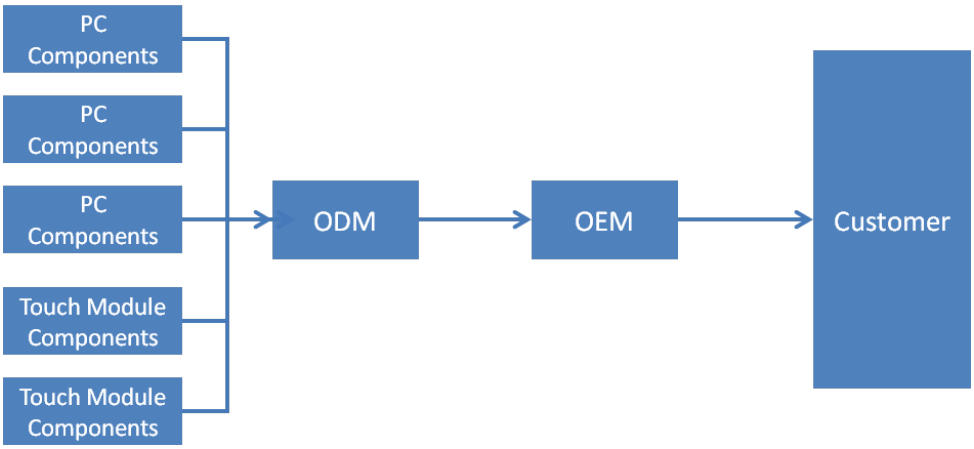


Figure 16, Touch module vertical integration

4.2.3 Constraints and Issues of the Touch Supply Chain

Even if the touch supply chain instantly is changing in terms of supply risk, one major constraint is the staggering demand of Indium Tin Oxide (ITO). The ITO is used as thin film over the touch sensor and allows an increased transparency of the touch sensor. Since the touch market continuously is growing, the ITO film industry is faced with supply shortages due to the growth in demand with more manufactures and the late response according to the exploding demand (Displaybank, 2013).

Except the ITO supply risk the touch supply chain is struggling with two main issues to reach customer success. First, there exist problems of reaching profitable yield in the production process (Credit Sussie, 2013*)*.

As the end market requires smaller devices and thinner shells, constraints in terms of the amount of used components and higher precision are increasing. It leads to a more complicated production process where it is hard to reach satisfying yield.

Current market leading touch technologies are struggling with this due to many components and problems with reaching thinner designs.

Second, the costumers have announced their discontent with the lack of qualitative hardware to a reasonable price which supports the touch function enabled by Windows 8. This is directly connected to the supply chain issues of integrating the touch function to a sensible cost. As ODMs struggling with adding touch functionalities into smaller and nimble devices, new notebooks with touch functionalities tends to look exactly the same as devices two or three years ago (Keizer, 2013).

The problems of smaller requested devices and the high price create a window of opportunity for FlatFrog as the request for a technique which meet profitable yield is highly requested on the market. The PSD technology offers a far simpler bill of material (BOM) with fewer components and could meet the demand of both higher yield and lower cost in production (Internal FlatFrog material, 2013).

4.3 PC Supply Chain Actors and Stakeholders

4.3.1 Quanta

Quanta is the world's largest ODM manufacturer, based in Taiwan and founded in 1988. With market shares of 30 % and 42 % in notebooks respectively AIO, Quanta is the largest producer of personal computer in both segments (Chien, 2013). With almost every OEM including HP, Acer, Lenovo and Apple, as their main customers, Quanta remain fairly unthreatened as the biggest ODM.

Quanta's core business is notebook manufacturing technology and is, unlike from Wistron among others, focusing on low cost production. This is characterized by their R&D expenses which during 2011 are less than 1 % of their revenue and a gross margin which is around 4 % (Bloomberg Business Week, 2013). In addition, their main OEM customer, HP, which stands for 40 % of their notebooks sales, has not an explicit innovation focus (Yang et. al, 2012).

To catch up in "the touch race", Quanta have established a joint venture with 3M to manufacture and commercialize project capacitive touch solution for the PC market (Credit Suisse, 2013). The collaboration includes mass production of touch modules, sensors, electronics and systems on computing devices. This includes AIO PCs, monitors, netbooks, notebooks and tablets. According to Credit Suisse (2013) Quanta also collaborates with Pixart on AIO with optical touch. A strategy which may seem wise, as the market still are unsure of which touch technology which will be the trend of the future.

4.3.2 Compal

Compal is the second largest ODM manufacturer of notebooks and fifth largest of AIO with market shares of 24 % respectively 5 % (Chien, 2013). Together with Wistron, Compal is leading the vertical integration of touch capabilities, adding air gap and full lamination. In addition, Compal internally sources the touch sensor by subsidiary Henghao, an aspect that Wistron do not possess (Credit Suisse, 2013). On their website, Compal state the importance of close relations between internal R&D and customer in order to be able to make decisions based on the market situation. They have a pronounced strategy to increase in-house knowledge by both investments in internal R&D as well as add capabilities by vertical integration (Compal, 2013).

In the touch segment Compal are producing mid size to large size glass projected capacitive touch panels and related components. With the investment in Henghao, they have possessed R&D and manufacturing knowledge which enables them to start perform lamination and produce touch panels for their own notebook projects (Credit Suisse, 2013).

In addition to their upstream vertical integration, Compal has started the first ODM/OEM joint venture with Lenovo to increase downstream supply visibility. The joint venture focuses on notebooks and is forecasted to produce 12-13 million notebooks in 2013 which stands for 42 % of Lenovo's notebook shipments (Lee, 2013).

Further, Compal is one of the ODM with highest innovation focus, characterized by the amount of R&D expenses part of the revenue is 1,5 % which is a high ratio in comparison to other ODM (Compal Annual Report, 2011).

4.3.3 Wistron

Wistron Corporation was founded in 2001 and is a Taiwan-based ODM manufacturer with focus on notebook PCs, desktop systems and handheld devices. With aim for design, manufacturing and after-sales support, Wistron is the third largest ODM manufacture of notebook and AlO with market shares of 18 % respectively 17 % (Chien, 2013).

Today, Wistron is one of the leading ODMs in terms of vertical integration, adding capabilities such as air gap and full lamination within the company boundaries (Credit Suisse, 2013). Acting in such a low margin market these tendencies tends to be a trend by a number of ODMs, adding capabilities either by acquisitions or creating both upstream and downstream joint ventures. This is strengthened by Wistron´s chairman Simon Lin, cited in Digitimes (2013):

"Lin believes the declining margin is not really a critical problem because such a situation tends to happen in more developed sectors. What PC makers should really focus on is to find a business model that can boost its value for clients for the next 10 years".

By acting in this way, Wistron are trying to get better control and visibility of their supply chain. With strategic investments in new business areas Wistron want to increase the knowledge and product portfolio, which will lead to increased value for the customer and in the end an improved profit margin (Wistron, 2012).

In the touch segment Wistron have made investment in a lamination facility and is focused on one glass solution (OGS). Key components for the touch panels are purchased, and then combined to manufacture the touch model (Credit Suisse, 2013).

4.3.4 Pegatron

Pegatron, founded in 2008 and based in Taiwan, is the fourth largest manufacturer of notebooks and AIO with market shares of 9 % respectively 16 % (Chien, 2013). Although Pegatron´s focus is on personal computers, they possess a wide product portfolio including motherboards, wireless systems and LCD TVs. They provide an overall solution to the customer with a desire for high-level contact beyond company boundaries. A strategy of creating mutual gain with customer and suppliers by a high level of communication is conducted (Pegatron, 2013). Pegatron´s largest OEM customer is Asustek who has 50 % of its notebook shipments produced at Pegatron during 2012. (Yang et al. 2012). As Asustek is the OEM with highest innovation focus and shortest lead time and product cycles which requires a close relationship with the supplier, this proof Pegatron´s high level communication strategy (Internal FlatFrog material, 2013).

According to Credit Suisse (2013) Pegatron has no strategy for touch strategy and are instead focusing on casing. This means they will have to buy complete touch modules from a TMI.

4.3.5 Intel – A Supply Chain Enabler

Intel was established in 1968 by two scientists, Robert Noyce and Gordon Moore. They founded the company with a vision to be a leading edge semiconductor memory developer. In 1971, they introduced the world's first microprocessor and have since then instituted a tradition of innovation and continuous growth (Company overview, www.Intel.com). Today, Intel design and manufactures advanced integrated digital technology platforms consisting of a microprocessor and a chipset. In addition, this could be complemented by addition hardware,

software and services. The primary customers of Intel are OEMs, ODMs, and industrial communication equipment manufacturers in the computing industry. Intel's platform exists in an extensive range of end products including PCs, data centers, tablets, smartphones, automobiles and medical devices.

The last decade Intel has positioned their selves in a unique position as a major player in the PC market with a large portion of the revenue from the end products *(*Intel Annual Report, 2011*)*. Analysis of the gross profit structure of cost per PC shows that about 30 % is generated by Intel in 2011. In comparison to the 11% gross margin of Asus, Acer and Lenovo per PC, Intel´s unchallenged position of power during the last decade is evident (Gardiner et al. 2012).

By starting investing in areas not directly related to their products Intel has start to position their business to take advantage of the growth in computing devices which connect with each other and with internet. This is primary conducted by Intel's subsidiary, Intel Capital that is the Intel group's global investment organization. Between the start in 1991 and 2012, the organization has invested over 10 billion USD in more than 1200 companies in over 50 countries. During 2011, Intel Capital created a fond of 300 million USD intended for investment, which enables Intel´s Ultrabook campaign (IT-jätte satsar i Lund, Sydsvenskan, 2012).

As Intel defines it in their 2011 annual report:

"Our investments, including those made through Intel Capital, generally focus on investing in companies and initiatives to stimulate growth in the digital economy, create new business opportunities for Intel, and expand global markets for our products"

This behavior by Intel could be defined as the concept of supply chain enablement as Intel enables success and growth of their product by investing in other, not directly related areas. Supply chain enablement could be compared to a major bread manufacturer invests capital in agriculture machinery to enable a larger supply of raw material (FlatFrog internal material).

Due to the fact that PCs, including both notebooks and desktops, accounts for about two-thirds of Intel´s total revenue; Intel´s performance is highly dependent on growth of the PC industry. As tablets and smartphones has entered the market and started to replace the PC, the PC industry struggles with a 3 % decline in 2012 and estimated to further decrease with 2 % in 2013 (Fu, 2013).

