UNIVERSITY OF VAASA

FACULTY OF TECHNOLOGY

DEPARTMENT OF PRODUCTION

Robert Kangasluoma

ORDER BACKLOG'S EFFECTS ON THE INDUSTRIAL COMPANY'S FUTURE REVENUE AND EARNINGS

Master's Thesis in
Industrial Management

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SYMBOLS AND ABBREVIATIONS

CO	Customer Order
MTO	Make To Order
EVA	Economic Value Added
DRP	Distribution Requirements Planning
SPSS	Statistical Package for the Social Sciences

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UNIVERSITY OF VAASA
Faculty of Technology
Author: Robert Kangasluoma
Topic of the Thesis: Order backlog's effects on the industrial company's future revenue and earnings
Instructor: Päivi Haapalainen
Degree: Master of Science in Economics and Business Administration
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ABSTRACT**:** This research examines order backlog's effects on the company's future revenue and operating profit in the 10 year period. 18 Finnish publicly listed companies are selected for this. Also economic downturn has significant effect on the company's order backlog and the effects are evaluated. In the end research examines which companies performed best in the downturn. Evaluating changes in order backlog can help management or investors to forecast company's future success.

Order backlog is one of the leading indicators used in revenue and profit forecasting. This indicator is used to indicate future performance for example in the heavy and high technology industries. Carefully executed order fulfillment process is necessary in managing order backlog efficiently. Process is needed in transforming order backlog's orders to revenue. In this quantitative longitudinal research Pearson's correlation efficient was chosen for main research method as it measures the association of two variables. Data was collected in Excel using numbers from 180 financial statements and statistical hypothesis testing was calculated in SPSS.

This research found out that order backlog, operating profit and revenue correlate to each other extreme significantly. In the downturn operating profit declines most. This is due to incapability to cut fixed and operating costs fast enough. Also revenue change is the smallest because the old order backlog is protecting it from declining in the downturn. Kone and Wärtsilä performed best in the downturn as they were the only companies with operating profit and revenue growth in the year 2009. These results to research questions suggest that changes in the order backlog should be taken very seriously in forecasting company future success.

KEYWORDS: Orders, forecasts, analysis, correlation, SPSS

VAASAN YLIOPISTO
Teknillinen tiedekunta
Tekijä: Robert Kangasluoma
Tutkielman nimi: Tilauskannan vaikutus teollisuusyrityksen liikevaihtoon ja tulokseen
Ohjaajan nimi: Päivi Haapalainen
Tutkinto: Kauppatieteiden maisteri
Pääaine: Tuotantotalous
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TIIVISTELMÄ: Työn tarkoituksena on tutkia tilauskannan vaikutuksia yhtiön tulevaan liikevaihtoon ja liiketulokseen 10 vuoden aikajaksolla. Tähän valittiin 18 suomalaista julkisesti noteerattua yhtiötä. Myös laskusuhdanteen vaikutuksia tilauskantoihin tutkitaan. Tutkimuksen lopussa tarkastellaan yhtiöiden selviytymistä taantumasta ja tuloksissa esitetään parhaiten siitä selvinneet yhtiöt. Tilauskannan muutosten analysointi voi auttaa yrityksen johtoa tai sijoittajia ennustamaan yrityksen tulevaisuuden menestystä.

Tilauskanta on yksi johtavista indikaattoreista tilauskannan ja tuloksen ennustamisessa. Sitä käytetään tulevan menestyksen mittaamiseen esimerkiksi korkean teknologian yrityksissä sekä raskaassa teollisuudessa. Huolellisesti toteutettu tilausten toimeenpanoprosessi yrityksessä varmistaa tilauskannan muuttumisen liikevaihdoksi. Tässä kvantitatiivisessa pitkittäistutkimuksessa Pearsonin korrelaatiokerroin valikoitui päätutkimusmenetelmäksi, koska sen avulla voidaan tutkia kahden muuttujan suhdetta. Tutkimuksen aineisto kerättiin Exceliin käyttämällä yhteensä 180 tilinpäätöstä ja tilastollinen hypoteesin testaus toteutettiin SPSS -ohjelman avulla.

Tutkimustulokset osoittivat tilauskannan, liikevoiton ja tilauskannan korreloivan toisiinsa erittäin merkittävästi. Laskusuhdanteessa näistä liikevoitto laskee eniten. Tämä johtuu kyvyttömyydestä kiinteiden ja muuttuvien kustannusten leikkaamiseen tarpeeksi nopeasti. Liikevaihto pienenee vähiten, sillä taantumassa kertynyt tilauskanta pehmentää liikevaihdon putoamista. Kone ja Wärtsilä selviytyivät parhaiten vuoden 2009 taantumasta, sillä ainoastaan niiden liikevaihto ja liiketulos nousivat kyseisenä vuonna. Tutkimustulokset osoittavat, että muutokset tilauskannassa pitäisi ottaa vakavasti ennustettaessa yhtiön tulevaa menestystä.

AVAINSANAT**:** Tilaukset, ennusteet, analyysi, korrelaatio, SPSS

1 INTRODUCTION

Forecasting is more important than ever for industrial companies. Future flow of earnings and revenue are wanted factors. There are many ways to forecast them for the future but order backlog is one of the leading indicators. This indicator is used to indicate future performance for example in the heavy and high technology industries. This research examines how order backlog affects industrial company's future earnings and revenues. (Lev & Thiagarajan 1993: 197)

This research is done by using quantitative longitudinal research. Longitudinal research is group of research methods that involves obtaining repeated measures of variables from the same group of individuals over an extended period of time. Longitudinal research is useful for studying changes in same variables as well as in associations between variables over time. (Wang 2013)

This kind of research which examines order backlog's direct effects on the future earnings and revenue is not done before. It is hard to make as the subject is rare and the source literacy related to it is scarce. I want to research, observe and analyze new things which are not too much studied in the mainstream research of the industrial management. My hypothesis is that order backlog has significant effect on the revenue and operating profit. To get answers I will conclude statistical hypothesis testing by calculating Pearson's correlation coefficient in SPSS.

1.1 Introduction to the topic

Order backlog varies from year to year and it depends on orders coming in the past. Sales orders define the industrial company's future survival as sales orders are needed all the time.

The company does not necessarily need more new customer orders (CO) if there are already many orders in order backlog. Strong order backlog is a key point for industrial company to survive hard times for example in the recession. It helps the company to create revenue and profit in hard times when customers are not ordering company's products or services.

It is interesting to know how changes in order backlog affects to the company's future. It is valuable information to the management of the company, investors and other stakeholders as accurate future estimation is important for everybody. Coming downturn could possibly be seen beforehand if there is shrinking amount of sales orders. Expanding order backlog indicates usually positive future.

Finance market fluctuations affect to the other economy sectors like exports, imports and consumer spending. The effects are most clear in the strong growth and the strong declines in economic situation. Industrial sector is vulnerable to the fluctuations in the finance market. It is not only fluctuations that happen in Finland, but also global fluctuations. Problems in the Finland's finance sector in the 90s caused deeper recession also in the industrial sector. Another example of this is the global finance crisis in the year 2008 to year 2009. This study also researches the effects of the shrinking order backlog in 2008 to the future revenues and earnings of the selected industrial companies. It is hard to forecast future revenue and earnings if suddenly finance markets crash. (Gulan;Haavio;& Kilponen 2014)

1.2 Research questions

The goal in this research is to find out how the changes in order backlog affect to the industrial company's future revenue and earnings. The companies chosen are located in Finland. This is examined in 10 year period. The companies are listed in OMX Helsinki Stock Exchange as they share enough

information about their order backlogs to the public. Not many companies listed are suitable for this study so only 18 companies were researched.

The period is from the year 2005 to the end of the year 2014 so the research has data from economic downturn of the year 2009. The interesting point if the growing order backlog is always positive indicator for growing revenue and earnings. The research focuses to the following three questions:

1: How does the order backlog effects on the company's future revenue and earnings in the 10 year period?
2: How these factors change in economic downturn?
3: Which companies performed best in the downturn?

2 ORDER BACKLOG

Order backlog is the total value of unfulfilled sales orders. Fulfilling orders and new orders makes the order backlog change constantly. Without increase in the amount of customer orders the company future seems worse. Order backlog is connected to the company's future earnings and sales revenue. (Businessdictionary 2016)

2.1 History of using order backlog in forecasting

Publicly released information in financial statements about order backlog has been released since the year 1970. Liu Gu, Zhiqiang Wang and Jianming Ye (2009) argue that all information in order backlog is in the change, and it is substantially underreacted by analyst and investors. Analysts and investors partially understand the positive impact of increasing order backlog to the company's revenue growth In the future. In contrast they appear to have no idea about that the increase in order backlog also implies better future profitability. (Gu, Wang, & Ye 2009: 0)

Gu, Wang and Ye (2009) have researched order backlog through empirical analysis and concluded that the information in order backlog is in its change compared to earlier order backlog. The level of actual order backlog is not so important. Change in order backlog shows a much stronger association with both future profitability and revenue growth for a company. (Gu, Wang, & Ye 2009: 2)

Their calculations indicate that company's backlog-to-assets ratio increase predicts higher future profitability and sales growth. Still stock market does not predict this growth in sales due to order backlog. Their conclusion is that this gives hedge to investor that takes changes in backlog-to-assets ratio seriously. As order backlog is traditional leading indicator, it seems that the issue is more

important than other indicators that are not so well known. (Gu, Wang, & Ye, 2009: 16-17)

2.2 Order backlog's influence

Shivaram Rajgopal, Terry Shevlin and Mohan Venkatachalam (2003) have examined if stock markets fully appreciate the implications of leading indicators for future earnings. They explicitly examine if the order backlog predicts future earnings. Order backlog is one leading indicator as there are also other ones listed by them. Those are product market share, customer satisfaction, patents, web traffic and managerial actions. (Rajgopal, Shevlin, & Venkatachalam, 2003: 461)

Company's revenue comes from sales orders and the order backlog is leading indicator of future revenue. There could be other revenue which is not formed from order backlog. For example ship cruise firm normally makes revenue from selling ship cruise tickets to consumers. There can be other revenue formed for example by selling one of its cruise ships. That is not normal daily revenue.

In different companies order backlog causes different effect on the next year's revenue. For example in the end of year 2000 Motorola had order backlog of 9.62 billion dollars. The company claimed it expects 94% of orders to be shipped during year 2001. This example shows that the order backlog has influence specifically to the next year's revenue. On the other hand Motorola's order backlog equals only 26% of its year 2000 sales so the effect is not so significant. This is due to changes in production cycle times in different companies. Long cycle means usually bigger order backlog (Rajgopal, Shevlin, & Venkatachalam 2003: 466)

Lockheed Martin in contrast had order backlog in the end of year 2000 that was 222% of the company's sales. 72% of it was expected to be shipped in year

2001. It has to be easy to guess that revenue in year 2001 was going up rapidly. Two significant observations were made by this information. The first is that order backlog is to be taken in account when company's future earnings are forecasted. The second one is that in different industries order backlog have different effect on the future years earnings. Some have smaller influence and some have bigger one. In airplane manufacturing industries production process takes many years. Production process is much faster in mobile phone industry. (Rajgopal, Shevlin, & Venkatachalam 2003: 467)

2.3 From order backlog to order fulfillment

Order backlog is an indicator of future sales which are unfulfilled customer orders. Order fulfillment process is necessary in managing order backlog. Filling orders efficiently and effectively is a critical way to provide good customer service. Order fulfillment process is not just filling orders in time. Company needs to design a network and a process that meets customer requests while minimizing the total delivered cost. Order fulfillment has significant affection to product availability which influences total sales volume. Figure 1 Shows order fulfillment process from CO perspective in practice. (Croxton 2003: 19)

