LUT School of Business and Management

Master's Thesis, Accounting

ACCURACY OF REVENUE FORECASTING AS A DEVELOPER OF FINANCIAL MANAGEMENT IN THE CONSTRUCTION INDUSTRY – CASE SKANSKA

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ABSTRACT

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The purpose of this research is to examine the diverse influences of accurate and inaccurate revenue forecasting on the performance of financial management and related business functions. The research examines the construction stream of Skanska Finland and is grounded on triangulation, combining the quantitative financial data and the qualitative material from ten interviews.

Given the current financial forecasting ability and the challenges and future visions of forecasting in the case study company, the research aims to compare the findings with the tendencies found in theoretical framework. The research focuses on the benefits of accurate forecasting as an enabler of better vision and judgement for managerial decision-making at all organizational levels. On the basis of the results, the aim is to identify key elements of revenue forecasting and the possible trends for further development of forecasting in the case study company.

The findings of this study stated that future-oriented market review, better system support, automation, sharing of the best practices, more profound focus on the forecasting of target works, communication, training and process follow-up have most potential to improve the accuracy of financial forecasting. The results of the empirical research clearly highlight the importance of the link between strategic management, organisational steering and a well-functioning forecasting process.

TIIVISTELMÄ

Tutkimuksen tarkoituksena on tutkia tarkkojen ja epätarkkojen liikevaihto-ennusteiden erilaisia vaikutuksia talousjohtamiseen ja siitä riippuvaisiin liiketoimintoihin. Skanska Suomen rakentamispalvelut -liiketoimintoa tutkitaan triangulaation avulla, joka hyödyntää kvantitatiivista talousdataa ja laadullista aineistoa yhteensä kymmenestä haastattelusta.

Ottaen huomioon tapaustutkimusyrityksen taloudellisen ennustamisen nykytilan, ennustamisen haasteet ja tulevaisuudennäkymät, tutkimuksen tavoitteena on verrata tutkimushavaintoja teoreettisessa viitekehyksessä havaittuihin suuntauksiin. Tutkimuksessa keskitytään tarkan ennustamisen hyötyihin, jotka mahdollistavat paremman näkemyksen ja arviointikyvyn johdon päätöksenteon tueksi kaikilla organisaatiotasoilla. Tutkimustulosten perusteella tavoitteena on yksilöidä liikevaihdon ennustaminen avaintekijät ja mahdolliset kehityssuunnat ennustamisen jatkokehitystä ajatellen tapaustutkimusyhtiössä.

Tämän tutkimuksen tulokset osoittivat, että tulevaisuuteen suuntautuva markkinakatsaus, parempi järjestelmätuki, automaatio, parhaiden käytäntöjen jakaminen, syvempi keskittyminen tavoitetöiden ennustamiseen, viestintä, koulutus ja prosessin seuranta ovat potentiaalisimpia tapoja parantaa talousennustamisen tarkkuutta. Empiirisen tutkimuksen tulokset korostavat selvästi strategisen johtamisen, organisaation ohjauksen ja toimivan ennustamisprosessin välisen yhteyden merkitystä.

ACKNOWLEDGEMENTS

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SYMBOLS AND ABBREVIATIONS

e	Error
n	Number of Observations / Sample Size
t	Time
X Y	Actual Value
$\hat{Y}$	Forecast Value
BB	Beyond Budgeting
BBRT	Beyond Budgeting Round Table
BI	Business Intelligence
BI & A	Business Intelligence & Analytics
BIM	Building Information Modelling
BU	Business Unit
CODP	Customer Order Decoupling Point
EBIT	Earnings Before Interests and Taxes
EBIT %	EBIT's Relative Share of Revenue
EVA	Economic Value Added
MAPE	Mean Absolut Percentage Error
MPE	Mean Percentage Error
PE	Percentage Error
POC	Percentage of Completion
S & A	Sales and Administrative Costs
S & OP	Sales and Operations Planning

1. INTRODUCTION

The purpose of forecasting in general is to provide a reasonable assurance of what might happen next (Lawless 2014, 44). In the modern business environment, the role of forecasting is more important than ever. The cycle of business has accelerated exponentially during the past decades forcing the information needs and flows to be constantly more versatile and rapid. Furthermore, stakeholders are increasingly demanding more accurate forecasts and supplementary analysis of key business information at an even faster pace. (Moon & Mentzer 2005; Waller & Fawcett 2013)

The role of data in today's organizations is enormous. Phenomenon has been simultaneously facilitated by the rapid development of technology and the reduced cost of data storage (Elbashir et al. 2013, 87). Business analytics is all about creating value out of the data (Acito & Khatri 2014, 566). Advanced data analytics allows companies to erect a complete "360 degrees" understanding of their business and operations. Better vision enables more effective steering, optimizing, process development and even partial automation of decision-making. (Bose 2009, 155) Forecasting is a fundamental company management process. Market awareness, strategy reviews, customer knowledge and financial forecasting provide the necessary information for management decision-making and goal setting. Despite the fact that forecasting is a broadly handled and familiar topic, it may easily be overlooked in the business world. (Lawless 2014; Wilder & Ozgur 2015) For many companies forecasting is also a process that includes a lot of untapped potential.

The primary task of management accounting is to enable managerial decision-making through measuring, analysing and reporting business-related financial information. Therefore is it quite obvious to draw a line between management accounting, business intelligence, analytics and forecasting. (Rikhardsson & Yigitbasioglu 2018, 37) The fundamental analysis of the company facilitates the predictability of its operations (Lee 1999, 415). Fundamental analysis may be understood as a study of historical data, which aims to improve the accuracy of forecasting. Accurate forecasts are in place to discover trends in advance, to

understand and map the threats and opportunities of business, to question existing assumptions and to guide towards alternative approaches. The key notion is to foresee the upcoming turns in business and to intervene before a turn occurs and risks materialise (Järvenpää et al. 2001, 165).