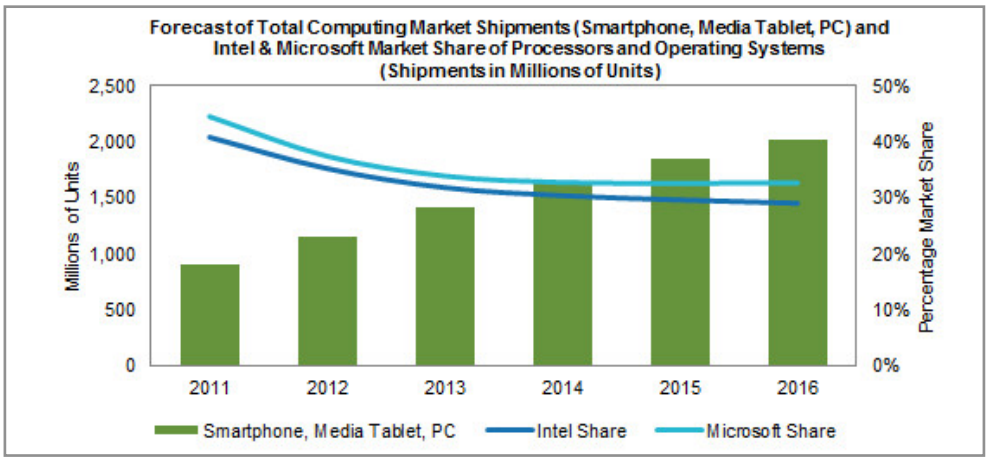


Figure 17, Intel and Microsoft market share of processors and operating systems (iSuppli Research, 2012)

Both Intel and Microsoft market shares of processors and operating systems in the consolidated segment of smartphone, tablets and PC have been declining the latest years which could be seen in figure 17. The trend is predicted to continue even if the curve is to be flattening out. Form factor changes when new players such as ARM, Qualcomm and NVIDIA set new standards because of their low price and power consumption. The market is converging as phones want become tablets, tablets wants to become PCs and PCs wants to become more like tablets. (iSuppli Research, 2012). Craig Stice, Senior Principal Analyst Compute Platforms at IHS iSuppli Research states:

"Wintel finds itself in the unfamiliar position of dancing to someone else's tune, following standards that were set by other companies for form factors, user interfaces and even pricing. This means Microsoft and Intel must think outside the box—even if it means adopting strategies that work against each other's interests."

To meet the future threat of a converging PC market Intel has started to broaden their strategic focus in terms of expanding their market segments beyond traditional PC and server business. In order to be able of challenging touch products this includes consumer electric devices, embedded applications, smartphones and tablets (Intel Annual Report, 2011).

4.4 FlatFrog AB

In June 2012 Intel Group invested 20 million Euro in FlatFrog together with current investors. A move well aligned with Intel's strategy of creating new business opportunities, this time trying to integrate the touch feature in PCs (IT-jätte satsar i Lund, Sydsvenskan, 2012). Alongside the investment Intel set a

requirement on FlatFrog to start focus on developing a touch solution for notebooks and AIO which aligns with Intel strategy.

As a result of Intel´s requirement of focusing on the PC market, FlatFrog re-aimed their focus from a branded product in the vertical segment to modules which are integrated in customer products. These products generally mean higher grade of customization and are produced and sold in high volumes. The search for potential partner who possible could integrate their touch solution in both notebook and AIO started in the summer of 2012 (Internal FlatFrog material).

4.4.1 Project PC

The project of reaching the PC market consists of several steps. First, a working design must be developed to fit the target product. Parallel, the process of defining a proper business model and then searching for and auditing potential partners and suppliers has to be performed.

In the sourcing process, FlatFrog divides the component into three groups to describe the character of each component:

1) *Compulsory components* - Close relationship with supplier and indication of big volume possibilities, as a compulsory component of the system. These components are often customized and cannot be changed by the touch module partner.

2) *Highly recommended components* - Important component which is highly recommended not to be exchanged by the touch module partner.

3) *Commodity components* - Off-the-shelf components, no commitments or contracts are performed with the supplier. If the touch module partner got a lower cost alternative, they are free to change supplier.

The Scan IC

One of the major advantages with the PSD technology is the high portion of standard components which enables a lower bill of material cost and a simpler supply chain. Despite this, there is one major component which is customized in the PC project, the Scan IC, being an ASSP (Application-Specific Standard Product). An ASSP is basically an integrated circuit (IC) customized for a specific use and application, but intended for a number of customers. FlatFrog's ASSP is a mixed signal (analogue and digital) circuit which controls the scanning frequency and drives the emitters and receives the signals from the detectors (FlatFrog Internal material).

FlatFrog does not possess the capabilities to develop a Scan IC in-house, hence, the activities of developing and manufacturing the chip had to be outsourced. The choice of the Scan IC partner ended up with a leading fabless semiconductor company. The vendor develops the Scan IC according to FlatFrog's specifications. The Scan IC is a critical component as it is crucial for the touch module to work, i.e. the touch module partner must source the Scan IC from the selected vendor.

When entering mass production with a new product or technology the most common way is to invest in new production equipment or adjust the current according to the new technology. This creates commitment from the manufacturing partner and optimizes performance but is often connected to a financial risk in terms of NRE paid to the manufacturing partner. Another alternative to get into production is to use the concept of retrofit, which basically means to use existing manufacturing equipment and with smaller adjustment replace the previous used technology without any need of extensive investments. The main benefits from the concepts of retrofit are:

- Utilization of existing facilities at ODM/TMI site
- Higher level of spare parts availability
- Decreased adoption for new product or technology in production (i.e. learning curve)
- Substitution for large CAPEX which enables faster return of investment (ROI).

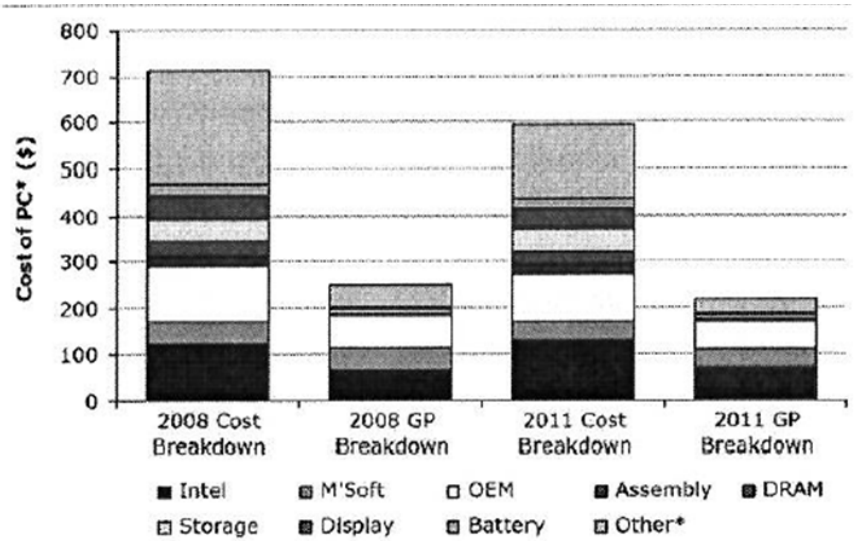
Even if these advantages seem tempting, one major risk concerning this alternative is the risk of replacement. Just as convenient it is to replace a competitive technology, just as big is the risk to be replaced since manufacturers always audit their suppliers and search for lowest possible cost.

4.4.2 Business Model and Supply Chain

As the development of business model and supply chain set up was under development during the writing of this thesis, no definite business model of FlatFrog could be presented in this empiric chapter. Two different alternative models and their related supply chain set ups will be evaluated in chapter 5. The first alternative is to use a license model where FlatFrog provides customer with their IP and specifications of a touch module. Second, product ownership model with outsourced production will be examined. In addition to the decision of business model, a selection of manufacturing partner must be done. This will further be described in 4.4.3.

The main concern when choosing model is that FlatFrog may get stuck in the middle between large multinational companies as the large ODMs and OEMs. FlatFrog wants to offer low price to the OEM but on the other hand they must manage to secure enough margins to both themselves and to the manufacturing partner. The PC supply chain is constrained; chart 5 pictures the cost breakdown for PCs during 2008 and 2011. Obviously, margins are unsparingly small for every actor on the market with Intel and Microsoft as the only exceptions. Hence, the supply chain will constantly trying to cut and question costs to maintain and improve profit.

Chart 1, Who makes money out of PC; Revenue and gross profit per PC (Gardiner et al. 2012)



Because of this, FlatFrog may struggle to justify their margin over time. ODMs are looking to improve their margins and competitiveness in a highly contested space where OEMs are moving from one ODM to another and margins are thin and are getting even thinner. Hence, every actor in the PC supply chain constantly trying to find ways to cut cost and FlatFrog may turn into a tempting target for the bigger players as a new and small actor. It increases the requirement both on continuous innovation as FlatFrog's every new generation must offer better performance and lower cost than competitors.

4.4.3 Manufacturing Partner Assessment

Independent of the business model a number of manufacturing partners has to be approached. Spreading out production risk and increase capacity are aspects which are essential when scaling up production. However, the character of further

manufacturing partners may vary dependent on the business model. It could either be a low cost focus, with a limited value adding partner like an EMS or an ODM which both assemblies and integrates the touch module into the PC.

Even if different characteristics are required for different partners, one major aspect is essential, to have OEM commitment. The OEMs create the pull in the market and all ODMs are used to work with OEM requirements. When having commitment from OEMs, most manufacturing partners will show interest and other obstacles could more be conquered.

For the initial assessment the most important part is to get an overview of how the evaluated company performs their business and what their incentives would be in a potential partnership with FlatFrog. In the early stage of partner assessment a number of measures and conditions were considered, briefly summarized in table 3.

Table 3, Manufacturing partner assessment

Measure/Characteristic	Explanation
Gross Margin	Measure which indicates the effort behind every earned dollar but also indication of the company´s focus.
R&D Spend	Defined as R&D expenses/total revenue. Measure which indicate level of R&D focus.
Market Share NB	Yearly shipments of notebooks, with or without touch.
Market Share AIO	Yearly shipments of AIO, with or without touch.
Supplier base for NB touch	Existing providers of touch solution for notebooks
Supplier base for AIO touch	Existing providers of touch solution for AIO
Tier one supplier for OEMs	Reach of possible end customers for FlatFrog
Existing relations and joint ventures	Existing vertical integration or cooperation's especially with focus on touch.

Gross Margin is defined in equation (1) and is a measure which could reveal and indicate several characteristics of a company.

$$Gross\ Margin\ (\%) = \frac{Revenue - Cost\ of\ sold\ goods}{Revenue} \qquad (1)$$

First, the gross margin is a measure of the internal effectiveness behind one company´s efforts to produce a sold product. A lower the cost of sold goods generates a higher gross margin, i.e. a measure of how much value which is added. Further, it indicates which kind of business the company participates in. For example, a licensing model normally generating a higher gross margin as the sold goods generally is IP or certain knowledge. A model based on ownership of the physical product causes lower margin as the cost of the sold goods is explicitly higher. Last, it could indicate the focus area of the company. Highly innovative and R&D focusing ventures must have higher margins to spend on continuous innovation while a manufacturing company with low IP and high focus on low cost production generally has lower gross margin.

R&D Spend, defined as R&D Expenses/Total Revenue is a measure of how much of the company´s revenue which is spent on R&D. It gives an indication of the ambition, whether is innovative or cost focused. Dependent of the supply chain set up and the elaboration of business model, different kind of partners are suitable for different kind of set ups. Hence, measures as gross margin and R&D expenses could give early hints in the initial audit of potential partners.

Market Share NB/AIO, information how big the company is on the market and which volumes that could be available in a potential collaboration. Also shows if there exists a focus on certain devices.