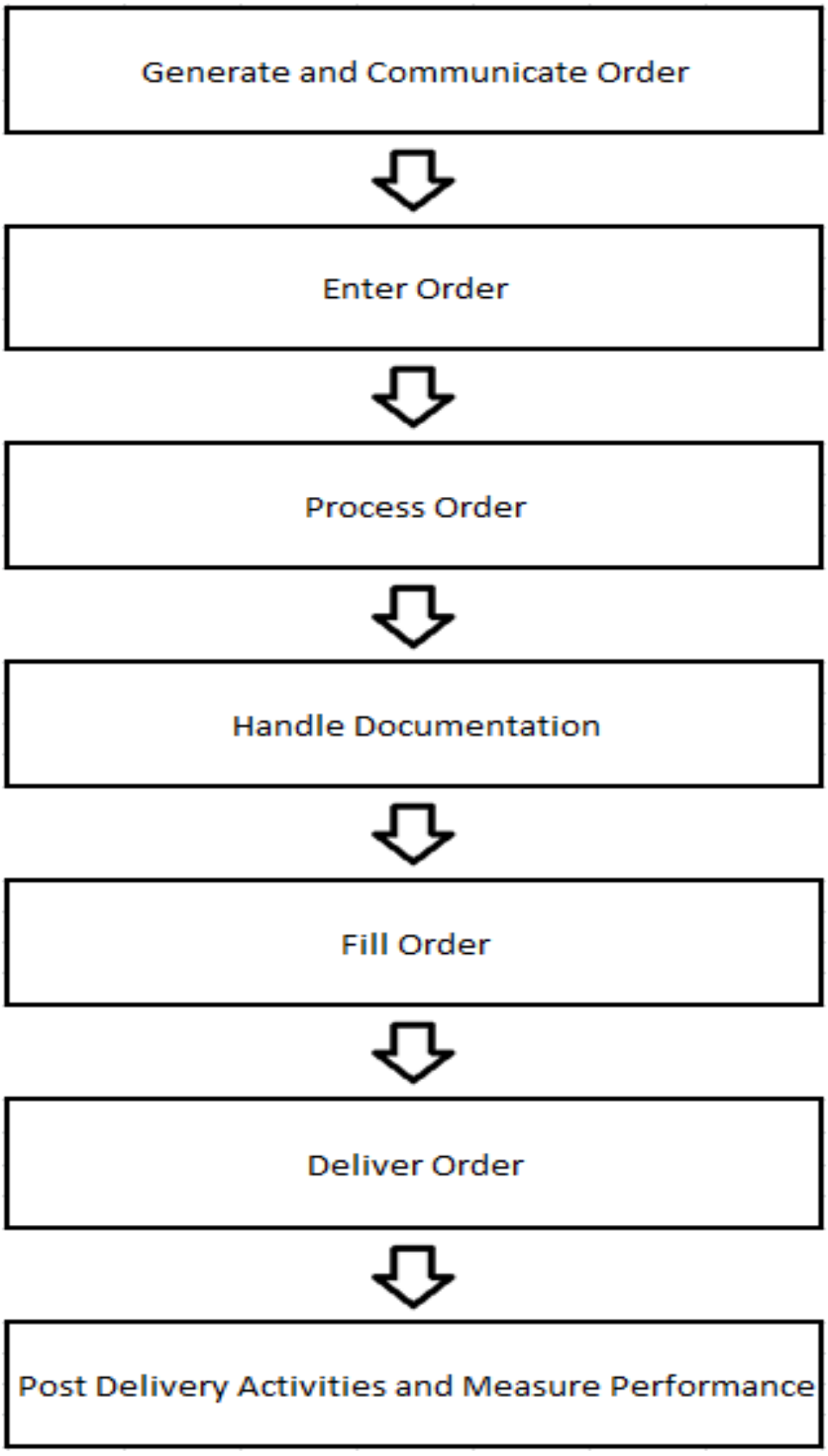


Figure 1. Operational order fulfillment process. (Keely L. Croxton 2001: 21)

2.3.1 Operational order fulfillment

Operational order fulfillment process is very transactional. It focuses on managing the CO cycle and the specific activities are executed primarily within the logistics function (Croxton, 2003: 26). In the first phase purchase order is generated and communicated. Orders come through the sales organization, customer service, or directly from the customer. This can be automated for example with electronic data interchange. Functional key interfaces for this phase are between the logistics, marketing and sales areas. (Croxton 2003: 28)

In the second phase order is entered and edited, if necessary. Errors in this phase can be very costly. To prevent this, process team should measure and track error levels. Root causes can be located this way. The order entry information works as input for generating future forecasts. Orders should be received on time and free of errors. (Croxton 2003: 28-29)

The third phase is process order. The first step is to check customer's credit. Then inventory levels should be checked and the order flow is planned. The way order is routed through the supply chain is called the distribution requirements planning (DRP) process. Orders which are not filled directly from inventory, the DRP process will determine where the order will be manufactured or assembled and how the shipping is done by the due date. (Croxton 2003: 29)

After processing the order, the documentation related to that order is prepared. Bill of lading, order acknowledgement, picking instructions, packing slips and the invoice are related documentation. Possible customs and duty forms are needed for this process. In many warehouse management systems, the documentation is prepared after filling the order. The fourth phase and the fifth phase in the process could change places depending of the company policy. (Croxton, 2003: 29)

The fifth phase is fill order. This phase involves picking, packing, staging, and load configuration according to picking instructions.. Order filling happens on

the plant floor or in a warehouse. After order is confirmed, the order status should be communicated to the customer service management team and possibly to the customer. (Croxton 2003: 29)

Deliver order is the final step of the order to delivery process. Shipping documents are prepared and the transportation plan is executed. After that delivery is confirmed and the freight bill is audited and paid. Delays and errors can be costly as they impact directly to customer. Control of the order is relinquished as the order is usually handed over to a transportation company. Good communication and relationship with transportation companies play an important role in this phase. (Croxton 2003: 29-30)

Post-delivery activities and performance measurement involves receiving and posting payment, addressing discrepancies and recording bad debt expense. An ongoing part of the whole order fulfillment process is to measure the process and share the results throughout the firm and the stakeholders of the supply chain. It is important to track the timeliness of the process because the order fulfillment process has a direct impact on the customer. Measuring order to cash cycle time and the customer cycle time are important for this phase. The order to cash cycle time measures the elapsed time from the receipt of the CO to the time that the payment is posted. The customer cycle time measures the elapsed time from the order being placed to the receipt of the order into the customer's warehouse. The variability of the customer cycle time is particularly important to the customer. This is because they need to have more safety stock in case of high variability. Measuring both the average time and the variation time required to complete each phase of the process gives results about which phase needs more improvements. (Croxton 2003: 30)

The order fulfillment process focuses on transactions at the operational level. That is why the management can focus on making critical improvements to the process that affect to the financial performance of the firm and its stakeholders

like customers and suppliers at the strategic level. For example sourcing costs can be minimized by an optimized network. (Croxton 2003: 19)

2.3.2 Strategic order fulfillment

Strategic order fulfillment process focuses establishing the structure for managing the process. Implementation of the strategic process within the company is a necessary step in integrating the company with the stakeholders in the supply chain. Figure 2 shows phases of the strategic order fulfillment process. (Croxton 2003: 22)

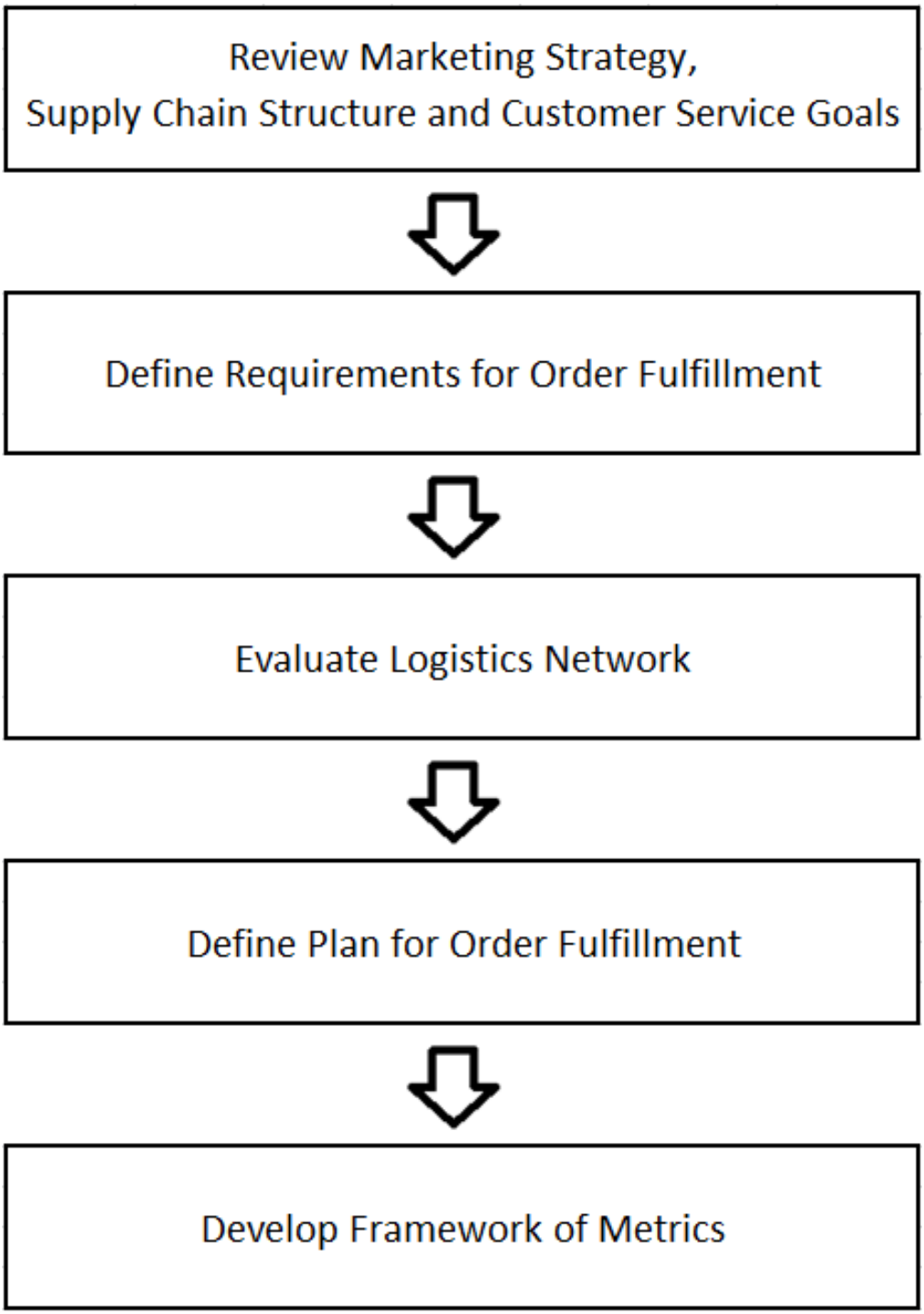


Figure 2. Strategic order fulfillment process. (Keely L. Croxton 2001: 21)

In the first phase of strategic fulfillment process, marketing strategy, supply chain structure and customer service goals are reviewed. This review determines the order fulfillment capabilities of the firm and the supply chain.

Customer service audit gives information about what are the most important issues to the customer. Supply chain structure needs to be examined. This is done to understand limitations and how cost is added as product moves through the supply chain. (Croxton 2003: 22-23)

The second phase focuses on defining the requirements for the order fulfillment process. In this phase order to cash cycle is reviewed, the supply capabilities is understood, lead-time and customer service requirements are defined. The customer relationship management and manufacturing flow processes provide information for this phase. Also operational requirements like the details as how many orders need to be filled per day need to be understood. (Croxton 2003: 23)

The third phase is about evaluating the supply chain network to determine if the network could be redesigned to resolve the gaps. The operation and design of the network has a significant influence on the cost and performance of the system. This can affect customer service levels, lead times and part component costs. Logistics network design tools can be used to decide which plants will produce which products, where warehouses, plants, and suppliers should be located, and which transportation modes should be used. Also customers need to be efficiently assigned to networks of supply. Decisions affect the capabilities, the cost, and the timeframe of the order fulfillment process. Data is needed from every functional area within the company like demand management, manufacturing flow, product development, commercialization and return managements processes. Analyzing this kind of data helps to make right decisions. (Croxton 2003: 23-24)

The fourth phase involves doing plan for order fulfillment, determining how orders from various customers or segments of customers will be taken and filled. This phase mostly determines the operational order fulfillment process. Steps should be determined for incident like order cannot be filled according to customer demands. Also rules should be developed how demand is allocated,

or possibly when an order should not be accepted at all. Flow of order information is important component of order fulfillment process. For example SAP allows customers to insert orders directly to supplier's system, bypassing the traditional, and manual, order entry process. (Croxton 2003: 24-25)

In the final phase framework of metrics must be developed to measure and monitor the performance of process. Metrics should be tied back to the company's economic value added (EVA). Figure 3 shows how improvements in the order fulfillment process influence EVA through sales, cost of goods sold, inventory investment, total expenses, other current assets and fixed assets. For example if the order to cash cycle is reduced, payments are made more quickly. This reduces the current assets on the books. It is important to understand how the process affects financial performance of the company. (Croxton 2003: 25)

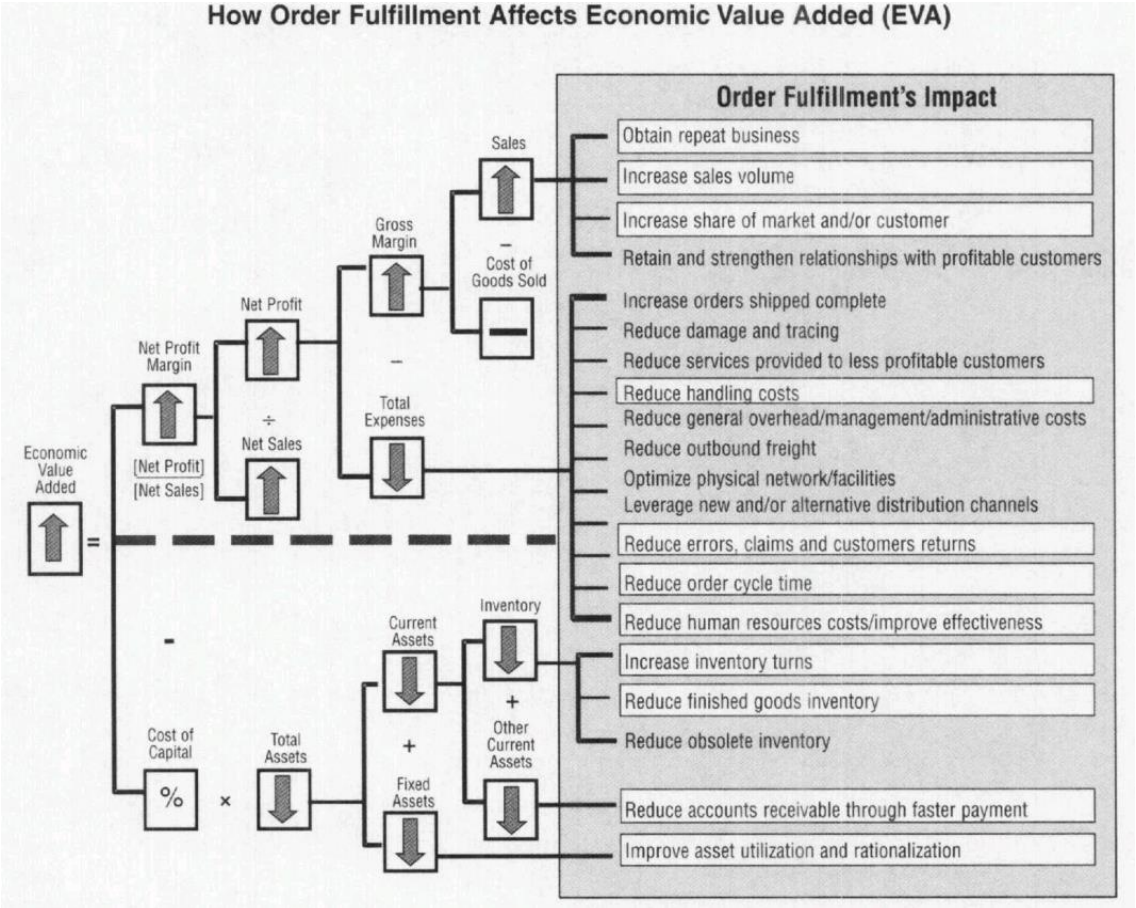


Figure 3. Economic value added. (Lambert 2001: 10)

Once the impact of order fulfillment is understood to the financial performance of the company, metrics need to be developed for the activities performed. For example order fill rate, order to cash cycle time and order completeness are typical process measures. Things what the customer deem important should be measured. The order fulfillment process should be reviewed periodically to assure that it is as effective and efficient as possible. (Croxton 2003: 25-26)

According to Riikka Kaipia (2008) especially Make-to-order (MTO) companies tend to have big order backlog. MTO companies build products according to customer specifications. MTO is used in cases which have a large number of possible configurations and when exact customer requirements cannot be forecasted. MTO is a suitable strategy for customized products with a large

product variety. Products have long delivery lead times and customers are prepared to wait for the product. The batch size in production is low as the product is modified especially for the customer. The order backlog forms a large part of the delivery time and it is used to respond to demand fluctuations. Order backlog's delivery lead time is the main source of flexibility. (Kaipia 2008: 126)

2.4 Order backlog is only one of the many key value-drivers

There are also other indicators for forecasting company's future earnings and revenue. Changes in these factors indicate changes in the company's valuation in the stock market. Baruch Lev (1993) from University of California and S. Ramu Thiagarajan (1993) from Northwestern University have been researched this in article called Fundamental Information Analysis published in the Journal of accounting research. Their old article is cited by almost all order backlog related scientific publications after year 1993 which was the year they published the research.

Lev and Thiagarajan (1993) pointed out 12 indicators which are important for forecasting future. 11 of them are described below besides order backlog and reasons why the indicator is relevant for the company's future are explained. (Lev & Thiagarajan 1993: 192)

2.4.1 Inventories

Growing inventory costs without increasing cost of sales is considered as bad signal. That kind of situation implements sales difficulties. Increasing inventory points that company's earnings are going to decline. This is due to management primary goal is usually lower inventory levels. Disproportionate growing of inventory can also be due to obsolete or slow-moving items that will be abandoned soon. Also inventory buildups affect positively to current earnings at the expense of future earnings by absorbing overhead costs. Decreasing

inventory usually is caused by higher demand for product which is causing increasing sales. Also decreasing cost absorption by this implies better earnings now and in the future. (Lev & Thiagarajan 1993: 192-193)

There are also positive reasons to have stable and little bit oversized inventory. The first and most important one is smoothing production as sales could fluctuate rapidly. The second one is minimizing stock-out costs as lack of urgent needed item could be very costly for a company. The third is stocking items as if there is going to be a significant increase in material price or supplier is going to increase price of the items bought. The fourth one is batch size which means supplier has attractive discount on the product price if those are ordered by certain amount. (Lev & Thiagarajan 1993: 193)

2.4.2 Accounts receivable

Increasing accounts receivable that are disproportionate to sales could implicate problems in company's product selling. It is also sign of shrinking earnings in the future from increasing receivables provisions. It might indicate manipulation in earnings as yet unrealized revenues are recorded as sales. These reasons for increasing receivables indicate low persistence of current earnings and decreasing future earnings. (Lev & Thiagarajan 1993: 194)

2.4.3 Capital expenditures

Relative decreasing capital expenditures might indicate concerns about the adequacy of current and future cash flows to sustain the past investment level. Decrease indicates short-term managerial orientation. Increasing capital expenditures affect positive to the future earnings and growing cash flow. (Lev & Thiagarajan 1993: 195)

2.4.4 Research and development

This indicator works the same way as capital expenditures. Decreasing research and development expenses might indicate management's worry about future earnings. It seems a cut in research and development is a way to boost earnings in the short-term. (Lev & Thiagarajan 1993: 195)

2.4.5 Gross margin

Gross margin balance is sales minus cost of sales. It is bad signal if it decreases disproportionate amount compared to sales. It is driven by such factors as competition intensity and the relation between variable and fixed expenses. This indicator affects company's long term performance. It is important with respect to earnings persistence and company's values. This indicator is defined as the difference between the percentage change in sales and that of the gross margin. (Lev & Thiagarajan 1993: 195)

2.4.6 Selling and administrative expenses

Administrative costs are usually approximately fixed. Too high growth rate of these expenses compared to sales is considered as negative thing for a company. This could be due to loss of cost control or unusual sales effort. This is measured by comparing the difference of percentage changes in sales to selling and administrative expenses annually. (Lev & Thiagarajan 1993: 196)

2.4.7 Provision for doubtful receivables

Companies with inadequate provisions for doubtful receivables will usually have decreased earnings from provision increases. Problem is the adverse implications of inadequate bad debt provisions for the persistence and growth of earnings. This signal is measured relative to the change in gross accounts receivable. It is percentage change in gross accounts receivable minus

percentage change in provision for doubtful receivables. It is concerning signal if the above calculation gives positive value as a result. (Lev & Thiagarajan 1993: 196)

2.4.8 Effective tax rate

Changes in effective tax rate have usually short time effect. Unusual decrease in company's tax rate is generally negative as it questions earnings persistence (Lev & Thiagarajan, 1993: 196). There is one good example in Finland about unusual decrease in industrial manufacturer's tax rate. Supplier for Nokia's mobile phone segment was company called Elcoteq. The company moved its headquarters from Finland to Luxembourg in 2008 to benefit lower tax rate. This did not save costs enough as the company filed for bankruptcy in the year 2011. (Taloussanomat 2012)

2.4.9 Labor force

Increasing labor force could be good for growing company. Still it needs more calculations. Labor force indicator is calculated as the annual percentage change in sales-per-employee. If this indicator is increasing, it is usually a good thing for the company. This indicator show changes in efficiency of labor and accounting for changes in the number of employees. (Lev & Thiagarajan 1993: 196)

2.5.10 LIFO earnings

Last in first out earnings are more sustainable to real earnings than first in first out earnings. LIFO is a closer proxy to current cost. It is a positive signal for the firm if it uses LIFO instead of FIFO. (Lev & Thiagarajan 1993: 196)

2.6.11 Audit qualification

It is important for the company to have good audit qualification. Disclaimed audit opinion means there could be serious problems in the company. (Lev & Thiagarajan 1993: 196)

3 Research methods

I chose 10 year period from start of the year 2005 to end of the year 2014. It was important to have economic downturn in this period which will show the effects of declining order backlog. It occurred in the year 2008 as the global financial crisis. These companies were chosen by examining firm's financial statements. Many industrial companies firstly chosen for research does not have order backlog reported and those were excluded from this research. Also some companies don't have clear order backlog records in 10 year period chosen and were also excluded. This caused extra work which is not seen in this research. I collected values of year end order backlog, revenue and operating profit for 18 industrial companies using their financial statements with sufficient data.

3.1 Longitudinal survey

Longitudinal surveys provide insights that cannot be obtained by any other means. That is the reason why it is highly valued by researchers and policy makers. The successful implementation of a longitudinal survey can create outstanding results. In this kind of survey there are considerable complexities involved in designing and carrying out a longitudinal survey compared to other surveys. (Lynn 2009: xv)

Method chosen for this research is longitudinal data analysis. It is done by collecting specific data for the research. Data describes the course of events during a particular time period which is 10 years in this case. It is best way for examining issues of change and causality in survey research which is not experimental. (Taris 2000: vii)

The association of two variables can be measured using correlation coefficient or the chi-square value. Many studies describe the association between pairs

of variables in causal terms. There are three criteria which must have been satisfied before a particular association between two variables can be interpreted in causal terms. Those are covariation, non-spuriousness, temporal order of events and causal inferences. (Taris 2000: 3)

Covariation proofs there is statistically significant association between the two variables of interest. Causal relationship could not be confirmed if there is no relationship at all. Non-spuriousness means that the association between two researched variables should not be due to the effects of other variables. Temporal order of events proofs that the causal variable must precede the effect variable in time. Change in the causal variable should not occur after a corresponding change in the effect variable. Causal inferences cannot be made straight from the empirical designs. Causal statements need a theoretical argument which specifies how the variables one affects variable two in a particular setting across time. Causal processes cannot be demonstrated directly from the data because the data can only present relevant empirical evidence serving as a link in a chain of reasoning about causal mechanisms. (Taris 2000: 3-4)

Order backlog is before actual revenue as order fulfillment process forms revenue from fulfilling orders in the backlog. Revenue is before operating profit as revenue minus costs and expenses forms operating profit. Causal relationship between order backlog, revenue and operating profit can be seen in the Figure 4.

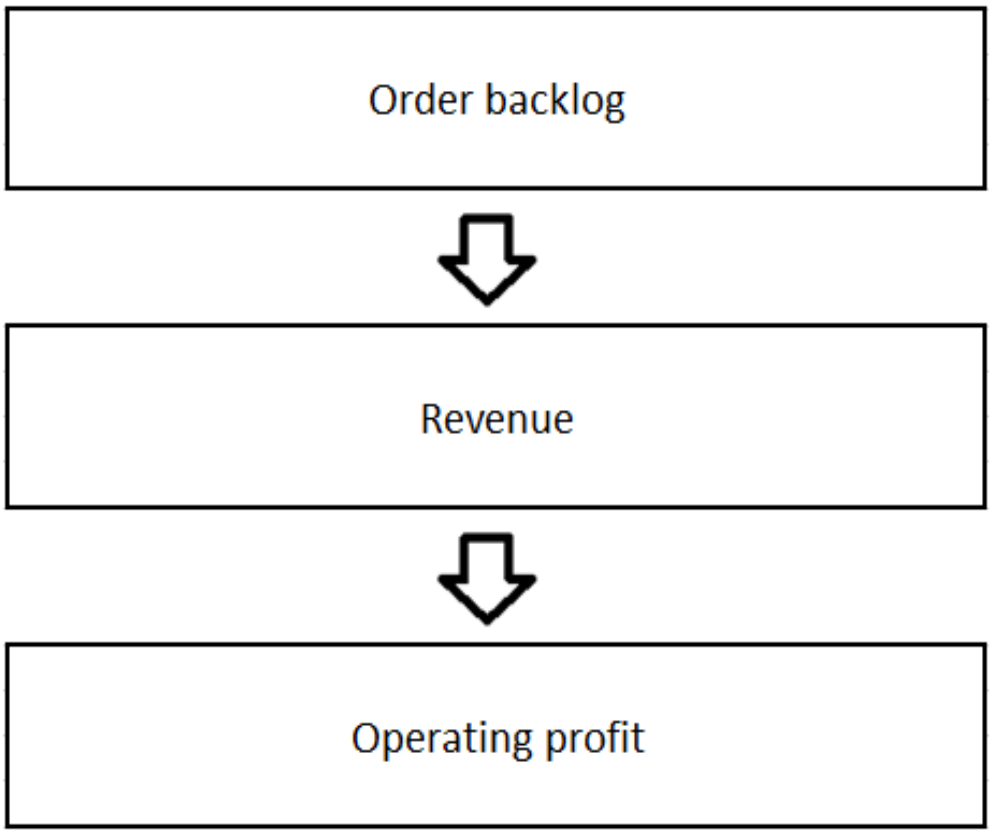


Figure 4. Causality of order backlog, revenue and operating profit.