Supplier base for NB/AIO touch, current suppliers of touch solutions for both notebook and AIO and which touch technology that is offered. This measure shows the existing competitors to FlatFrog and which technology they are using. Reveal the opportunity to assess if there is a need for FlatFrog's solution as many competitors offer projected capacitive panels which struggles with yield in the production for larger screens sizes.

Tier one supplier for OEMs, i.e. which brand customer in terms of OEM is possible to reach.

Existing relations and joint ventures, as vertical integration is an increasing trend among ODMs this is an important factor to consider. Tells which capabilities a potential partner possesses, especially joint ventures and collaborations focusing on touch and displays.

4.5 Company studies

The cases of Arm and Qualcomm are used as a case study to exemplify companies which have succeeded in entering a highly innovative market with a license model. The purpose is to find critical success factors and key characteristic for applying such model.

4.5.1 The ARM Case

The following chapter will refer to MarketLine (2012), unless otherwise stated. ARM is one of the leading examples when it comes to using a licensing model and maintains strong IP in a strong competitive environment. They are a designer of microprocessors for the electronic market and have by their unique business model achieved commercial success and are one of the leading companies on their market. The basic behind the licensing model is that it enables ARM to provide the customer with their product without actually own any material or production facilities and instead provide the license to a third-party manufacturing company.

Technology Background

A processor is the brain in electronic systems, where it receives data from a subsystem in the electronic system, manipulate the data and then sending it forward to another subsystem. The processor use algorithms to perform the instructions, which are manually programmed.

There are two types of processor technologies; Complex Instruction Set Computing (CISC) and Reduced Instruction Set Computing (RISC). CISC is an advanced design with a wide range of instructions and have a complex architecture of different algorithms. An example of a CISC processor is the Intel Pentium. The RISC technology has a simpler design and will offer smaller number of instruction with less complexity. Examples of RISC technology are ARM design processors.

The benefits to use RISC technology are the low power consumption and geometric design compared to CISC technology. But the technical power will be lower with the RISC technology. Hence, the RISC is the processor ideal for products that are battery driven and requires physical small devices. Compare to CISC technology, which are more suitable for larger product with power supply and need more technical features for example PC desktops market.

ARM Business Model

The business model behind ARM success is the effective development of a license model, see figure 18. In the beginning ARM was a small company with great microprocessor technology and limited financials (ARM, 2010). With these limited

circumstances and in a low margin market, a different business model became the key to success when entering the microprocessors business.

The characteristics with the business model are the revenue streams and the lack of product ownership for ARM. Royalties and license fee are the two main revenue streams in the business model, which are the green arrows in figure 18. In 2010, royalty and license fee stood for 54 % respectively 33 %of the total revenue. To get access to the processor design the microprocessor manufacture pays an upfront license fee to ARM. Afterwards they are obligated to pay a fixed fee per produced microprocessor with ARM´s architecture. ARM´s royalty is relatively small, but the amount of products and long-term production will generate important revenue. Further, ARM dedicates the two major revenues to specific parts in the organization; the license fee is dedicated to research and development and the royalty incentivizes ARM to work with customers and build the ecosystem (ARM, 2010). The transfer of ownership to the license receiver creates a win-win situation for both ARM and license receiver. ARM will not have any developing expenses for manufacturing and the license receiver do not need any research and development cost for the microprocessor.

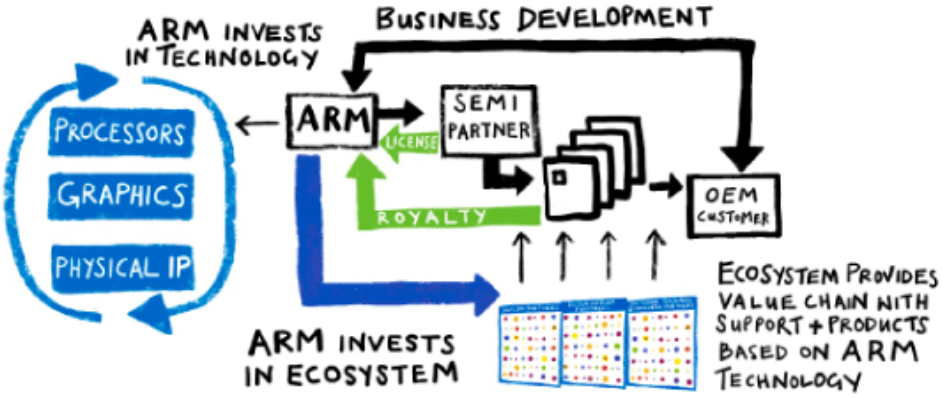


Figure 18, ARM business model

The investment in technology for ARM is vital to stay competitive because the lack of manufacturing facilities in the own organization. As ARM just provides the IP to the license receiver and if one generation lacks required level of innovation the customers will in the end stop trading with ARM. To get closer to the end customer, ARM has a business development relation with the end-customer, i.e. OEM´s, to gain knowledge of the drivers in the end market. With the investments in the ecosystem ARM tries to achieve supply chain enablement. If they see a potential market for microprocessors, there objective of the investments will be to

push the development forward and then taking market shares in the new market. The license model is a flexible business approach and creates an advantage for ARM because they can relatively easy change direction of their business. Lastly it will be important to consider the appropriate of the product since not every product may be suitable with this type of license model;

"It might be that some technologies or markets are more conducive and likely to succeed with this type of organization than other. For example, it is hard to see how Airbus 380 could have been build and coordinated in an open innovation system like that of ARM´s." (Andersen, 2012)

Market Shares and New Markets for ARM

ARM´s focus is to develop low power driven and advanced microprocessor for the commercial electronic market. Because of the technical advantage the processor have become a standard with 86 % market share of the mobile computing device markets. Further, ARM is strong dependent of the mobile computing market. Until 2011/2012 ARM have experienced fairly low competitive in this market. Recently, when Intel starts their development of Atom processor, the electric consumer market is changing and the old boundaries are blurred by the convergence, all microprocessors manufactures will drive towards each other. As consumer needs tend to ask for a more all-in-one solution when it comes to smartphones, tablets and even notebook, the competition is constantly increasing. As the mobile market still will be the key end market for ARM, much because of their high market share, they need to develop new business areas and find synergies in other markets to keep the company growing.

4.5.2 The Qualcomm Case

Qualcomm is a global semiconductor company with high innovation focus who design and manufacture products and services in the digital wireless telecommunication industry (Qualcomm Incorporated, 2012). With more than 25 years of experience Qualcomm is today on of the markets leading companies and act in the edge of innovation for next-generation mobile technology (Qualcomm Incorporated, 2012).

Business Model

The development of today's business model started when Qualcomm tried to enter the wireless market (Qualcomm Incorporated, 2012). A market which was dominated by a few major players offered little room for a small innovation-focused company. Instead of focusing on the vertical business segment, Qualcomm used a horizontal business model to enter the market. The new business model

enabled an easier market entrance and created a satisfactory environment for innovation (Qualcomm Incorporated, 2012).

Qualcomm horizontal business model, see figure 19, are based on two main activities; non-product ownership and strong commitment to R&D (Qualcomm Incorporated, 2012). With the R&D focus Qualcomm has enable new technologies for the mobile market and allows partners to focus on their core competence (Qualcomm Incorporated, 2012). The continually innovation has over the years generated in a strong patent portfolio.

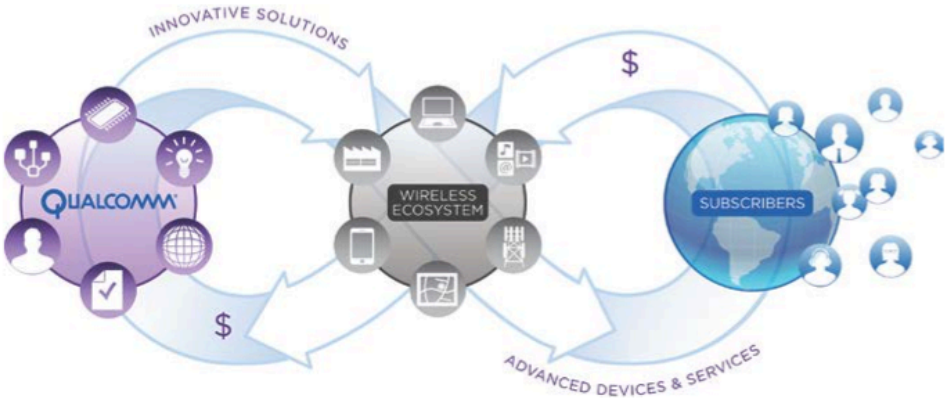


Figure 19, Qualcomm business model

To create non-product ownership Qualcomm needs to provide their technical solution to the market by selling licenses of the portfolio to partners in the supply chain (Qualcomm Incorporated, 2012). In the beginning Qualcomm was cash-strapped and needed a new way of commercialize their products to customers. The licensing model enables other manufacturing companies' to get access to Qualcomm´s patent portfolio and thereby get access to new technologies and Qualcomm avoid extensive investments in CAPEX (Qualcomm Incorporated, 2012). In the extension, Qualcomm eliminates barriers for new companies entering the market, as they offer a solution where new ventures does not need to spend a fortune in OPEX in terms of R&D expenses (Qualcomm Incorporated, 2012). Further, benefits that manufacturers see in Qualcomm includes the acceleration of development cycle for their new products, continuously development of products, faster time-to-market and differentiated offerings to the market (Qualcomm Incorporated, 2012).

How Qualcomm Creates Value

If Qualcomm wants to stay competitive it is essential to continuous increase the value in their product portfolio. With an expressed strategy of taking on challenges

other see as impossible, Qualcomm continues to provide the wireless mobile market with new technologies (Qualcomm Incorporated, 2012).

Qualcomm has made large investment in their R&D and has from its start spent more than $20 billion in their program until the beginning of 2012 (Qualcomm Incorporated, 2012). Only during 2011 investment of nearly $3 billion were made, an amount which corresponded to 20 % of the annual revenue (Qualcomm Incorporated, 2012). Simultaneously as the IP value has grown extensively, Qualcomm have succeeded to not increase the standard royalty rate (Qualcomm Incorporated, 2012). Figure 19 shows how Qualcomm pushes innovations into the eco-system of mobile wireless technology market.

Qualcomm has affected the whole market of mobile wireless market with their business model. Instead of searching for vertical integration with partners in the downstream supply chain this open the market for more players to enable technologies and for themselves to reach multiple customers (Qualcomm Incorporated, 2012). The vertical integration requires large investment and the choice of partner will be limited according to the financial constraints or company resources (Qualcomm Incorporated, 2012). The enablement of technologies encourages both small and larger companies to push their innovation of new products with support from Qualcomm licenses (Qualcomm Incorporated, 2012).

Matching innovations with market needs is a key factor to succeed for an innovation company and Qualcomm made it with success (Qualcomm Incorporated, 2012). Therefore, is it important to identify costumer needs on future generation of products. Use technologies in right way, take advantages from experience in other projects and seize opportunities when they appear is crucial for success. See wider then original market and finding solution of problem in other areas with their technology are further aspects which Qualcomm considers in order to stay competitive and perform at the leading edge of their business (Qualcomm Incorporated, 2012).

As customers and the number of external interfaces increases Qualcomm has realized the importance of aligning activities towards future visions and objectives. A comprehensive roadmap has been developed to convince customer of the direction of the company and align the broad product portfolio to continue create future competitive advantages against competitors (Qualcomm Incorporated, 2012).

5. Analysis

In this chapter, the collected data and information in the empiric chapter will be analyzed with basis in the theoretical framework. Two business models and related supply chain set will be considered, starting with the license model followed by a product ownership model. Both alternatives will be analyzed through the same procedure consisting of both qualitative and quantitative methods. First, a description and mapping of the supply chain will be performed followed by an analysis of more qualitative aspect by a SWOT, Porter´s five forces and a relationship analysis. The second part will contain an analysis of more quantitative character considering cost and margin connected to the specific model.

5.1 Choice of Analyzed Models

Since a large number of different supply chain set ups and business model could be applied in this case, a selection of which to be included in the analysis has to be made. The following two alternatives have been chosen for further investigation and analysis.

- *OEM licensing* — FlatFrog is selling the license to an OEM which outsources production to a third party manufacturer.
- *Product ownership* — FlatFrog takes full product ownership but outsources production on a manufacturing partner. This will be followed by the influence of introducing the concept of reverse consignment.

Of course, there exist several additional models and intermediate stages of the chosen two. Not all alternatives could be included in this thesis. The selection has mainly been based on which models that has been most realizable to implement. This has been performed via discussions with employees at FlatFrog related to which models they think of as most feasible. For example, one option which could be theoretical achievable is to sell the license straight to a manufacturing partner i.e. an ODM. But, due to the characteristic of the market and its supply chain, this would probably not feasible in the reality. It is the OEM which dictates the market and creates the pull in the pipeline, without OEM commitment FlatFrog would have struggled to even enter the market. Further options that are down-prioritized are the alternative to be acquired of a larger actor (i.e. be vertical integrated) and if FlatFrog would own the production facilities.

5.2 OEM Licensing Model

FlatFrog's potential supply chain set up in a license model is illustrated in figure 20. The basic idea behind the model is that the license of the touch module is sold

to an OEM. The OEM outsources the production to a third party manufacturer which performs the production of the touch module and the PC. The manufacturer takes full product ownership and handles all physical flows including sourcing and distribution.

In such model the role of FlatFrog could actually be described as outside the supply chain when just considering the flow of goods and material. The interfaces in the licensing model will instead just consider financial and information flows. The model is based on that FlatFrog will not, at any time, own any material. FlatFrog provide the semiconductor vendor with specification of the Scan IC and the OEM with the touch module specification. The sourcing of commodity components is performed by manufacturing partner according to the recommendation of FlatFrog when the project has gone into production. The revenue stream consists of the royalty per sold unit from the OEM.

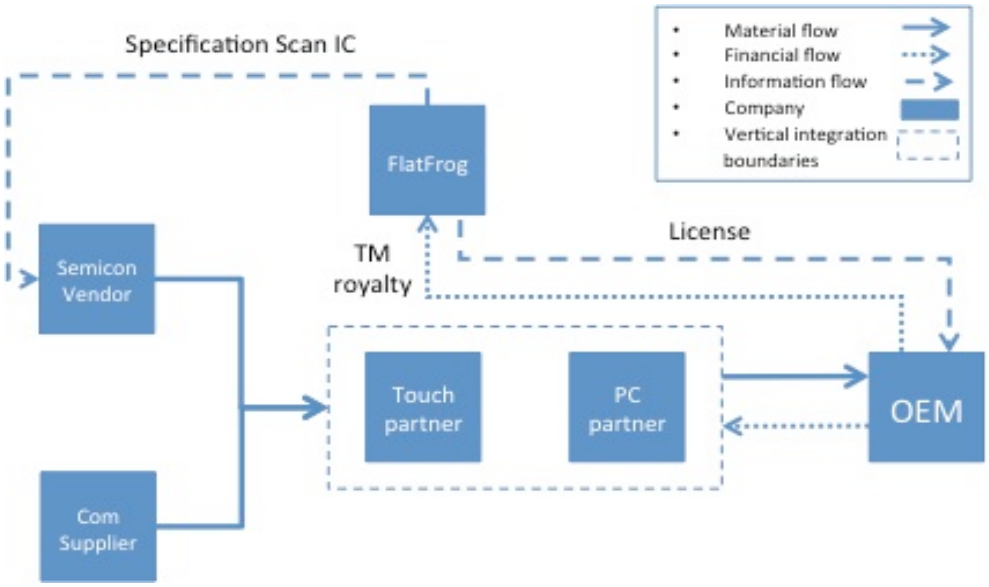


Figure 20, Supply chain map license model with ODM as manufacturing partner

To make a generic evaluation and comparison of different business models connected to different supply chain setups, a uniform way of defining and comparing different models must be applied. By summarizing the theoretical framework and considering business models in chapter 3, the criteria listed below were determined to be of most value:

- *Identification of customer*
- *Identification of value creation*

- *Identification of revenue stream/how to make money*
- *Key Resources*
- *Key Processes*
- *Key Relationships*
- *Business model versus Strategy*
- *Suitable for company maturity phase*

The different criteria found for the current situation are stated and described in table 4. Some of the aspects may be the same for all analyzed models as they are related to the benefits of FlatFrog's technology.

Table 4, License model definition

Criteria	Description
Identification of customer	The primary customer is the OEM brand actor which procures the licenses of the FlatFrog touch module and provides a manufacturing partner with a third part license.
Identification of value creation	The value created for the customer is primarily a reference design based on a larger amount of standardized components, which means a lower cost in the bill of materials. Secondarily, the manufacturing process for the technology, due to larger amount of standardized components, enables a higher production yield.
Identification of revenue stream	The revenue stream is the royalty per sold touch module from the OEM.
Key Resources	Since the cases of ARM and Qualcomm have proven that this kind

	of business model requires a high innovation speed, the R&D resources FlatFrog possess must be seen as key resources.
Key Processes	Increase number of customers/interfaces to create multiple revenue streams.
Key Relationships	The OEM brand customer relationship, even if no extensive amount of resources should be allocated, there must exist an exchange of requirements and sense of the market such as forecast and customer feedback.
Business model versus Strategy	The business model is defined as selling a license of the touch module to OEM brand customer. The strategy is defined as competing with a touch module which primarily offers a lower cost.
Suitable for company maturity phase	Low risk when entering market in terms of little capex needed. Could be hard to maintain margins in later stages as price erosion increases.

5.2.1 SWOT - Analysis

In this part a SWOT-analysis will be performed with focus on internal strength and weaknesses respectively external opportunities and threats with a license model. To put this into context, the analysis will later be compared to a SWOT-analysis performed on a model based on product ownership. An overview of the analysis for OEM licensing is presented in figure 21.

Figure 21, SWOT - analysis license model

Strengths

A licensing model offers a fast, low-risk entrance to the market due to its highly flexible character. First, the time to market is significantly shorter, since no production facility or machinery has to be bought or built. This equates to a lower risk in terms of less need of initial capital expenditure (CAPEX) and the time to ROI, for FlatFrog and the license customer, will be shorter. Further, no establishment of supply and distribution channels is needed, since this is handled by the license customer. In the long term view, this will also keep the operating expenditures (OPEX) at a lower level, due to less employee and maintenance cost. Also, the interface with the OEM implies a close connection to the end customer in the supply chain which gives a valuable sense of fluctuations in the market.

The model further implies avoidance of product ownership for FlatFrog, a factor which means lower risk, since responsibility for material is taken by the manufacturing partner and the OEMs. Usually, the manufacturing partner takes the product ownership until the product is delivered to the OEM. In some cases,

however, the OEM could take early ownership of strategic components or material, i.e. reverse consignment, to secure supply and increase the upstream visibility.

Licensing their product to an OEM customer locates FlatFrog in a downstream position in the supply chain. This entails two main benefits: the avoidance of margin stacking and the second is the close distance to the end customer. Since the position is in the end of the supply chain, almost no actor will add their margin to FlatFrog´s offer, which gives a better control of their cost and enables a lower BOM cost. Having a close distance to the customer eases the process of forecasting and sensing fluctuations of the end customer need. Further, it reduces the bullwhip effect whose amplitudes increase the further upstream position of the company.

Weaknesses

Many of the strengths of a licensing model are most evident in the initial stages of a market entrance, and the main weaknesses appear as the market matures and competition increases. The major weakness with the model is the loss of control which leads to the business could be hard to defend. That is to say the knowledge of the BOM cost will be known by the customers and starts to question which contribution FlatFrog makes to the end product. The customer is responsible for sourcing the material and will soon figure out which margin FlatFrog intend to have on their offer. Once the product is licensed, the profit of FlatFrog is dependent on the sales from the OEM as the license agreement is based on royalties per sold units and no larger license fee. There is little room to effect which products the OEM will campaign and put most marketing resources on.

From the case studies of ARM and Qualcomm, it is concluded that to stay successful with a license model in such competitive front-edge environment, mainly one aspect is essential. Because the ease of being substituted due to the lack of a physical offer, one must stay at the innovative edge to develop new generations of technology which outperform the former. This is explicitly important when acting in an environment where time-to-market and the product cycles are short. The customer is going to require improvement or change after some experience with the first generation. If FlatFrog cannot offer improved future generations, customers will get unsatisfied and start using other alternatives. Hence, the risk of being comfortable, due to success in the initial stages, is considered a potential weakness.

To reach a multiple-customer effect FlatFrog must provide a reference design which could easily be adopted by the customer. The weakness lies in the initial stages and to gain confidence among the customers without revealing too much IP. This situation could be compared to the fundamental paradox formulated by

Kenneth Arrow. To avoid this situation, it is important with protection in terms of patents. However, even with comprehensive patent protection, this initial issue is considered a trust issue, as one never could be sure of the counterpart's incentives.

Opportunities

The main opportunity with the current model is the possibility of obtaining multiple revenue streams with limited resources. Since the logic behind a license model is to sell IP without performing any kind of manufacturing and existing demand of a profitable touch solution from the customers, this is an opportunity for FlatFrog. A potential model is illustrated in figure 22, where FlatFrog provide a large number of OEM with license of the touch product which creates multiple revenue streams. The interfaces with the manufacturing partner require fairly small resources in line production phase. The main efforts are spent in the beginning when ramp up and support in the initial production are required. However, this opportunity is based on a manufacturing partner who continuously supplies several OEMs in order to receive frequent revenue streams.

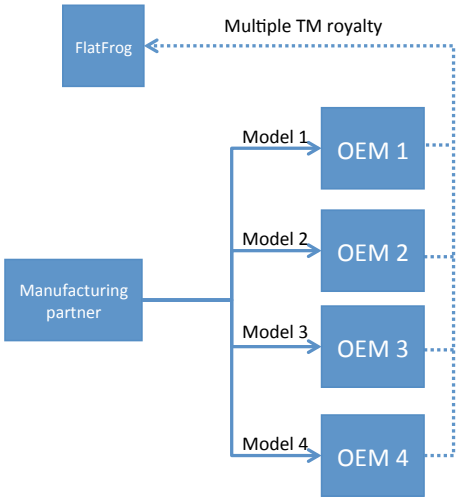


Figure 22, Multiple customer reach

Threats

As FlatFrog not are selling a physical product and rather providing their customers with IP, cost reductions could mainly be done by improved design. Customer will sooner or later request price reductions. When not having any production or purchasing activities to spread these reductions on, this will hit the profit margin.