3.2 Design used

Design for collecting longitudinal data determines the way data is collected. The design of a longitudinal research should be fixed before the last wave of the research has been conducted. Design phase errors tend to be costly and difficult to correct. In general researcher should decide in advance the number of waves of their research. (Taris 2000: 5)

Time series analysis design uses repeated measurements which are taken from the same set of participants. The measurements are not always equally spaced in time. This design allows assessment of intra-individual change. This is because the same participants are observed across time. The time series design is very flexible. This kind of research is usually reserved for studies with

a very limited number of subjects. Those are followed through time at a large number of occasions and for a small number of variables. (Taris 2000: 6)

3.3 Companies chosen for the research

The companies are Finnish manufacturing companies listed in Helsinki Stock Exchange. Huge amount of data is available for these companies as they report their operations four times a year. I worked in strategic purchasing department in Wärtsilä for two years and I have seen how the order backlog predicts the future of the whole company.

I chose 18 Finnish industrial companies that report their order backlog publicly in their website. In order to evaluate results in this research it is good to know a little about case companies businesses as some businesses are more stable in fluctuations in revenue and earnings. Every company's size is listed below in terms of revenue with some relevant information about the industry companies are working with. The companies are listed in alphabetical order.

3.3.1 Cargotec

The first company is Cargotec which specializes in handling cargo solutions in ships, ports, terminals, logistics centers, heavy industry and automobile machinery. Also maintenance service is Cargotec's main business. The company has revenue of 3,4 billion euros for the year 2014 and it has operations in over 100 countries. It employs over 11000 people. (Cargotec, 2015)

3.3.2 Componenta

The second company is Componenta which provides castings solutions to machinery and vehicle manufacturing companies. These castings are used to

build their customer's machinery. The company has revenue of 500 million euros for the year 2014 and operations in 10 countries. 4250 people work in the company. Componenta acquired Turkish casting company Döktas in the year 2006 which almost doubled the company's revenue in the year 2007. (Componenta 2015)

3.3.3 Cramo

The third company is Cramo which rents machinery, equipment and modular space for building industry, public sector and private customers. Cramo operates in 15 countries with over 2500 employees. It has revenue of 652 million euros for the year 2014. Cramo made corporate acquisition in the year 2005 which multiplied the company's revenue. (Cramo 2015)

3.3.4 Exel Composites

The fourth company is Exel Composites which manufactures composite profiles and pipes for different industries. It has revenue of 79 million euros for the year 2014. (Exel Composites 2015)

3.3.5 Glaston

The fifth company is Glaston which manufactures glass processing machines and related solutions. Business has two segments which are Machines and Services. It has production in four different countries and revenue is 125 million euros for the year 2014. Glaston sold company's side business Kyro Power in the year 2007. Financial key numbers of Glaston in the Table 2 are without Kyro Power in the years 2005 and 2006. (Glaston 2015)

3.3.6 Kone

The sixth company is Kone which provides elevator and escalator solutions and maintaining service for them after installation. It is one of the leading companies in that field. The company employs over 47 000 employees. The revenue of the company is 7,3 billion euros for the year 2014. (Kone 2015)

3.3.7 Konecranes

The seventh company is Konecranes which is world leading group in industrial class cranes and their service. Total revenue of the company is 2 billion euros for the year 2014. The company operates in 48 different countries with 12 000 employees. (Konecranes 2015)

3.3.8 Metso

The eighth company is Metso which provides machinery and services for mining, oil, gas and rock crushing industries. It has three business fields that are Minerals, Flow control and Services. It has revenue of over 3,7 billion euros for the year 2014 and about 14 000 people are working for the company. The company operates globally within 50 countries. Metso divided into two companies in the year 2014. In this research combined financial numbers of Metso and Valmet were used in the year 2014 in the Table 3. (Metso 2015)

3.3.9 Lemminkäinen

The ninth company is Lemminkäinen which is specialized in construction business. It constructs infrastructure for public sector and builds houses for consumers. Revenue is 2 billion euros for the year 2014. The company operates in Nordic countries and Russia with 5600 employees. (Lemminkäinen 2015)

3.3.10 Outotec

The tenth company is Outotec which provides leading technology and service solutions for mineral, metal and water processing in mining industry. Outotec has two business areas that are Minerals Processing, and Metals, Energy & Water. The revenue of the company was 1,4 billion euros for the year 2014. (Outotec 2015)

3.3.11 Ponsse

The eleventh company is Ponsse which is one of the leading companies in forest machine manufacturing and maintenance services. The company employs over 1200 people worldwide. The revenue is 391 million euros for the year 2014 (Ponsse 2015)

3.3.12 Raute

The twelfth company is Raute which manufactures wood processing machinery. Customers use it to process wood into veneer, plywood and laminated veneer lumber. Company has revenue is 94 million euros for the year 2014 (Raute 2015)

3.3.13 SRV Yhtiöt

The thirteenth company is SRV Yhtiöt which is focused on house construction business. It has operations in Finland, Estonia and Russia. SRV group has revenue of 684 million euros for the year 2014 and it has about 1000 employees. (SRV Yhtiöt 2015)

3.3.14 Tulikivi

The fourteenth company is Tulikivi which is world's largest manufacturer of heat-retaining fireplaces. The company employs about 300 people and has revenue of 40 million euros for the year 2014 (Tulikivi 2014)

3.3.15 Vacon

The fifteenth company is Vacon which develops and manufactures AC drives and invertters. The company also provides maintenance services for these. Vacon's products save energy and offer optimum control for electric motors. Revenue of the company is 409 million euros for the year 2014 and it has 1600 employees. (Vacon 2015)

3.3.16 Vaisala

The sixteenth company is Vaisala which provides equipment for professional weather observation, industrial measurement and life science solutions. Revenue of the company is 300 million euros for the year 2014. (Vaisala 2015)

3.3.17 Wärtsilä

The seventeenth company is Wärtsilä which provides complete lifecycle solutions for marine and energy industries. Wärtsilä's business is divided to Ship Power, Power Plants and Services. The company has revenue of 4,8 billion euros for the year 2014 and it operates nearly 70 countries with approximately 17 700 employees. (Wärtsilä 2015)

3.3.18 YIT

The eighteenth company is YIT which leads the way in construction field. The construction company creates attractive and sustainable urban environments by

building housing, business premises, infrastructure and entire areas. The company divided in to two companies called Caverion and YIT in the year 2013. This event is the reason why in the Table 6 order backlog, revenue and operating profit of the YIT declined dramatically in the year 2013 (YIT 2016)

3.4 Process of collecting data

I wrote values to Excel-sheet containing total of 540 values. I did this manually opening every firm's financial statement from the selected years. For this process I practically observed 180 financial statements. Real amount of financial statements were bigger as many companies were excluded from this research due to missing information of order backlog. Also some companies which were excluded had only public information of 7 or 8 years of order backlog. It can be frustrating if data is collected at first for 8 years and then company suddenly stops presenting its order backlog. It took a significant time to collect those 540 values as financial statements are usually long and they use different names for order backlog depending of the company policy. For example total orders and orders at the end of the year are examples of different naming policies. There were also new orders presented in many financial statements which are not researched in this study. Also order backlog, revenue and operating profit could be in different pages in financial statement. Figure 5 presents process of collecting data for this research.

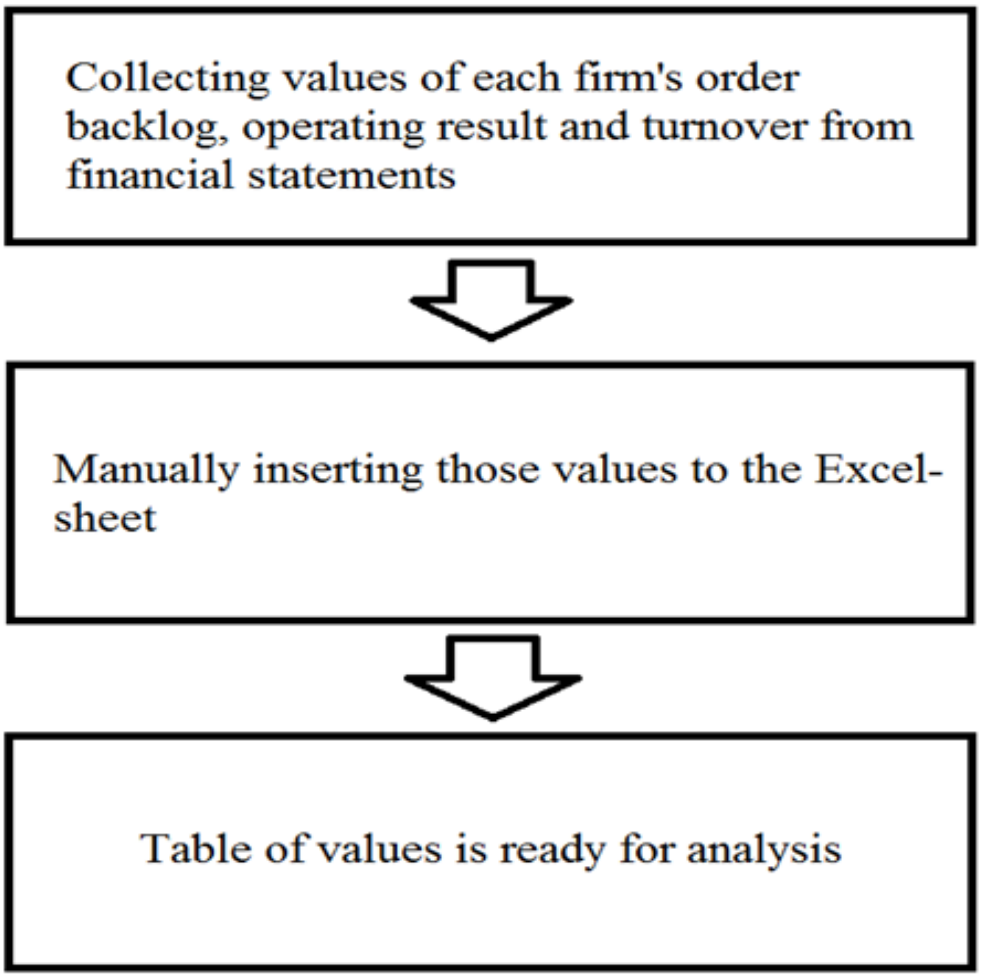


Figure 5. Process of collecting data for this research.

Next tables show values for each year's order backlog, turnover and operating result for the selected companies. All the numbers presented in the Tables 1–6 are in million euros. Sources for these tables are companies' financial statements for each year. Information of 180 financial statements was used in the creating process of these tables.

Table 1. Financial information of Cargotec, Componenta and Cramo.

	Year	Cargotec	Componenta	Cramo
Order backlog	2005	1257,00	60,40	31,10
	2006	1621,00	101,00	82,00
	2007	2865,00	129,00	94,60
	2008	3054,00	73,60	106,80
	2009	2149,00	58,80	102,80
	2010	2356,00	94,50	87,70
	2011	2426,00	99,50	102,70
	2012	2021,00	83,00	89,50
	2013	1980,00	87,00	85,20
	2014	2200,00	89,00	97,50
Turnover	2005	2358,00	343,20	77,00
	2006	2597,00	362,10	402,40
	2007	3018,00	634,70	496,40
	2008	3399,00	681,40	579,80
	2009	2581,00	299,60	446,70
	2010	2575,00	461,60	492,10
	2011	3139,00	576,40	679,90
	2012	3327,00	544,80	688,40
	2013	3181,00	511,00	657,30
	2014	3358,00	495,00	651,80
Operating result	2005	194,80	6,60	18,00
	2006	221,70	14,90	68,60
	2007	221,10	38,20	91,80
	2008	192,80	47,90	91,80
	2009	61,30	-15,40	18,80
	2010	131,40	13,50	27,40
	2011	207,00	29,80	54,30
	2012	157,20	10,00	64,40
	2013	92,50	18,20	66,80
	2014	126,60	17,80	34,30

Table 2. Financial information of Exel, Glaston and Kone.

	Year	Exel	Glaston	Kone
Order backlog	2005	12,40	108,80	2326,80
	2006	15,00	111,20	2762,10
	2007	12,90	87,00	3282,30
	2008	11,70	60,70	3576,70
	2009	8,20	45,50	3309,10
	2010	13,30	42,10	3597,80
	2011	13,10	37,60	4348,20
	2012	10,70	34,20	5 050,1
	2013	10,50	39,10	5 587,5
	2014	12,80	57,90	6952,50
Turnover	2005	91,30	238,90	3242,20
	2006	112,40	234,70	3600,80
	2007	113,50	269,80	4078,90
	2008	94,90	270,40	4602,80
	2009	70,00	151,80	4743,70
	2010	72,90	149,40	4986,60
	2011	85,10	142,70	5225,20
	2012	76,00	115,60	6 276,8
	2013	69,30	122,20	6 932,6
	2014	79,30	124,50	7334,50
Operating result	2005	12,40	22,10	272,00
	2006	7,10	18,10	360,10
	2007	10,10	16,60	473,2
	2008	8,20	6,20	558,40
	2009	6,80	-33,60	600,3
	2010	9,40	-11,30	696,40
	2011	11,10	-1,40	725,10
	2012	5,90	-3,40	828,70
	2013	5,50	2,10	953,40
	2014	8,90	4,90	1035,70

Table 3. Financial information of Konecranes, Metso and Lemminkäinen.

	Year	Konecranes	Metso	Lemminkäinen
Order backlog	2005	432,10	2350,00	1011,30
	2006	571,60	3737,00	1326,70
	2007	758,00	4341,00	1414,10
	2008	836,00	4088,00	1064,50
	2009	607,00	3415,00	958,40
	2010	756,20	4023,00	1226,40
	2011	991,80	5310,00	1400,40
	2012	942,70	4515,00	1443,90
	2013	893,50	3325,00	1733,20
	2014	979,50	3573,00	1456,10
Turnover	2005	970,80	4221,00	1601,70
	2006	1482,50	4955,00	1795,90
	2007	1749,70	6250,00	2174,10
	2008	2102,50	6400,00	2481,80
	2009	1671,30	5016,00	1965,50
	2010	1546,30	5552,00	1892,50
	2011	1896,40	6646,00	2183,90
	2012	2171,50	7504,00	2267,60
	2013	2099,60	6471,00	2020,10
	2014	2011,40	6131,00	2044,50
Operating result	2005	49,30	335,00	72,50
	2006	105,50	457,20	108,10
	2007	174,70	580,00	127,20
	2008	248,70	637,00	123,20
	2009	118,80	293,60	23,20
	2010	115,10	445,20	29,00
	2011	117,20	572,00	44,00
	2012	138,30	599,00	50,10
	2013	115,50	364,00	-3,90
	2014	119,10	423,00	52,30

Table 4. Financial information of Outotec, Ponsse and Raute.

	Year	Outotec	Ponsse	Raute
Order backlog	2005	596,00	54,90	55,00
	2006	866,40	59,20	77,00
	2007	1317,20	110,10	56,00
	2008	1176,70	41,50	24,00
	2009	867,40	20,30	22,00
	2010	1393,10	68,30	33,00
	2011	1985,00	71,90	36,00
	2012	1947,10	41,80	50,00
	2013	1371,70	99,80	28,00
	2014	1138,00	158,40	44,00
Turnover	2005	556,20	226,10	108,60
	2006	740,40	238,60	106,20
	2007	1000,10	310,10	110,80
	2008	1217,90	293,00	98,50
	2009	877,70	146,70	36,60
	2010	969,60	262,40	62,90
	2011	1385,60	328,20	74,30
	2012	2087,40	314,80	101,30
	2013	1911,50	312,80	83,30
	2014	1402,60	390,80	94,00
Operating result	2005	24,30	29,10	4,40
	2006	51,60	29,60	4,50
	2007	96,10	37,10	8,60
	2008	120,20	13,60	6,40
	2009	58,60	-15,70	-9,70
	2010	41,60	21,70	1,30
	2011	111,90	28,80	-0,70
	2012	184,30	24,50	5,00
	2013	141,90	22,50	1,80
	2014	10,40	41,70	2,60

Table 5. Financial information of SRV Yhtiöt, Tulikivi and Vacon.

	Year	SRV Yhtiöt	Tulikivi	Vacon
Order backlog	2005	251,80	9,20	18,80
	2006	453,70	10,40	29,70
	2007	545,20	6,90	34,80
	2008	460,80	4,90	48,00
	2009	481,60	4,80	32,00
	2010	593,70	6,30	52,10
	2011	810,80	5,70	36,60
	2012	827,80	4,60	50,00
	2013	949,00	4,40	46,80
	2014	937,00	4,20	62,20
Turnover	2005	422,00	58,60	149,90
	2006	479,50	82,10	186,40
	2007	544,80	69,90	232,20
	2008	547,10	66,50	293,20
	2009	390,50	53,10	272,00
	2010	484,80	55,90	338,00
	2011	672,20	58,80	380,90
	2012	641,60	51,20	388,40
	2013	679,40	43,70	403,00
	2014	684,40	39,30	409,40
Operating result	2005	21,80	6,30	18,10
	2006	24,60	8,20	23,10
	2007	12,20	1,00	29,20
	2008	34,80	3,20	34,60
	2009	10,70	-2,40	22,50
	2010	13,00	-0,30	32,40
	2011	14,10	-2,40	34,80
	2012	6,90	0,10	36,50
	2013	26,40	-4,30	40,60
	2014	24,90	-2,40	47,20

Table 6. Financial information of Vaisala, Wärtsilä and YIT.

	Year	Vaisala	Wärtsilä	YIT
Order backlog	2005	55,30	2906,00	1878,80
	2006	77,60	4439,00	2802,30
	2007	82,30	6308,00	3509,00
	2008	90,30	6883,00	3234,00
	2009	95,50	4491,00	2773,60
	2010	129,00	3795,00	3250,10
	2011	134,30	4007,00	3752,70
	2012	105,60	4492,00	3901,50
	2013	122,00	4311,00	2713,70
	2014	129,20	4530,00	2125,90
Turnover	2005	197,90	2639,00	3023,80
	2006	220,80	3190,00	3284,40
	2007	224,10	3763,00	3706,50
	2008	242,50	4612,00	3939,70
	2009	231,80	5260,00	3452,40
	2010	253,20	4553,00	3847,00
	2011	273,60	4209,00	4524,70
	2012	293,30	4725,00	4675,90
	2013	273,20	4607,00	1858,80
	2014	299,70	4779,00	1801,20
Operating result	2005	31,50	225,00	227,70
	2006	38,60	263,00	258,80
	2007	35,30	380,00	337,80
	2008	38,00	525,00	260,60
	2009	12,00	592,00	165,50
	2010	11,80	412,00	229,10
	2011	16,10	445,00	240,50
	2012	30,20	483,00	248,80
	2013	18,10	537,00	152,80
	2014	26,40	522,00	114,00

4 Analysis of the financial statements

According to Toon Taris (2000) the association of two variables can be measured using correlation coefficient (Taris 2000: 3). Also changes in order backlog, revenue and operating profit were observed in the 10 year period chosen and particularly in the downturn.

4.1 Correlation between order backlog, revenue and operating profit

I chose to calculate Pearson's correlation coefficient for order backlog, revenue and operating profit to see how they correlate to each other. Calculating correlation coefficient measures association between two variables as presented in methods used part of this research. I want to proof that order backlog affects significantly to revenue and operating result. Pearson's correlation coefficient formula is presented below in the Figure 6.

$$r = \frac{N\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{[N\Sigma x^2 - (\Sigma x)^2][N\Sigma y^2 - (\Sigma y)^2]}}$$

Where:

- N = number of pairs of scores
- Σxy = sum of the products of paired scores
- Σx = sum of x scores
- Σy = sum of y scores
- Σx^2 = sum of squared x scores
- Σy^2 = sum of squared y scores

Figure 6. Pearson's correlation coefficient formula. (Kavanaugh, 2015)

Value r ranges between -1 and 1. -1 means perfect linear negative correlation and 1 means perfect linear correlation. Value 0 means that there is not linear

correlation. High or low r means that y and x are linearly dependent. It does not proof causation between x and y. Causality is based on the information about relationship between variables. (Tapio Nummenmaa 1997: 154-155)

I calculated Pearson's correlation coefficient between order backlog and revenue using program named IBM SPSS Statistics (SPSS). All companies are in this calculation. This was done by using values in the tables above for ten year period. Result for this calculation is below in Table 7.

I also calculated p-value in SPSS to know if the correlation is significant. I used significance level of 5% which is commonly used in statistical analysis. Two-tailed P value is smaller than **0,000**. This means correlation coefficient for revenue and order backlog is extremely statistically significant. Result for this is also below.

Table 7. Order backlog and revenue correlation table from SPSS.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-83,650	54,342		-1,539	,125
	revenue	,806	,022	**,942**	37,312	**,000**

The Pearson's correlation coefficient is **0,942.** The correlation between order backlog and revenue seems very strong (Tapio Nummenmaa 1997: 162). Though the result is expected as order backlog is strong indicator of future revenue.

I also calculated p-value in SPSS to know if the correlation is significant. I used significance level of 5% which is commonly used in statistical analysis. Two-

tailed P value is smaller than **0,000**. This means correlation coefficient for revenue and order backlog is extremely statistically significant. (Tapio Nummenmaa 1997: 167)

Order backlog and revenue correlate almost perfectly. It is surprising that the correlation is this significant. The result proofs order backlog is leading indicator of revenue.

Scatter points in the Figure 7 created in Excel shows visually linear connection between order backlog and revenue. All the numbers presented in the Figure 7 are in million euros. Though there are clear scatter points which are not in the linear straight. This can be due to much higher order backlog compared to revenue in some cases.

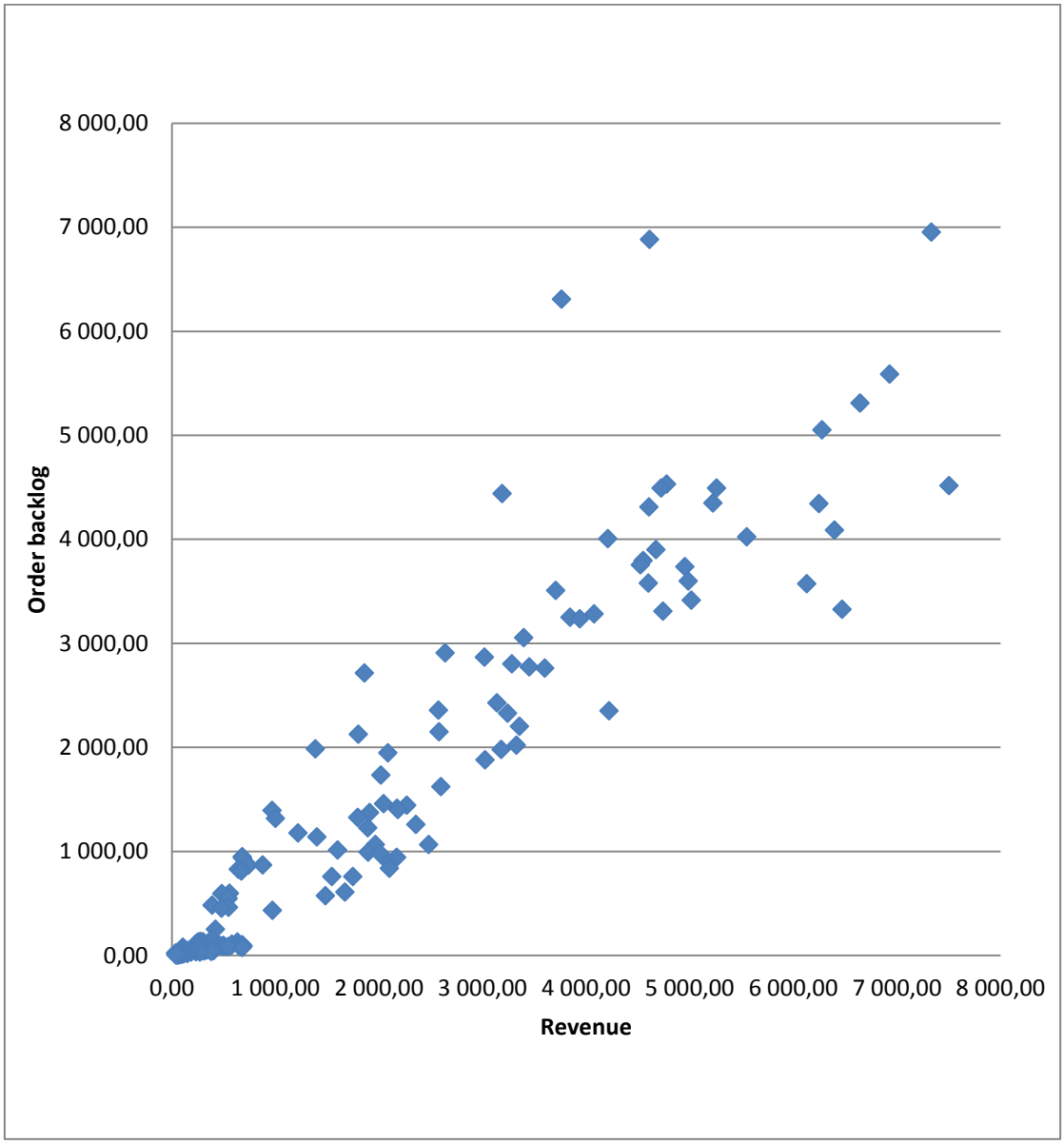


Figure 7. Order backlog and revenue.

For the second table calculated Pearson's correlation coefficient between operating profit and revenue. This was done by inserting financial statement data to SPSS from the Tables 1–6 above. Result for this calculation is below in the Table 8.

Table 8. Operating profit and revenue correlation table from SPSS.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	464,047	67,430		6,882	,000
	operating profit	8,773	,280	**,920**	31,311	**,000**

The Pearson's correlation coefficient for operating profit and revenue is **0,920**. High correlation between these two variables is sign of linear dependence. Causal relation could be determined as company has to generate revenue before operating profit. This means changes in revenue affects directly to operating profit. (Tapio Nummenmaa 1997: 155)

Two-tailed P value is smaller than **0,000** so the result is extremely statistically significant. Scatter table in the Figure 8 created in Excel shows visually linear connection between order backlog and revenue. All the numbers presented in the Figure 8 are in million euros.