A further threat with the current model is the IP protection. Since a third part partner will perform the manufacturing, there is lack of control in which way the third party exploits the technology of FlatFrog. Even if the patent protection is comprehensive, it still poses a threat.

5.2.2 Porter´s Five Forces

Porter´s five forces is a model that analyzes the attractiveness of entering a certain market. Since the market in this case is the same, the analysis will be done considering entering the market with different business model and supply chain setups. This will imply the analysis in the way that some aspects will remain the same for different alternatives due to aspects connected to the PSD technology.

The Threat of Entry

Since existing touch solutions on the market cannot offer satisfying yield in production, especially for larger screens, the OEM are screaming after a technology which could quickly offer profitable yields. The release of windows 8 has pushed the usage of touch into PCs, but the fact that Windows 8 has not met expectations, is partly due to the reason that PC with touch are too expensive and cannot attract consumers. Almost all actors in the PC supply chain acts on the OEM interest. The OEMs creates a pull in the upstream supply chain and prefer certain companies as suppliers. Selling the license to an OEM will create a pull after FlatFrog's touch module in the upstream supply pipeline. This factor will both lower the threat of entry and make the time to market faster due to a stronger request for the FlatFrog touch module.

An OEM license business model allows FlatFrog to use the already established supply and distribution channels of the OEM customer which are further factors that lower the threat of entry. This allows FlatFrog to have a slim organization, focusing on its core processes and preparing the product design for scale production. Further advantages are the OEM's experience of the market and ability to handle larger scale production, which are valuable competencies in the ramp-up process.

The Threat of Substitute

There is a constant threat of being substituted by competitors, since very small changes in machinery are required from the manufacturer. Touch is a relatively new feature in PCs and there are a large number of smaller, R&D-focused firms which take every chance available to reach success. The threat of substitutes exists and is constantly increasing as the technique develops.

Further, both Intel and the OEMs have a wide coverage of existing technologies and, of course, not a sole focus on FlatFrog. The race between different touch suppliers is becoming obvious and it increases the threat of being substituted as the number of competitors is improving their costs and yields in manufacturing.

The Power of Buyers

The PC market is a buyer's market. The OEMs choice which partners they want to work with and use multiple sourcing to spread out production risk and secure supply. Selling the touch module license to the OEM means a good way to create an interest for the PSD technology. Hence, it is important to keep them pleased. If the OEMs not are satisfied with FlatFrog they will not be hesitant to change and the manufacturing partners will act accordingly.

The power of the OEM can on the contrary be used as an advantage. Since the manufacturing partner and OEM are negotiating prices in volume production, they have as larger actors stronger purchasing power in negotiating than FlatFrog would have on their own.

The Power of Supplier

The licensing model allows avoidance of product ownership for FlatFrog and no actual interface with the suppliers in production phase. From the manufacturing partner's point of view, there is no instant supplier threat due to the fact that FlatFrog´s technology consists of a high amount standardized components which are off-the-shelf products and could easily be replaced.

The Competitive Rivalry

Even if the competitive rivalry is comprehensive, with many companies offering different kind of touch modules with TPK as the superior market leader, their success rates are limited. The industry of touch is going to meet a huge growth the next coming years, and the need of a superior touch solution is obvious, mainly in terms of cost but also performance to meet requirements of new operating systems. But, the competitors are continuously improving, and the yield rates are getting higher and FlatFrog´s window of opportunity will get smaller as competitors cost are improving. The main short term objective for FlatFrog is to catch this window

of opportunity and make a fast market entrance, objectives which are benefited by a licensing model.

Further, the exit barrier with a licensing model, if failing to get in to the consumer electronics market, is not that high. FlatFrog could aim for the vertical segment, i.e. screens in various sizes for applications in the education sector or automotive industry, segments with lower volumes but greater margins, without complications such as unutilized production facilities and machinery.

5.2.3 Alternative Partner Selection

In the choice of manufacturing partner there exist an alternative to approach a company one step earlier in the supply chain as illustrated in figure 23. This company would only perform the manufacturing and assembly of the actual touch module. Such partner would mean a more objective touch module supplier which could deliver to several PC partners (generally an ODM). Then, more customers could be reached with same resources as with a manufacturing partner who performs the production of both the touch and the PC. The major disadvantages are the increase margin stacking since an additional actor will add their margin to the touch module.

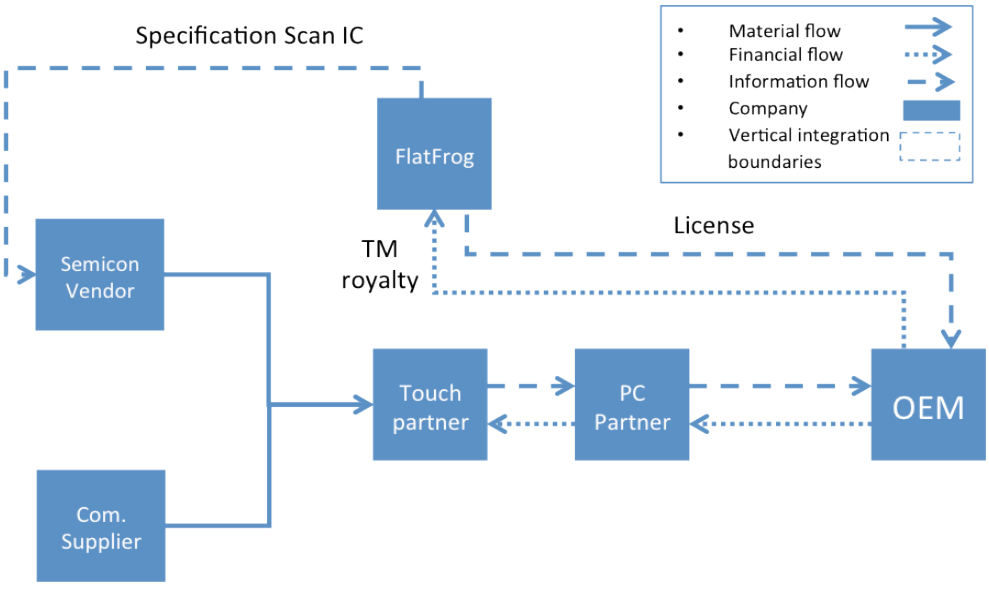


Figure 23, Supply chain map license with TMI as manufacturing partner

5.2.4 Relationships

The major relationship in the current supply chain set up is the interface with the OEM. It is considered as of great importance due to future roadmaps, information exchange related to market knowledge and forecasts. Further, the OEM ability to create a pull in the supply chain is vital for FlatFrog. These relationships could be of different nature dependent on the development stage of the relation. This analysis will be based on Gadde and Håkansson relationship matrix concerning involvement and continuity. In the pre-relationship stage the relation is defined as complex, especially in the situation where FlatFrog still is new on the market and the OEMs may want to perform comprehensive audits before initiate a relationship. As the relation evolves through the exploratory and development stage the relation still requires some involvement from both parts to align needs and specifications as well as coordination with the manufacturing partner. The latter aspect creates another dimension of complexity in the initial stage of the relationship in terms of a third party interface and interest.

Once it has reached the stable stage the relation is redefined as a "simple" relationship, which is illustrated in figure 24. This is the objective of the license model, to create as many relationships as possibly with high continuity and low involvement from FlatFrog and generate a situation where not being dependent on single customers. Hence, the purpose with every relationship in this model must be to reach the stable stage as fast as possible. The easier adoptable FlatFrog's reference design will be, the faster this stage will be obtained.

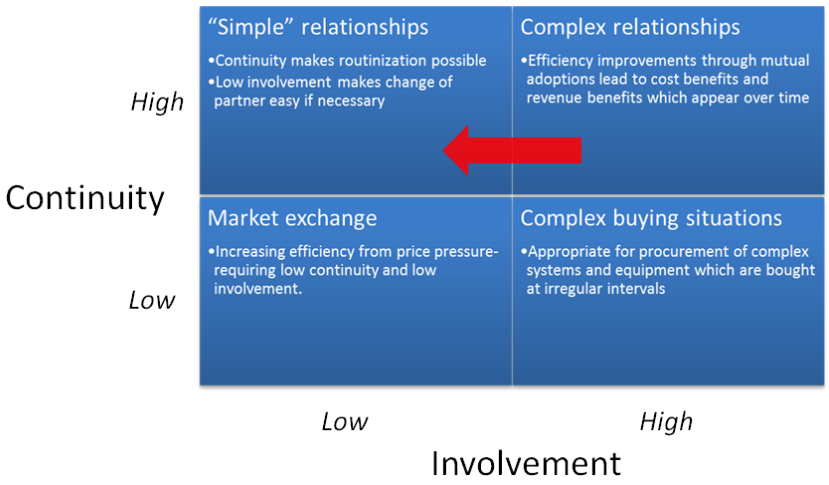


Figure 24, Relationship matrix license model

However, it exist situations where the relationship still remains complex. If the OEM wants customization or updates of the design, FlatFrog could require NRE to perform these updates. The NRE will justify and provide profitability of the higher involvement from FlatFrog. Such model will result in a complex relation where efficiency and cost improvements jointly could be achieved.

The second relationship is with the manufacturing partner. This relationship is expected to require some resources in the initial phase during ramp up and in terms of initial production support and adjustments. The logic behind the license model is reaching multiple revenue streams but still maintain a small organization. Hence, this relation should as soon as possible turn into a simple character.

5.2.5 Quantitative Analysis

Bill of Material Analysis

In the quantitative analysis, a fictive Bill of Material (BOM) has been developed to illustrate how the models and connected margin stacking will affect the touch module price to the OEM. The BOM for selling the license to an OEM is illustrated in table 5. The material cost is divided into three areas: compulsory, recommended and standardized components. A classification which is based on the FlatFrog way of dividing components, described in *4.4.1 Project PC*. The profit of FlatFrog, in terms of the license fee per sold unit, is added followed by the margins of the manufacturing partner. The margin consists of a 10 % manufacturing cost and a 5 % profit margin, numbers which are assumptions and just used in this analysis. These margins will be added on the total component BOM and not on the license royalty, a fee which theoretically does not affect the manufacturing partner. The output is the touch module price to the OEM which ends up in 75.5 USD.