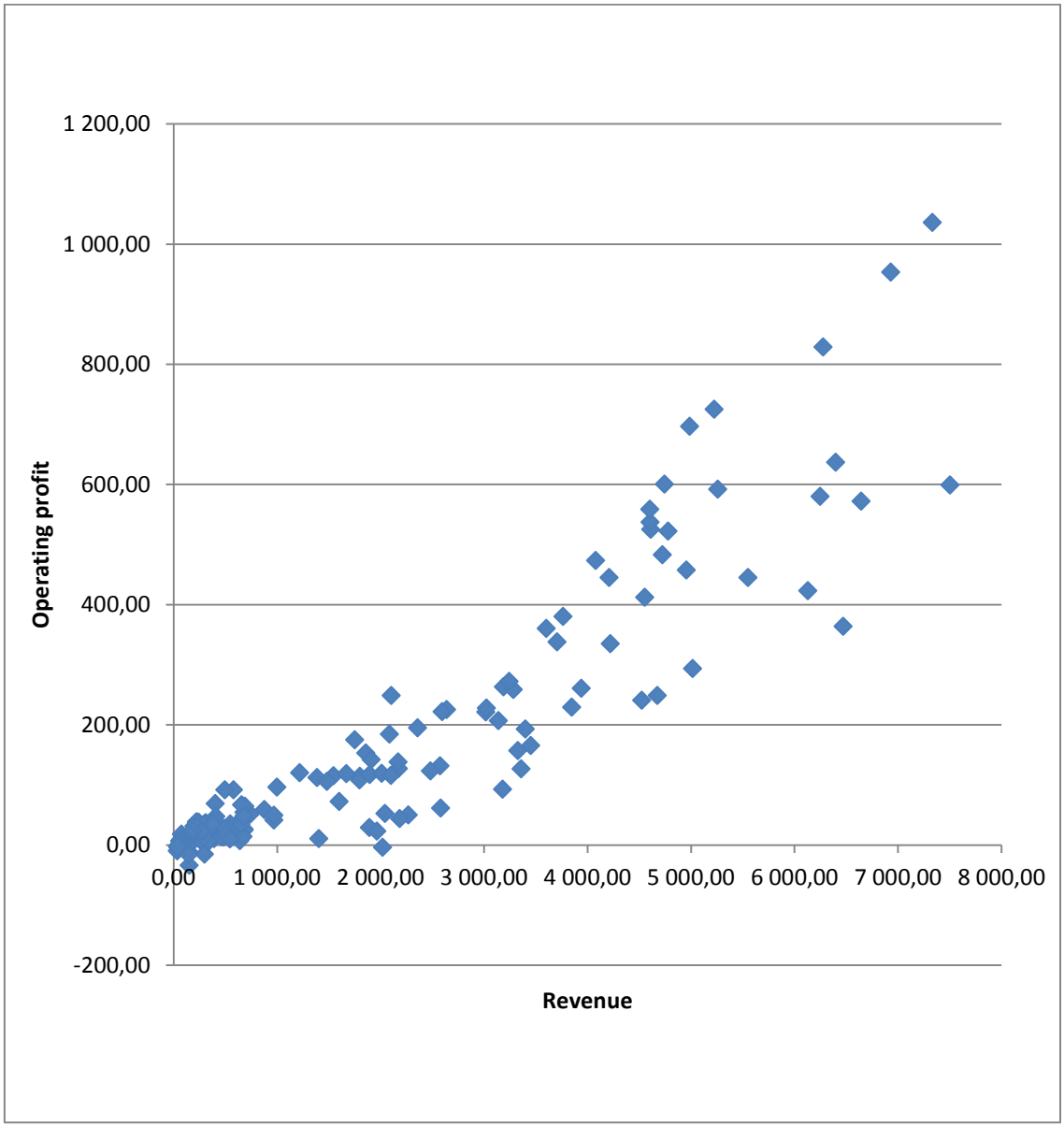


Figure 8. Operating profit and revenue.

For the third table I calculated Pearson's correlation coefficient between order backlog and operating profit. This was done by using same values in the tables above. Result for this is in the Table 9.

Table 9. Order backlog and operating profit correlation table from SPSS.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	251,204	63,502		3,956	,000
	operating profit	7,370	,264	**,902**	27,931	**,000**

The Pearson's correlation coefficient for order backlog and operating profit is **0,902**. High correlation between these two variables is sign of linear dependence. Causal relation could be determined as company has to generate order backlog before operating profit. This means changes in order backlog affects directly to operating profit. (Tapio Nummenmaa 1997: 155)

Two-tailed P value is smaller than **0,000** so the result is extremely statistically significant. Scatter points in the Figure 9 created in Excel shows visually linear connection between order backlog and operating profit. All the numbers presented in the Figure 9 are in million euros.

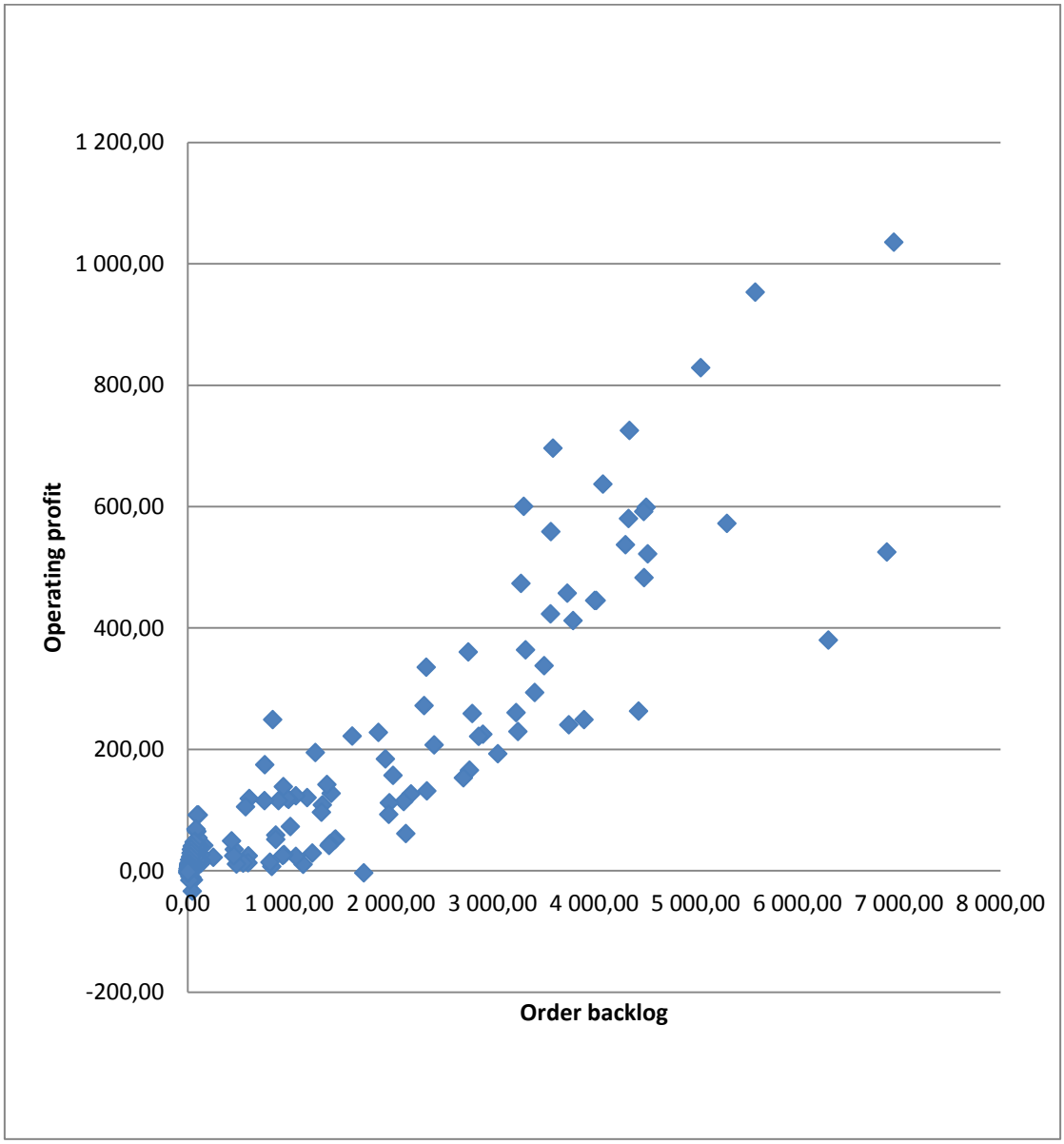


Figure 9. Operating profit and order backlog

4.2 How order backlog, revenue and earnings change in downturn?

In 2008 companies had total order backlog of 24835 million euros. In year 2009 it was only 19654,1 million euros. Total order backlog of the selected companies declined 20,86% in one year. Total revenue was 31923 million euros in the year 2009. In one year it declined 13,33% resulting 27666,40 million euros in the year 2009. Most significant change happened in operating profit.

Companies total operating profit for the year 2008 was 2950,6 million euros. It declined 35,4% in just one year to 1907,30 million euros. 5 of the companies did not make positive profit in the year 2009 as their operating profit was negative. Table 10 shows total numbers for the companies in years 2008 and 2009 in million euros.

Table 10. Total numbers before and after economic downturn.

Year	2008	2009
Total order backlog	24835,0	19654,1
Total revenue	31923,0	27666,4
Total operating profit	2950,6	1907,30

4.3 Which companies performed best in the downturn?

Only Kone and Wärtsilä had an increase in the revenue and the operating profit from the year 2008 to the year 2009. Tables 1–6 show that there is only one company, Vaisala which had bigger order backlog in the year 2009 compared to year 2008. Raute and Ponsse had over 50% decline in order backlog in the same period.

The company with scatter points rounded in the Figure 10 is Wärtsilä which has order backlog much higher than revenue for three consecutive years from 2006 to 2008. Rounded scatter points are not in the trend line due to Wärtsilä's stronger performance in the amount of order backlog. This is a very positive indicator for future revenue growth. Wärtsilä's revenue grew from the year 2005 to the year 2009 99,3% which is best growth in the selected period of all the companies researched. The economic downturn of the year 2009 caused decline in the order backlog putting it back to the trend line alongside other companies. Still the strong order backlog of the year 2008 has outstanding results for Wärtsilä's year 2009 revenue. It has the best percentage growth of

revenue in the year 2009. It is the only company alongside Kone which has a positive revenue growth in the year 2009. 16 other companies had declining revenue in the year 2009. This study indicates strong order backlog has significant effect on protecting company revenue from declining in economic downturn.

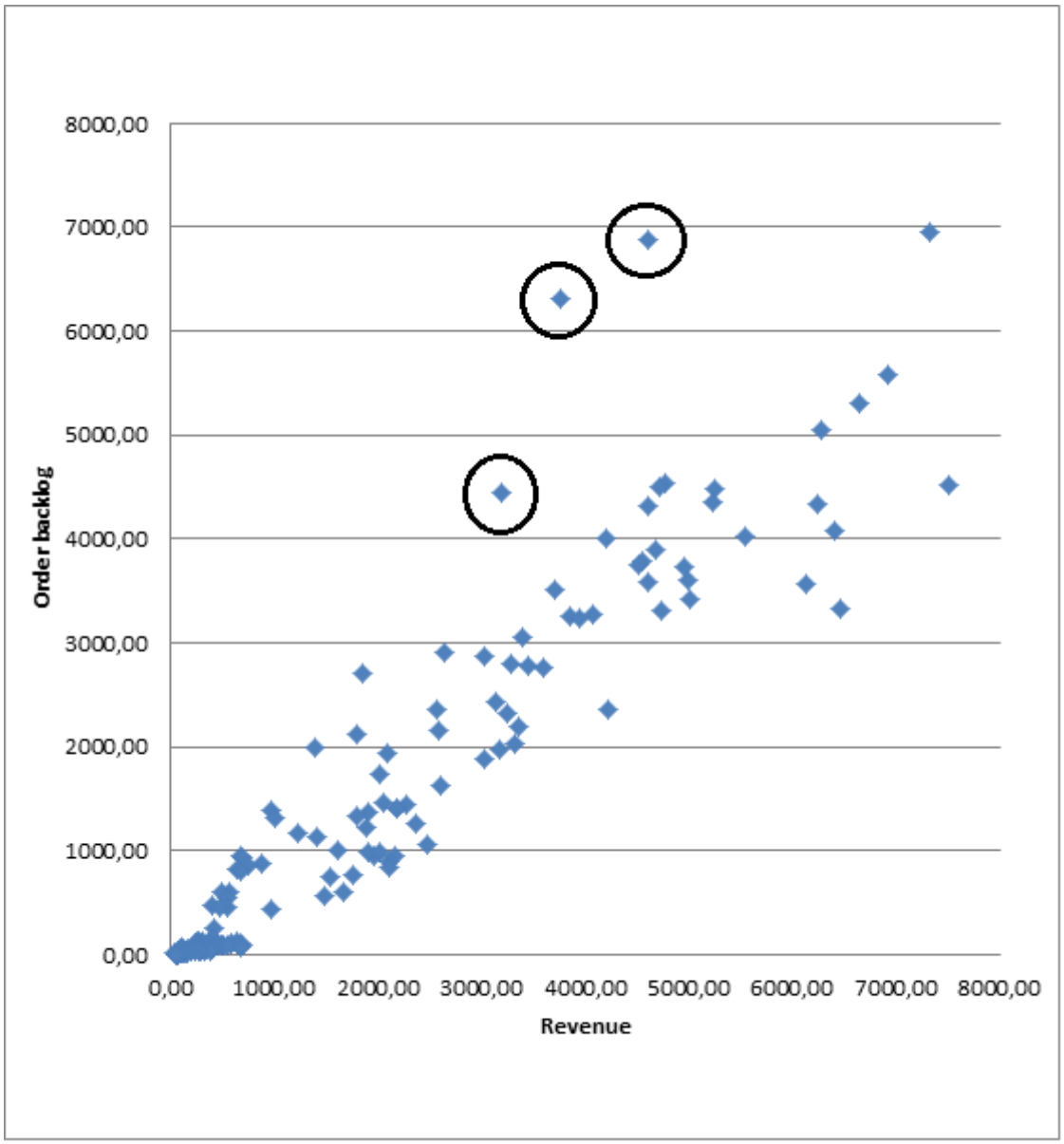


Figure 10. Wärtsilä's order backlog is much higher than other companies.