Table 5, BOM analysis license model with ODM manufacturing partner

Standardized Components	**Price**	
A		7.00
B		21.00
C		14.00
Tot		**42.00**
Recommended Components		
D		7.20
E		4.80
Tot		**12.00**
Compulsory Components		
F		6.00
Tot		**6.00**
Total Component BOM Touch Module		**60.00**
FF Profit		
License		**6.50**
Touch Partner Margins		
Profit %	5 %	3,00
Manufacturing Cost %	10 %	6.00
Tot		**9.00**
OEM Touch Module Price		**75.5**

As described earlier, one of the main advantages of this model is the avoidance of margin stacking. The license is sold to a late-positioned customer in the supply chain and no other actor will add their margin to the royalty. This results in a low total cost for the OEM, given the structure of the industry. However, it will also imply some complications when customers require cost reductions. When customers request a lower cost, FlatFrog may have to reduce their margin to maintain attractiveness. Other cost reductive areas such as purchasing and production are performed by the manufacturing partner and they will probably not share potential savings with FlatFrog. As other actors in the supply chain could more easily achieve cost reductions, this puts pressure on FlatFrog who may be forced to reduce the royalty.

Earlier, the alternative to use a manufacturing partner positioned one step earlier in the supply chain was suggested. A touch partner will produce the touch module which then is procured by an ODM. The ODM will offer the touch module as a part of a one-stop-shop solution to the OEM. It will result in just one interface for both FlatFrog and the OEM, but generate increased margin stacking. The OEM will pay a higher price for a turnkey touch solution since the ODM will add some profit margin on top of the touch module price. This will imply some changes in the BOM due to the additional margin stacking. The license fee of FlatFrog will remain the same. Likewise, the margins of the touch partner will remain as their contribution is the same as before. The change consists of the margin added by the ODM, consisting of a 2 % profit for offering a complete touch solution to the OEM. No manufacturing margins will be added since no such activities will be performed by the ODM and the touch module is invoiced separately from the PC.

As seen in table 6 this setup entails an increase in OEM price with 1.4 USD per unit. The higher price corresponds to the additional value the OEM enjoys for a turnkey touch module solution.

Table 6, BOM analysis license model with TMI manufacturing partner

Standardized Components		Price
A		7.00
B		21.00
C		14.00
Tot		**42.00**
Recommended Components		
D		7.20
E		4.80
Tot		**12.00**
Compulsory Components		
F		6.00
Tot		**6.00**
Total Component BOM Touch Module		**60.00**
FF Profit		
License		**6.50**
Touch Partner Margins		
Profit %	5 %	3.00
Manufacturing Cost %	10 %	6.00
Tot		**9.00**
ODM Margins		
Profit %	2 %	1.38
Manufacturing Cost %	0 %	0.00
Tot		**1.38**
OEM Touch Module Price		**76.9**

Further, this kind of BOM analysis usually is performed in an initial stage before large-scale production. Production prices are very likely to be adjusted over time according to production optimizations and increasing yield. However, the main benefits with a license model are hard to realize with this kind of analysis. Most of all it means a low risk due to the avoidance of material investment. The cost of goods sold will almost be negligible which makes the time to reach profitability significantly shorter.

The main disadvantage is the low cost of goods sold which avoids the cost erosion to be spread out on purchasing or production activities. It could be mitigated by

better design in terms of cheaper or fewer components but the rest of the erosion will hit the profit margin. Hence, a company with a licensing model is very dependent on R&D to develop future attractive generations or new products.

5.3 Product Ownership

The model considered in this chapter entails FlatFrog as a product owner. This setup requires a manufacturing partner which produces the touch module according to FlatFrog´s specifications, but will not take product ownership in the process. The partner could be of different nature and possess different characteristics. It could either be a R&D focused partner with a highly valued IP portfolio which contributes to FlatFrog´s R&D within their area of expertise. The other alternative is a low margin EMS or contract manufacturer with high manufacturing focus, little IP and little value adding.

From a FlatFrog point of view this model will require a larger organization and an increased number of external interfaces since activities as sourcing and distribution could be performed in-house. The supply chain is illustrated in figure 25 and position FlatFrog in the actual supply chain in a more traditional setup with inventory speculation describing the transfer of ownership. FlatFrog will be responsible for source, negotiate and procure components and material. The specifications of the Scan IC will still be sent to the semiconductor vendor, which are responsible for arranging the production of the ASSP. Last, the finished touch module is sold to an ODM which integrates it into a PC device which is further delivered to the OEM.

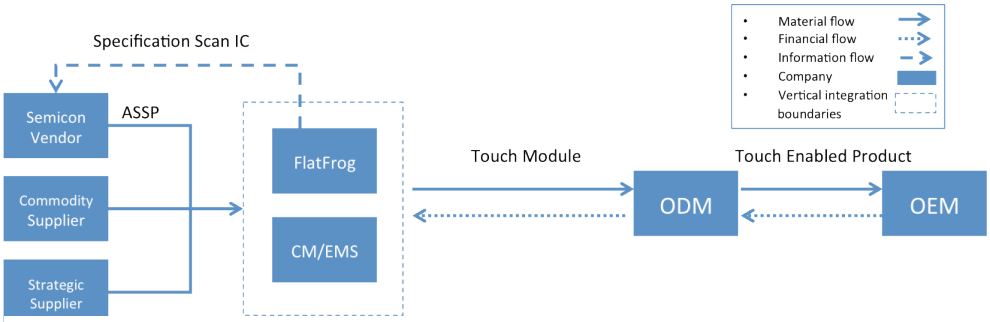


Figure 25, Supply chain map product ownership

In table 7, the characteristics of the product ownership business model is defined according to relevant theory.

Table 7, Product ownership model definition

Criteria	Description
Identification of customer	FlatFrog will act as a touch module provider serving their customer with a turnkey touch solution and the customer could both be an ODM or an OEM, dependent on the strategy of the OEM.
Identification of value creation	The value created for the customer is primarily a touch module based on a larger amount of standardized components which means a lower cost for the customer. Secondly, FlatFrog could continue to market the FF brand as a superior touch solution with highly competitive performance.
Identification of revenue stream/how to make money	The revenue stream consists of the profit per sold touch module.
Key Resources	To stay competitive in a front edge market with short time to market and the product cycles, R&D are essential.
Key Processes	Supply chain performance such as purchasing and manufacturing processes which maintain a low cost offered to the customer.
Key Relationships	The relation with the manufacturing partner is essential to improve quality and cost in production.

Business model versus Strategy	The business model is to produce and retail a FlatFrog branded touch module. The strategy is defined as competing with a touch module which primarily offers a lower cost and superior performance.
Suitable for company maturity phase	Higher risk when entering the market due to product and material ownership. Major advantages could be enjoyed in later phases with greater control over supply chain, downstream visibility and a solid customer offer.

5.3.1 SWOT - Analysis

A summary of the SWOT-analysis performed on the product ownership model is presented in figure 26.

Figure 26, SWOT - analysis product ownership

Strength

The main strength is taking full product ownership of the touch module. By doing so, FlatFrog increases the control of all the flows in the supply chain. If FlatFrog is also responsible for sourcing and distribution, it will result in greater visibility and control which eases the processes of forecasting and planning.

The IP protection is considered to be safer as a product owner. A pure touch module assembling partner does not need, and would probably not have any interest, to possess deeper knowledge behind the PSD technology. The number of external interfaces will decrease which also benefits the protection of IP. As an actual supplier of a physical touch module, no specifications or BOM has to be sent out to FlatFrog´s customers. With less exposure it is harder for the customer to make a cost breakdown and question FlatFrog´s prices.

Lastly, the supply chain setup will be constructed in a more traditional way and the transfer of ownership will be performed by inventory speculation, except the possible alternative of reverse consignment. The customers will be offered a touch module in the way they are used to; a single interface will deliver the module which eases coordination and communication in the supply chain. FlatFrog´s offer will be easier to understand and the revenue streams easier to control and overview.

Weakness

The main weakness with a product ownership model is the initial lack of reliability. FlatFrog is a new and none-established company on the market and with lack of reference products on the new market to prove their credibility. It could be a real challenge to convince low risk players on the PC market to take the initially risk of supply from an inexperienced partner without evidence of success in terms of products on the market.

Furthermore, product ownership means a financially higher risk since at least some of the material has to be procured and owned by FlatFrog during the process. Of course this leads to higher requirements on the organization and a higher OPEX is required due to increased external interfaces and a larger organization. In comparison to selling just a license, FlatFrog are now responsible for the manufacturing and problems in production as well as customer support. Due to the ownership of material the cost of goods sold will be significantly higher. It leads to a longer time to return of investment and an increased financial risk.

Lastly, the position in the supply chain will partly be further away from the end customer, as the touch module could be sold to both ODMs and OEMs. Even if sales processes will still be aimed towards OEMs, this will probably be more

extensive and resource demanding. Another factor to consider is the bullwhip effect. The further down in the supply chain a company positions itself, the higher the amplitudes of bad communication can be.

Opportunity

As product owner FlatFrog has a great opportunity to exploit the FlatFrog brand as a superior touch solution. A well-known brand could give an extra dimension in the request of FlatFrog´s technology which will give an additional competitive advantage in terms of a brand which offers a great performance.

The technical challenges PCT experiences in manufacturing open a window of opportunity for FlatFrog. Succeeding to catch this window and enter the market with a lower cost alternative will reveal opportunities of great volumes and beneficial margins. Comparing to current market leader TPK, who owns their product, and has a gross margin of 17% which indicates FlatFrog´s opportunities with such business model.

Threat

The main threat in a product owner model is the fact that FlatFrog may be considered the weakest link in the supply chain as a new and inexperienced actor. This will lead to a skewed power relationship with their partners, where FlatFrog may be influenced in a direction which would not be beneficial. For example, as a new company on the market, they will not possess the same purchasing power as large multinational company with long experience of the industry. The threat of being overpowered in negotiations with customers is a substantial threat which could decrease the margin. It could be compared to Apple, which totally dominates their supply chain and overpowers their suppliers to get heavy discounts.

5.3.2 Porter´s Five Forces

The Threat of Entry

Entering the market using a business model based on product ownership implies a greater threat of entry and higher barriers in comparison to an entrance with a licensing model. The first reason is the fact that an initially higher investment is required in terms of raw material. Further, even if FlatFrog is not likely to own any factories in the initial stage, NRE to initially support the contract manufacturer may be required. Other factors which increase the barriers for entrance are the lack of established supply and distribution channels as well as the large number of external interfaces which must be established. These are factors which increase the threat of entry and are very resource demanding. Lastly, FlatFrog does not possess any

actual experience in large-scale production, which makes the initial obstacle of a market entrance even higher.

The Threat of Substitutes

As a vendor of a physical product FlatFrog will get a stronger commitment from customers when they tie up capital in ordered touch modules. This commitment decreases the threat of substitutes. Further, as an owner of the touch module FlatFrog possesses the ability to customize and test their offering in a higher grade which enables a more complex design offering than with a licensing model. This kind of extra industry efforts eases the way of reaching customer satisfaction and lowers the threat of substitutes.

The Power of Buyers

Because the position in the supply chain as a product owner is upstream, there will be a lot of pressure from a number of downstream buyers. Large actors in terms of ODMs and OEMs will be trying to negotiate FlatFrog´s prices, and with less negotiating power FlatFrog may be considered the weakest link in the supply chain. Factors such as experience and limited capacity will be constraints for FlatFrog as it gives them less negotiation space with bigger actors.