Wärtsilä and Kone are also only companies with growing operating profit in the year 2009. Kone is outstanding company. It is only firm which has operating profit growth every single year in the selected 10-year period. Kone has also best operating profit growth of 281% from the year end of the 2005 to year end of the 2014

5 Final results and discussion

After analysis chapter, final answers to the research questions are ready for observing. Order backlogs effects on the operating profit and revenue are presented. Also those factors relationship to the downturn is interesting. Finally there are best performing companies presented which have clear edge in the downturn compared to other industrial companies.

5.1 Research question 1

The first research question observed order backlog's effects on the company's future revenue and earnings in the 10 year period. According to Lev and Thiagarajan (1993) changes in the order backlog is leading indicator of future sales and earnings. This indicator is used to indicate future performance for example in the heavy and high technology industries (Lev & Thiagarajan 1993). Change in order backlog shows a much stronger association with both future profitability and revenue growth for a company (Gu, Wang, & Ye 2009: 2).

Order backlog is unfulfilled sales orders which need to be fulfilled in order to increase a company's revenue. Just an increase in the order backlog does not guarantee growing revenue and operating profit. The order fulfillment process has to be done according customer's demands. This means for example precise lead time and good quality in the process. Carefully planned order fulfillment process makes sure that the order backlog converts efficiently to revenue.

Analysis of the 18 industrial companies resulted in extremely high correlation between order backlog, revenue and operating profit. These results were also extremely significant as proved in the p-tests. Linear dependence of these variables was proven. These results prove as suggested in the theory part of this thesis that the order backlog is strong indicator of future revenue and

earnings. Correlation between these variables shows that the rise or decline in the order backlog affects the company's future revenue and earnings the same way. If the company's order backlog declines, so does the revenue and operating profit. Growing order backlog indicates revenue and operating profit to grow almost the same pace as the order backlog.

Order backlog's effect on the companies' revenue and operating profit is clearly visible in the Figure 11. Axis X presents the year and axis Y presents million euros. Every year total order backlog grows leads to the next year's revenue and profit to grow. In the years 2008 and 2012 order backlog declined, but the revenue and operating profit increased. Figure 11 shows that in the next years 2009 and 2013 also operating profit and revenue declined! **It seems that the declining order backlog indicates decline in revenue and operating profit in the next year. This is also possible sign which proofs that order backlog forecasts economic downturn. The order backlog correlates extremely significantly with company's revenue and operating profit in the 10 year period.**

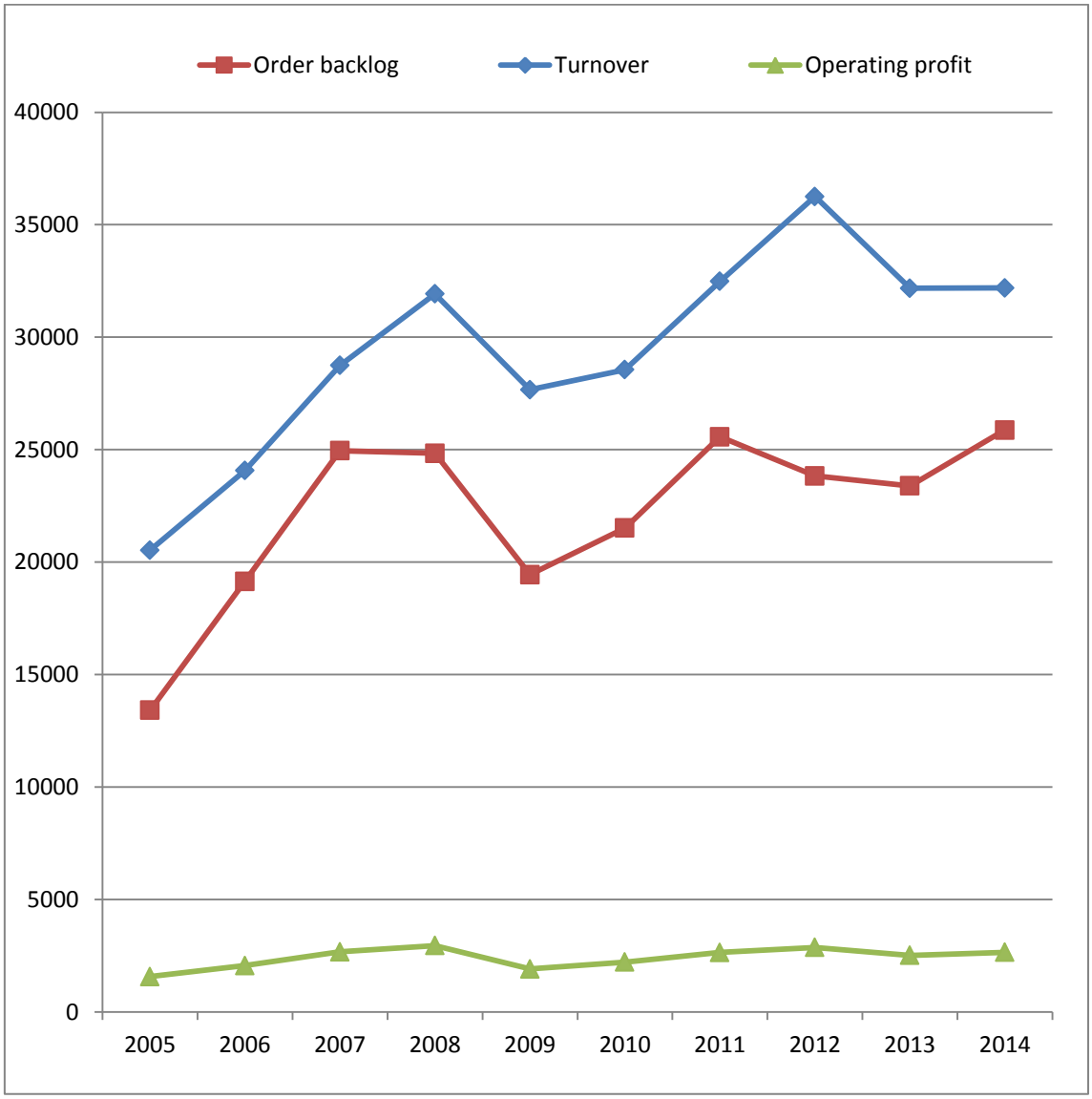


Figure 11. Development of total order backlog, revenue and operating profit

The extreme correlation between variables is surprising as it was not to be expected to be this strong especially between order backlog and operating profit. Still the correlation of the variables is expected as it has been researched in the theory part. This result indicates that order backlog data can be used for forecasting future revenue and operating profit. According to Gu, Wang and Ye (2009) analysts and investors appear to have no idea about that the increase in order backlog also implies better future profitability (Gu, Wang, & Ye 2009: 2).

5.2 Research question 2

The second research question observed how order backlog, revenue and operating profit changed in the economic downturn. **Total order backlog declined 20,86% in the year 2009. Total revenue declined 13,33% in the same period and also total operating profit declined 35,4%.** It seems that operating profit declines most. This is due to incapability to cut fixed and operating costs fast enough to meet new market situation of lower demand for the company's products.

Table 11 presents development of the total order backlog, revenue and operating profit. They shrink in the year 2009 compared to the year 2008. The companies could have been researched one by one. This could have been done for example inspecting average order backlog decline for all companies. This was not done as the result is very similar as calculating total order backlog, operating profit and revenue. **The most significant thing found in the calculations is the size of the decline percent as all factors shrink in the downturn, especially operating profit. Revenue change is the smallest because the old order backlog is protecting it from declining which proves the protective effect of order backlog in the bad economic times. Economic downturn seems to have very negative effect on the order backlog, revenue and especially operating profit.**

Table 11. Total data of the companies in the 10 year period.

Year	Order backlog	Turnover	Operating profit
2005	13415,70	20526,20	1570,90
2006	19142,90	24071,20	2063,30
2007	24953,40	28746,60	2670,20
2008	**24835,20**	**31923,00**	**2950,60**
2009	**19442,00**	**27666,40**	**1907,30**
2010	21517,60	28555,20	2218,70
2011	25569,30	32481,90	2647,20
2012	23834,90	36250,60	2869,50
2013	23387,40	32179,20	2512,10
2014	25870,80	32188,00	2648,20

Shrinking order backlog could cause serious financial problems to the company. For example order backlog of the companies Raute, Tulikivi, Componenta, Glaston and Ponsse got significantly smaller in the year 2008 compared to the year 2007. This is due to lack of new orders. The next year these companies made negative operating profit. These companies probably had difficulties to adjust their fixed and operating costs to the changing economic environment. Production capacity can be too big. It is possible that the lack of new orders could be one of the earliest signs of the company's future problems.

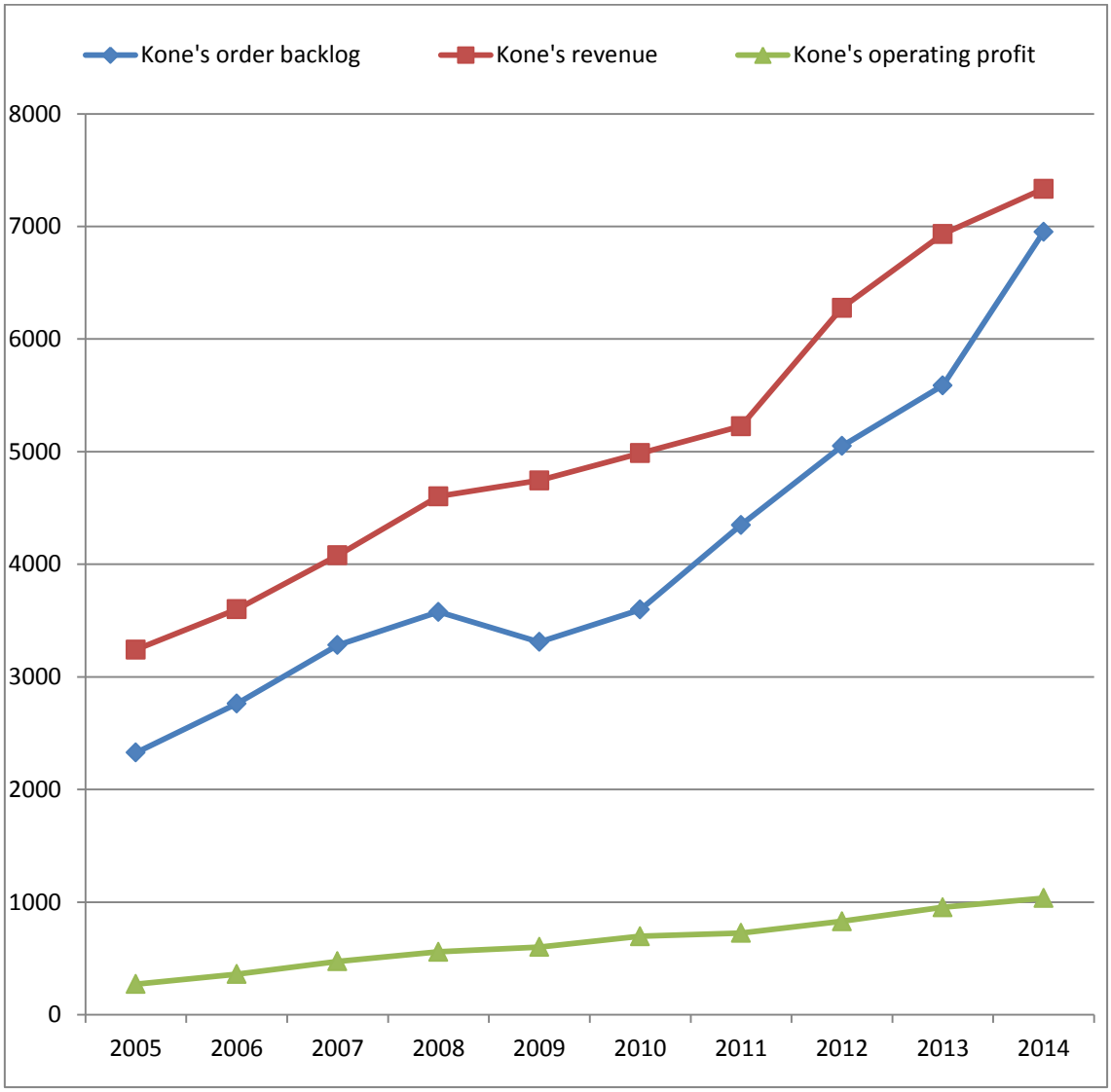
5.3 Research question 3

The third research question evaluated which companies performed best in the downturn. Even if the total key numbers in the financial statements of the companies declined, there are some companies which have growth in the year 2009 compared to the year 2008. This could be sign for company is having example good management and company culture or the company operates in fast growing industry which does not slow down even in the downturn.