The Power of Suppliers

As product owner FlatFrog will probably stand responsible for the sourcing of material. As a small actor it could be hard to get same prices as larger and more experienced competitors. This may result in a higher BOM-cost. Dependent on the character of the contract manufacturer, it could of course assist and add some purchasing power which would mitigate this risk. On the other hand, the manufacturer probably has limited interest in the BOM-cost since they probably will get paid per produced unit and will not directly be influenced of the material cost.

The Competitive Rivalry

The existing rivalry on the markets is increasing, but due to the growth rate of the touch feature and limited success of competitors, the effect on the competitive rivalry is estimated to be fairly low. Still, being the product owner adds the aspects of higher exit cost in terms of tied up capital in unused raw material or potential production equipment which means higher exit barriers. A contract with a manufacturer or ownership of some machinery makes it more costly for FlatFrog to aim for other types of devices or market segments due to tied up money in specific devices.

5.3.3 Mitigation Alternatives

Reverse consignment

This alternative entails the possibility of using the concept reverse consignment which will reduce the risk of owning material. Today, OEMs are already taking early ownership of critical components to secure supply and create upstream visibility. Persuading the OEM customer to take initial ownership of some supplies would not only benefit FlatFrog with less risk, but also the OEMs themselves in terms of less margin stacking. A potential supply chain setup applying reverse consignment is illustrated in figure 27.

Two of the major weaknesses in the product ownership model could be mitigated by this alternative. First, the initial financial risk could be reduced as the OEMs could take early ownership of most of or even all of the BOM cost. The reduction of risk enables the product ownership model to be used earlier in FlatFrog's maturity development due to less need of investment.

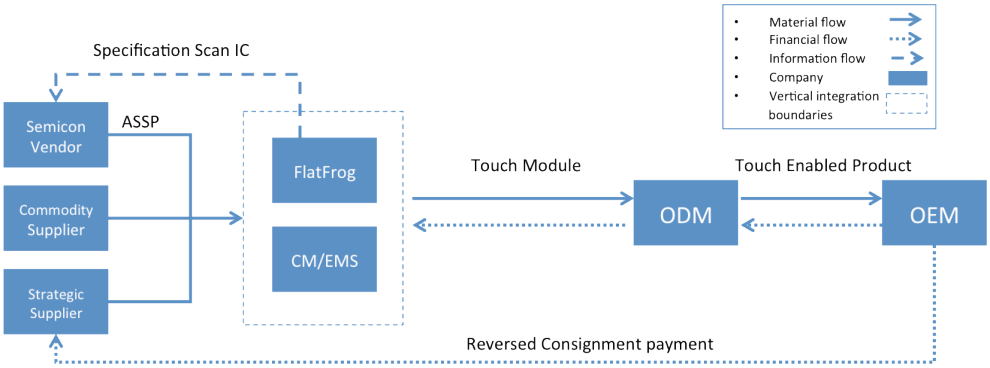


Figure 27, Supply chain map product ownership with reverse consignment

The second weakness which could be mitigated by reverse consignment is FlatFrog's limited experience of managing the supply chain for large scale, global production. With a major reduction of the share of the BOM to be owned, the material flow to handle will be substantially less. It further benefits the size of the FlatFrog organization which needs not be of equal size as in the case of ownership for the whole BOM.

5.3.4 Relationship Analysis

The major relationship in this model is with the manufacturer partner. The nature of this relationship is dependent on the characteristics of this partner. If the partner possesses a high level of IP the relationship should be of a closer, more strategic nature. The manufacturing partner could increase the value added by contribute to

R&D with its expertise within certain areas as well as with manufacturing excellence. In such case the relationship should be positioned in the upper right quadrant in the relationship matrix as a complex relation. Efficiency improvement could be gained over time as both parts doing mutual adoptions which could lead to both cost and performance improvements.

As it requires fairly large resources to maintain, feed and develop such relationships, the objective must be to keep the number of relations at the lowest level possible, and at the same time maximize the output. Hence, the choice of partner is essential. First, the partner must have enough capacity and experience to handle future forecasted volumes. Second, the partner must be a 1st tier ODM customer to avoid a number of margin stacking steps and additional costs for the end customer. Furthermore, existing OEM preferences are vital to create demand and request for FlatFrog's touch module in the supply pipeline.

Last, characteristics which are considered important for this kind of partner are:

- *High gross margin* – Indication of high value contribution from the partner.
- High R&D spending – Large R&D efforts which yield a highly valued IP portfolio, which could contribute to a future close collaboration.
- *Existing supplier for notebooks/AIO* – Due to the constrained market and the fact that few actors are willing to take a risk with unestablished suppliers; the partner should already deliver touch solutions to ODM and OEM customers.

The other alternative is to go for a low-cost, pure manufacturing partner. This kind of relationship would be of a more simple nature and is positioned in the upper left quadrant in the relationship matrix. This relationship is characterized by high continuity and a high level of routinization which requires low involvement from FlatFrog. Such relationships enable having many different production partners, which spreads out the supply risk. Other advantages of multi-sourcing include the ease of shifting percentage of production between suppliers and creating competitiveness between suppliers to enjoy additional cost reductions. Preferred partner characteristics are:

- *Low gross margin* – Indication of low margin, cost reduction and pure manufacturing focus.

- *Low R&D spend* – Small RD efforts which further indicate manufacturing focus and low value-adding activities which signal a low cost offering.

The characteristics of the different relationships are summarized in figure 28.

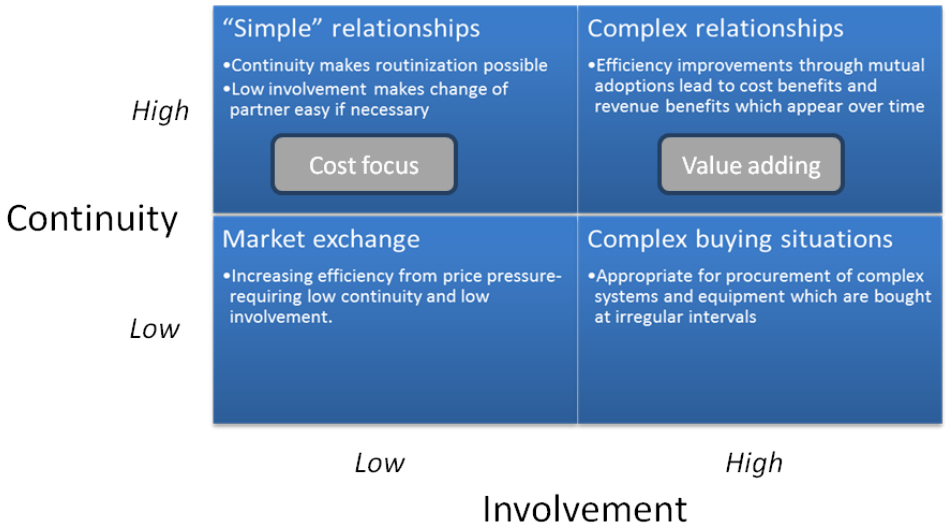


Figure 28, Relationship matrix product ownership

Finally, the last kind of relationship, which is of relevance to this model, is the connection to the OEMs. Since this means a further upstream position in the supply chain, FlatFrog´s distance to the end customer becomes essentially longer. Hence, the sense of the market via OEM connections is vital to create awareness of what is requested and creates a need for the FlatFrog offering. Although this interfaces does not consider any exchange of material or financial flow, and could not be positioned within the relationship matrix, they are still of highest importance.

5.3.5 Quantitative Analysis

Bill of Material Analysis

The BOM analysis for the product ownership model is based on the same BOM component cost for the touch module as before. However, as FlatFrog will be positioned in the actual supply chain, some margin stacking is added. First, in this business model FlatFrog must have a higher profit. The profit should cover expenses connected to the product ownership which not are included in the BOM. These expenses are related to a larger organization and responsibility for the product including cost for higher OPEX, warranties and claims. The profit is increased to 14 USD.

Second, the choice of manufacturing partner is based on the objective to find the lowest possible cost connected to this model. The partner is assumed to be a low-margin, high-volume actor which not will be owner of any material and is just performing the assembly of the touch module. Profit and manufacturing margins are set to 2 % and 5 %, respectively. Contingency with such assumption is that these margins will change over time according to production conditions being improved and negotiation progress.

The finished touch module is bought by the ODM and offered to the OEM as a turnkey touch solution. Hence, the ODM will add a profit margin of 2 %. To make a generic comparison in the BOM analysis, this margin must be added to receive the actual OEM touch module price. Last, FlatFrog receives their revenue from the ODM as a more traditional supply chain set up based on inventory speculation.

As seen in table 8, the OEM price for the touch module increases to 79.8 USD due to margin stacking. The increase means a respectively 4.3USD and 2.9 USD higher price compared to the two license models. Such difference could be a devastating factor in the initial fight of customers. It will further be even more substantial when PCT competitors improve their cost over time and competition increase. Even if the OEM touch module price increases with FlatFrog as a product owner, the main drawback is the increased financial risk and need of material investment. This will require further investments and a larger organization.

Table 8, BOM analysis product ownership

Standardized Components		Price
A		7.00
B		21.00
C		14.00
Tot		**42.00**
Recommended Components		
D		7.20
E		4.80
Tot		**12.00**
Compulsory Components		
F		6.00
Tot		**6.00**
Total Component BOM Touch Module		**60.00**
FF Profit		
Profit		**14.00**
CM Margins		
Profit %	2 %	1.20
Manufacturing Cost %	5 %	3.00
Tot		**4.20**
ODM Margins		
Profit %	2 %	1.56
Manufacturing Cost %	0 %	0.00
Tot		**1.56**
OEM Touch Module Price		**79.8**

As mentioned before, to mitigate the initial financial risk and avoid margin stacking, the concept of reverse consignment could be used. In table 9, 60 % of the BOM is assumed to be reversed consigned by the OEM. The OEM will procure the material before any manufacturing margins are added. The consequence is that the OEM takes a larger risk due to the ownership of the material through the whole supply chain. Hence, the same level of profits and margins from downstream supplier will not be accepted. The profit of FlatFrog is decreased to 11 USD due to lower risk when just being responsible for 40 % of the BOM. Still, FlatFrog must be responsible for cost such as warranties and claims for the whole touch module.

The margins of the contract manufacturer remain the same since they perform the production of the touch module, independent of the ownership. Last, the ODM profit margin of 2 % is still added since they deliver the finished touch module as a black-box solution to the OEM. Unlike prior, their profit is now only based on the 40 % of the material which not is reversed consigned.

Table 9, BOM analysis product ownership with reverse consignment

Standardized Components		**Price**
A		7.00
B		21.00
C		14.00
Tot		**42.00**
Recommended Components		
D		7.20
E		4.80
Tot		**12.00**
Compulsory Components		
F		6.00
Tot		**6.00**
Total Component BOM Touch Module		**60.00**
FF Profit		
Profit		**11.00**
CM Margins		
Profit '%	2 %	1.20
Manufacturing Cost %	5 %	3.00
Tot		**4.20**
ODM Margins		
Profit %	2 %	0.78
Manufacturing Cost %	0 %	0.00
Tot		**0.78**
OEM Touch Module Price		**76.0**

It results in the OEM price per touch module decreases to 76 USD. A decrease with about 3.8 USD compared no reversed consignment and ends up in the same region as the both license model. However, even if the lower cost to the OEM is a meaningful advantage the real benefit gained from the reverse consignment is the

lower initial risk for FlatFrog. If 60 % of the material could be reversed consigned, it will reduce the cost of sold goods with 60 % which means a significantly lower risk. Last, in this model one of the main benefits with product ownership is overlooked. The better control of cost and the possibility to achieve cost reductions in production and purchasing will avoid the price erosion to solely hit the profit. This will contribute to a stronger maintenance of the profit margin over time.