Vaisala had growing order backlog in the year 2009 compared to the previous year. Inspecting Vaisala's financial statement of the year 2009 shows that company purchased Quixote Transportation Technologies which increased order backlog 6,8 million euros (Vaisala 2009). Without the acquisition, the actual order backlog was not growing but it was shrinking. This means that none of the companies researched could grow their comparable order backlog in the year 2009 economic downturn.

Kone and Wärtsilä were the only companies in the year 2009 which had growth in the revenue and the operating profit compared to the year 2008. Wärtsilä had much bigger order backlog compared to revenue before downturn as seen in figure 10. Wärtsilä's revenue growth in the year 2009 was also fastest of the companies researched. None of the other companies had bigger order backlog compared to revenue during the year 2008. This could mean that huge order backlog compared to revenue can protect company's revenue and operating profit during downturn.

Kone had best operating profit growth of 281% in the 10 year period. It was the only company which increased profit in the every single year during the selected period as seen in the Figure 12. Axis X presents the year and axis Y presents million euros. **Kone and Wärtsilä performed best in the downturn as they were the only companies with operating profit and revenue growth in the year 2009.**



12. Kone's key numbers

In the Figure 12 Kone's order backlog seems to have grown outstandingly aggressively in the year 2014 compared to the previous years. Still the revenue seems to be lagging behind in the same year as seen in the Figure 12. It would be interesting to know how this affects the company's year 2015 financial statement. Kone's order backlog was 24% higher in the end of the year 2014 compared to the end of the year 2013. The results of this research suggest that the revenue and operating profit should follow the fast growth of the order backlog in the year 2015. Kone's financial statement for the year 2015 shows

that operating profit grew 20% and revenue grew 18% (Kone, 2016). In this case the key numbers followed aggressively grown order backlog. This observing was done just to one company and the results are not statistically significant.

These results and observations suggest that the changes in order backlog should be taken very seriously in forecasting company future success.

5.4 future research

In the future it would be interesting to see how similar results would other companies give us. There could be 1000 companies in the research to give even more statistically significant results. Also longer timespan like 40 years for research would be interesting to observe. Finland is too small country to do this kind of large scale research based on listed companies which have public data found in their websites. For example research could be done about specific industry like construction and machinery. Also this study could be conducted in some country that has bigger markets like in Germany or in United States of America.

Research companies could be divided also to small, medium and large companies to see how the size of the company affects the research. In the 10 year period only small and medium sized companies seemed to have negative operating profit in the downturn. Large companies tend to be more stable as they have more significant resources in funding investments and other operations.

In theory part there were other factors than order backlog which affect company's operating profit and revenue. Those factors are key indicators for forecasting company's future. Deeper study about this could be done. For example what kind of is positive relation between growing gross margin and

growing revenue. More analysis methods could also be used to find more interesting results about the financial statements. This research did not calculate production cycle times in different companies which affects to how many orders are fulfilled in the next year.

Data analysis company Bloomberg Institute published in April 2016 an analysis tool which focuses on using supply chain data to estimate future earnings Also user of the tool can generate more accurate revenue forecast. Forecasting with supply chain data is future, not past. (Bloomberg 2016)

6 Conclusion

This thesis researched 18 industrial companies listed publicly in Finland. The main research question wanted to know how order backlog affects industrial company's revenue and operating profit in the 10 year period. The second research question examined how those factors change in economic downturn. The third research question observed which companies performed best in the downturn.

Future flow of earnings and revenue can be forecasted using leading indicators and order backlog is one of them. Order backlog is unfulfilled sales orders which generate revenue after order fulfillment process. This process divides to operational and strategic parts. Operational order fulfillment process is very transactional. It focuses on managing the customer order cycle and the specific activities are executed primarily within the logistics function. Strategic order fulfillment process focuses establishing the structure for managing the process. Implementation of the strategic process within the company is a necessary step in integrating the company with the stakeholders in the supply chain. These processes should be executed carefully as it is a way order backlog turns to revenue. Good quality and exact lead times in the process makes sure that customer will order more products or services from the manufacturing company.

Quantitative longitudinal research was used as a method. Period examined was 10 years as there are different situations in the market during that period like economic downturn. Data was collected in Excel using 180 different financial statements. The association of two variables can be measured using correlation coefficient Statistical hypothesis testing was concluded by calculating Pearson's correlation coefficient in SPSS.

The all calculations showed high linear dependence between order backlog, revenue and operating profit. Highest correlation of **0,942** was between order backlog and revenue. The Pearson's correlation coefficient for operating profit

and revenue was **0,920**. Also correlation coefficient for order backlog and operating profit was **0,902** which is also surprising high. Two-tailed P value for these correlation calculations was smaller than **0,000** so the results are extremely statistically significant. **This research found out that order backlog, operating profit and revenue correlate to each other extremely significantly. Order backlog's effect on revenue and earnings is significant due to causality of these variables.**

Then behavior of order backlog, revenue and operating profit was examined in the downturn which is referred globally as financial crisis. In the economic downturn of 2009 total order backlog of the researched companies went down **20,86%** in one year from the previous year. Also total revenue declined **13,33%**. Total operating profit declined most dramatically as it went down **35,4%**. The most significant thing found in these calculations is the size of the decline percent as all factors shrink in the downturn. **Operating profit declines most. This is due to incapability to cut fixed and operating costs fast enough. Revenue change is the smallest because the old order backlog is protecting it from declining. This calculation seems to prove big order backlog is good protection for the company in the downturn. Economic downturn seemed to have very negative effect on the order backlog, revenue and especially operating profit. Also significantly shrinking order backlog could be the main reason for the company's having negative operating profit in the downturn.**

Only Kone and Wärtsilä had an increase in the revenue and the operating profit from the year 2008 to the year 2009. Wärtsilä had much bigger order backlog compared to revenue before downturn which protected it in the downturn. This example could mean that huge order backlog compared to revenue can protect company's revenue and operating profit during downturn. Kone had best operating profit growth of 281% in the 10 year period. It was the only company which increased profit in the every single year during the selected period. These success factors could be sign that company has good management and

company culture. Or it might be that the company operates in fast growing industry which does not slow down even in the downturn. **Kone and Wärtsilä performed best in the downturn as they were the only companies in this research with operating profit and revenue growth in the year 2009. The results and observations of this master's thesis suggest that the changes in the order backlog should be taken very seriously in forecasting company future success.**

LIST OF REFERENCES

Bloomberg. (2016). *Equities: Using Supply Chain Data to Estimate Future Earnings* [Motion Picture]. Retrieved from https://vimeo.com/161775127.

Businessdictionary. (2016). Retrieved 20 April 2016 from http://www.businessdictionary.com/definition/backlog.html.

Cargotec. (2015). Retrieved 1 April 2015 from http://www.cargotec.com/fi-fi/cargotec/Sivut/default.aspx.

Componenta. (2015,). Retrieved 1 April 2015 from http://www.componenta.com/fi_about_us/.

Cramo. (2015). Retrieved 1 April 2015 from http://www.cramo.com/Web/Core/Pages/BusinessAreaStartPage.aspx?id=16902&epslanguage=FI.

Croxton, K. R. (2003). The Order Fulfillment Process. *The International Journal of Logistics Management, Vol. 14 Iss 1*. Retrieved from http://dx.doi.org/10.1108/09574090310806512.

Exel Composites. (2015). Retrieved 1 April 2015 from http://qfx.quartalflife.com/Clients/(S(02va42akjx3grbww2nlkgeum))/_Temp/Exel-Factsheet-02va42akjx3grbww2nlkgeum.pdf.

Glaston. (2015) Retrieved 1 April 2015 from http://www.glaston.net/Global/Investors/Glaston_Vuosikertomus_2014.pdf?epslanguage=fi.

Gu, L., Wang, Z., & Ye, J. (2009). Information in Order Backlog: Change versus Level. Retrieved 21 October 2015 from http://www.fma.org/NY /Papers/Informationinorderbacklogchangeversuslevel.pdf.

Gulan, Haavio, & Kilponen. (2014). *Suomen Pankki.* Retrieved 10 June 2015 from https://helda.helsinki.fi/bof/bitstream/handle/123456789/13320 /173610.pdf?sequence=1.

Kaipia, R. (2008). Effects of delivery speed on supply chain planning. *International Journal of Logistics Research and, 11*(2). Retrieved from http://dx.doi.org/10.1080/13675560701671687.

Kavanaugh, M. (2015). Kavanaugh's Vehicle for Content and Curriculum. Fairfield, Maine, USA. Retrieved 1 June 2015 from http://www.kvccdocs.com/KVCC/2013-Fall/PSY101-OLA/ assignments/QA-Ratio-Ratio-Data.html.

Keely L. Croxton, S. J.-D. (2001). The Supply Chain Management Process. *The International Journal of Logistics Management, 12*(2), 21.

Kesla. (2015). Retrieved 1 April 2015 from http://www.kesla.fi/documents/10304/0/Vuosikertomus+2014.

Kone. (2015, 4 1). Retrieved from http://www.kone.com/fi/yhtio/.

Kone. (2016). Retrieved 20 April 2016 from http://cdn.kone.com/ www.kone.com/fi/Images/KONE_Tilinpaatos_2015.pdf?v=3.

Konecranes. (2015). Retrieved 1 April 2015 from http://www.konecranes.com /investors/konecranes-as-investment/factsheet.

Lambert. (2001). Supply chain metrics. *International Journal of Logistics Management, 12*(1). Retrieved from http://search.proquest.com /docview/235943909?accountid=14797.

Lambert, D. M. (2005). *Supply Chain Management: Processes, Partnerships, Performance.* ISBN:0975994913.

Lemminkäinen. (2015). Retrieved 1 April 2015 from http://www.lemminkainen.fi/Lemminkainen/Yritys/.

Lev, B., & Thiagarajan, S. R. (1993). Fundamental Information Analysis. *Journal of accounting Research, 31*(2). Retrieved 23 October, 2013, from http://faculty.haas.berkeley.edu/kli/papers/Lev%26Thiagaraian-1993JAR.pdf.

Lynn: (2009). *Methodology of Longitudinal Surveys.* Wiley. ISBN: 978-0-470-01871-2.

Metso. (2015). Retrieved 1 April 2015 from http://www.metso.com/company/about-us/.

Outotec. (2015). Retrieved 1 April 2015 from http://www.outotec.com/en/Investors/Outotec-as-an-investment-2/.

PKC Group. (2015). Retrieved 1 April 2015 from http://qfx.quartalflife.com/Clients/(S(ccmkdu4xuxa2shy4d05lhyy5))/_Temp/pkcgroup-Factsheet-ccmkdu4xuxa2shy4d05lhyy5.pdf.

Ponsse. (2015). Retrieved 1 April 2015 from http://www.ponsse.com/ponsse.

Rajgopal, S., Shevlin, T., & Venkatachalam, M. (2003). Does the Stock Market Fully Appreciate the Implications of Leading Indicators for Future Earnings? Evidence from Order Backlog. *Review of Accounting Studies, 8*, 461. Retrieved 20 October 2015 from http://search.proquest.com/docview/208533138?accountid=14797.

Raute. (2015). Retrieved 1 April 2015 from https://newsclient.omxgroup.com /cdsPublic/viewDisclosure.action?disclosureId=644548&messageId=800 904.

SRV Yhtiöt. (2015). Retrieved 1 April 2015 from https://www.srv.fi/en /srvcompany/srv-company.

Taloussanomat. (2012). Retrieved 31 October 2015 from http://www.taloussanomat.fi/porssi/2012/10/15 /elcoteqin-ex-pomoksmlssa-luxemburg-syopalainen-eun-sisalla /201239865/170.

Tapio Nummenmaa, R. K. (1997). *Tutkimusaineiston analyysi.* Porvoo: WSOY. ISBN:P9510213691.

Taris, T. (2000). *A PRIMER IN LONGITUDINAL DATA ANALYSIS.* London: SAGE Publication. ISBN:0761960260.

Tulikivi. (2015). Retrieved 1 April 2015 from http://www.tulikivi.com /en/tulikivi/corporation.

Vacon. (2015, 4 1). Retrieved 1 April 2015 from http://www.vacon.com /Vacon/company/.

Vaisala. (2009). Retrieved 20 April 2016 from http://www.vaisala.fi /fi/investors/reports/annualandinterimreports/2009/Tilinp%C3%A4%C3%A4t%C3%B6s%202009.pdf.

Vaisala. (2015). Retrieved 1 April 2015 from http://www.vaisala.com/en/investors/companyinfo/Pages /review-CEO.aspx.

Valmet. (2015). Retrieved 1 April 2015 from http://www.valmet.com/en/about_us.nsf/WebWID/WTB-131118-2257B-DAA91?OpenDocument.

Wang, M. (2013). Longitudinal Research. ISBN: 9780199846740.

Wärtsilä. (2015). Retrieved 1 April 2015 from http://www.wartsila.com/about.

YIT. (2016). Retrieved 26 April 2016 from http://www.yit.fi/yit_fi /Tietoa_YITsta/Perustietoa_YITsta/YIT%20lyhyesti.