6. Result

In this chapter the result from the analysis are to be presented. The result from both qualitative and quantitative aspects is featured in a brief and perspicuous way. The objective is to create an overview of the findings in the analysis which the conclusion will be built up on.

To quantify the result from the qualitative aspects in the analysis, the major areas of importance is summarized in table 10. As seen in the table a licensing model eases a market entrance and means a substantially lower risk. It further offers the most cost efficient alternative to the OEM which is the primary customer.

Table 10, Summary benefits, qualitative analysis

	License	Product Ownership
Initial Financial Risk	X	
Time of Market Entrance	X	
Maintenance of Margin		X
BoM Cost	X	
Control		X

The product ownership model compiles a larger initial risk but is considered as a stable long term alternative when profitability is reached. It implies greater control both in terms of IP protection and over the supply chain where cost reductions easier could be achieved in terms of reductions in material and manufacturing costs.

Table 11, Summary OEM touch module price

Model	OEM Touch Module Price ($)	Change (%)	Profit Margin ($)
License with Touch/PC Partner	75.5	-	6,5
License with Touch Partner	76.9	+1.8 %	6,5
Product Ownership	79.8	+5.6 %	14
Product Ownership Reverse Consignment	76.0	+0,6 %	11

Table 11 shows a comparison between the OEM touch module prices for the different models. As expected, the license model with a manufacturing partner

performing both the touch and PC, results in the lowest cost. As seen in the table there is just a small difference between all alternatives except the full product ownership model. Last, a comparison of the different profit margins is presented. The product ownership model generates the greatest margin but it is not necessary that it corresponds to the greatest net profit. Additional cost such has higher OPEX and possible increased CAPEX will be added to that model. For a license model no such cost will occur and the time to return of investment will be shorter.

7. Discussion and Conclusion

This chapter contains the conclusion of the analysis. The conclusion includes discussion and motivation concerning choice of business model and supply chain set up in a company´s entrance of a new market. First, a brief, general conclusion is presented followed by a more comprehensive discussion with FlatFrog, as a small, innovative and relative inexperienced actor, in focus. Finally, recommendations for further research within the area are presented.

7.1 Goal Fulfillment

First of all, a brief discussion concerning the fulfillment of the goals will be presented.

A: Understand current business model and supply model and investigate if it is suitable for entering the market and generation of optimally long term profit.

In the initial phase of the thesis the license model was the planned model to use for FlatFrog. This has however changed a couple of time during the project time and resulted in an investigation of two possible business model and supply chain set up with some mitigation alternatives.

B: Evaluate alternative supply chain positions and connected business models.

Two different business models with related supply chain set ups has been concerned including a license model and a product ownership model. Further, some mitigation options connected to weaknesses of the models has been presented.

C: Examine what kinds of relationships, partners and networks those are attractive in different supply chain set ups.

A number of characteristics of potential partners has been defined and explained. The different characteristics where explained to fit differently in different models.

D: Map and explain FlatFrog's position in the PC touch supply chain and how it implies corresponding ways of making business and enter the market.

Four different supply chain positions have been mapped with foundation in two business models. These positions have been evaluated according to the possibilities of a market entrance.

E: By research create an understanding of the market, its actors and characteristics.

A wide understanding of the PC market in general and the touch market in specific has been attained during the project. It has been primary been reach by participating in the daily work and interaction with the FlatFrog organization. Secondary, it has been accomplished by research and literature review.

7.1.1 Evaluation of Research Method

To evaluate the used research methods, summarized in table 2.7, and conclude what which could have been done in another way, a brief discussion of the research method will here be presented. Overall, the used research methodology has been working out well. Some aspects could however been conducted in another way. First, the concept of focus groups could be used a bit earlier in the project to avoid working on tracks in "the wrong direction". Second, a more structured plan of a how to perform the quantitative analysis could have been developed earlier to ease the collection of the quantitative data. Last, to avoid the strong opinions of the area of the thesis at FlatFrog and maintain objectivity, the authors could have used some "off-site sessions". Such short sessions could be used for uninterrupted discussions without influence from the organization. This is however somewhat of balancing since the objective has been to spend as much time with the organization as possible due to great learning's and the gained experience.

7.2 Discussion

"It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change." – Charles Darwin

The general result is that the license model means a much lower risk when a company is about to enter a new market. The time of entrance is shorter and no heavy initial investment is necessary. On the other hand, a product ownership model implies greater control of the supply chain and stronger margin defending. Hence, a market entrance is not only about the actual choice of business model. The model must be based on the characteristics of the company and the environment where it acts. For example, a large organization introducing a new product on a market where it already is present may prefer a product owner model due to better control. Similarly, a smaller company facing a new market would reduce its risk by applying a license model.

Considering the specific case of FlatFrog, additional layers of complexity will emerge. FlatFrog is a new actor about to enter a new market which is highly competitive and cost focused. With limited financial capability and credibility such

entrance faces a number of obstacles. To define the main criteria the initial model must fulfill, two main objectives are defined below.

1) Fast market entrance to catch the window of opportunity before competitors reach competitive cost.
2) Get a product on the market to create credibility, show the PSD technology appropriateness for large scale production and avoid missing design wins at customers.

Initially, a license model with an ODM partner seemed to be an optimal choice. A late position in the supply chain and a fast market entrance are aspects which are highly valuable. In addition, a partner with experience of large scale manufacturing is a further characteristic which are considered of great importance. Most of all, a license model decreases the financial risk and does not require FlatFrog to make large investment in material. These aspects contribute to fulfill the short term objective of a market entrance.

A product ownership model would probably increase the time to market due to the need of a larger organization and the set up of supply and distribution channels. This will also affect the possibility to create credibility. Hence, the longer time to a market entrance; the more customers will be missed due to the lack of a finished product which strengthens the reliability.

However, no matter how easy something may seem, the reality could be another. First, it is hard for a new, small company to attract and get attention from a large international player like a top ODM. FlatFrog risks to not get enough resources allocated and may be left behind. Second, OEMs switches their production between the different ODMs from quarter to quarter. This would make it hard for FlatFrog to reach multiple OEM customers with just one ODM as manufacturing partner. Even if this set up theoretically seems to be of greatest value it could be hard to accomplish in reality.

Still, selling just a license is considered to be the most attractive alternative in the initial stage, both in terms of strength and weaknesses as well as market entrance aspects. Instead of meet the obstacles to use an ODM as a manufacturer; an earlier positioned manufacturer could be approached. It enables FlatFrog to supply several ODMs with touch modules since this actor would act as an objective touch module supplier. Many TMIs struggles to reach profitable yield and are suffering from economic losses the latest years. Market leader TPK remains unthreatened and could maintain high prices. Hence, many middle-sized TMIs should be very interested in FlatFrog's offer which could give a lower cost and higher yield.

Aiming for a partner in that size would also secure resource allocation and enough attention to make ramp up and production run smoothly.

Nevertheless, also this option brings some concerns. Since the TMI position in the supply chain is one step earlier than an ODM, some additional margin stacking will occur. But, the result of the BOM-analysis shows that the increased margin stacking will affect the price in a limited way and should not be seen as a major concern.

Further this model is very beneficial in terms of risk and return on investment. So far, many aspects prove that a licensing model would generate the greatest and the fastest profitability. However, even if the theory points in one direction, some of the gained market insights are of another character. Many potential manufacturing partners are "pot committed" due to large PCT investments, a condition which might obstruct the implementation of a licensing model. Finding a partner which agrees to take all risk and perform the execution of an unproven technology supplied by a new company may be hard, even if all calculations and forecast indicates success.

Former Ericsson CEO stated *"Culture beats strategy every time"* (Karlsson and Lugn, 2012), a quote which is used to describe changes within a company. Applying it to the situation of FlatFrog, it should rather be defined as: *"Operational reality beats best strategy every time"*. Such model would mean that FlatFrog may be forced to act according to the practical reality of the market instead of internal strategic preferences. The reality could obstruct an entrance with a license model, and instead a product ownership model has to be used.

Even if the result of analysis indicates problems to reach early profitability some major advantages are overlooked. The benefit of control and avoid the cost erosion to hit the profit margin could be a major advantage over time. Further, the PC market currently experiences a convergence and the characteristics of the market are about to be changed. As the Wistron chairman earlier were quoted:

"Lin believes the declining margin is not really a critical problem because such a situation tends to happen in more developed sectors. What PC makers should really focus on is to find a business model that can boost its value for clients for the next 10 years".

This indication, together with the ODM trend of increasing internal capabilities by vertical integration, may point out the direction. In this highly competitive environment; control and upstream visibility may be the main characteristics to

consider. The initial risk could be mitigated by reverse consignment which enables FlatFrog to employ this model in an early stage which could be critical to reach the window of opportunity.

To conclude, a license model enables a low risk, fast entrance in a new market. Profitability and great earnings could be achieved within a short time. This may not however be feasible in reality and, as the market mature, issues might emerge. External pressure will increase and margins will continue to decrease. Independently if success could be realized with license model it is vital to continuously audit the changes of the market and the improvements of competitors. A license model may be the most attractive choice with current circumstances, but a product owner model, or a combination of both, may be the best alternative in the future.

7.3 Conclusion

With above motivation, the conclusion of this project is that it is difficult to determine the most optimal business model and supply chain set up just considering a specific company. It is dependent on current conditions and agility of the market which continuously are changing. Hence, the most important secret to a thriving business, in accordance with Johnson et al. (2008), is recognizing when it is need of a fundamental change. As Charles Darwin said; it is not the strongest or most intelligent who survives, it is the one most adoptable to change.

7.4 Academic Contribution/Recommendation for Further Research

The thesis academic contribution constitutes of three future research opportunities. First, when mapping a company's supply chain and relate it to the intended business model, these two aspects tend to converge into each other. Little has been found concerning a framework which maps a supply chain and simultaneously defining the business model. An extended framework which includes both a supply chain map and definition connected business model would enable a comprehensive foundation of evaluation how an organization performs its business.

Second, the concept supply chain enablement has been an increasing strategy for larger companies to pave the way for improved opportunities by investing in areas not directly related to the own business. However, almost nothing has been found in academic research concerning a definition or multiple examples of supply chain enablement. So far, it seems to be a kind of business expression mainly used in the corporate world. A thorough research concerning the definition of supply chain enablement would be valuable.

Last, the work process of this thesis could be seen as academic contribution. To interact and work within the organization which was studied was an inspiring way of performing the thesis. It gave an understanding and depth to the analysis which would have been hard to attain otherwise. However, it is important to be aware of the influence from the organization which could affect the objectivity the thesis. If the objectivity could be maintained, this work process is recommended for future development.

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