Efficient data access and processing empowered by new technologies have changed the way of business forecasting. The data, of which availability used to be utopia, is now helping companies to plan their future. Organisations are ready to resource considerably in an attempt to forecast the market movements. (Frizzo-Barker, Chow-White, Mozafari & Ha 2016, 403) Therefore, it is fundamental to understand the current way of forecasting in the company, what are the related challenges and limitations and to perceive the future development paths of forecasting.

1.1 Background

The only way to gain comprehensive knowledge of the future is firstly to understand what has happened in the past and secondly to create a review horizon from this moment forward, which take into account both the organizational tendencies and the issues identified in the surrounding business environment. The use of economic indicators as performance metrics offers first and foremost static past review and answers the question 'what has already happened'. However, the fast-paced modern business world requires constant renewal from companies and becoming fixated on the rear-view mirror may be fatal for business. (Bose 2009; Jain 2006) On the other hand, carefully thought out forecasting processes enable the company to clarify its own operations, to know what to expect in the future and to gain more competitive advantage (Armstrong 2001, 60).

In addition to the internal needs of the company, disclosure obligations create a basic need for forecasting and analytics. Compelling needs vary from listed companies to more liberal reporting obligations of unlisted companies. Furthermore, forms of voluntary disclosure have become more widespread, including corporate responsibility reporting. (Eng & Mak 2003, 325) The disclosure obligation of listed companies applies not only to the financial statement information, but also to all the

information that is relevant to the valuation of a listed company. The relevant information refers to any substantial change that the listed company must inform investors about. Thus, change management and forecasting can be considered an important area from the perspective of the company's credibility, image and profitability. Furthermore, reliable and systematic forecast may be the key facilitator in communication with stakeholders.

"The paradigm shift towards more data-intensive business landscape is inevitable."
(Ylijoki 2019, 103)

Today's sophisticated predictive models are data driven, real-time platforms that are able to adjust seamlessly based on the need of the user case (McAfee et al. 2012, 64). In the construction business, this could mean better communication and faster response to change at all organizational levels in case of an altered situation that forces the original plans to change on the fly. In the best case, the use of better forecast models could benefit the whole business model and lead to better bid calculations, increased productivity, improved safety, reduced costs and completion time, better quality of the end product and more accurate financial forecasts (Kärkkäinen, Lavikka, Seppänen & Peltokorpi 2019, 155). From the financial point of view, it does not matter if we consider the construction site management or the group leadership team; the objectives have the same core. Projects and operations are wanted to be as predictable as possible.

During the 1980s, business forecasting began to emphasis demand-driven forecasting and this has increased in significance ever since (Lapide 2009, 18-19). Revenue related financial ratios, such as EBIT's (Earnings Before Interests and Taxes) relative share of revenue (henceforth abbreviated as 'EBIT %'), have always played an important role in measuring and steering the performance of the company. Case study company of this research is Skanska that operates in a highly competitive construction industry known for its modest profit margins. Since Skanska have globally had a few setbacks in the construction business, focus has been increasingly centred on relative profitability. In this regard, the accuracy of revenue forecasting has a key role in strategic guidance of Skanska.

1.2 Research Objectives and Delimitations

Forecasting is widely recognized as an essential capability for business management (Cox 1987, 515). As a planning facilitator, the importance of forecasting is undeniable. Financial forecasting, as its best, comprises the core of management decision-making and gives the people in charge a telescope to capture moments in the future to analyse, plan and more importantly, take action. Data obtained in the forecasting process nourishes the business intelligence and data analytics, which are first and foremost designed to enhance the efficiency of decision-making (Rikhardsson & Yigitbasioglu 2018, 43). The data needed for effective forecasting and predictive analytics is widely available in the majority of organizations. However, its utilization as part of financial forecasting is still not very common. Therefore, organizations need to reflect on how much information can be accessed and hence utilized in a way that benefits the organization. Waller & Fawcett (2013, 79-80) considered forecasting as one of the most fertile areas of predictive analytics to further research.

The purpose of empirical research is to identify the status of financial forecasting in the case study company. Given the current financial forecasting ability and the way of forecasting in the case study company, research aims to compare it with the examples found in theoretical framework. Research focuses on the use and the benefits of the accurate forecasting as an enabler of better vision and judgement for management in all organisation levels. On the basis of these results, aim is to identify possible trends for the development of forecasting in the case study company. The primary research question to be answered is:

How can we improve the accuracy of financial forecasting in general?

The first sub-objective is related to the explanatory impact of secured revenue in construction business. The purpose of the first sub-objective is to discover regularities on how financial forecasting accuracy improves over time. The primary dependent variable is the accuracy of revenue forecast, whereas the explanatory factor is the amount of secured revenue. Secured revenue is based on the share of

the forecasted revenue to be recognized during certain year, which is already in the order backlog. The second sub-objective takes a position on the role of rolling forecasting as part of the financial forecasting process and its accuracy in the case study company. The secondary research questions are:

*How the amount of secured revenue affects forecast accuracy
in different time horizons?*

What is the role of rolling forecasting related to forecasting accuracy?

The empirical part of the research is delimited to study the construction company Skanska, more specifically its operational business unit Finland (henceforth abbreviated as 'BU') and its regional and district units. Research is limited in time to cover the years 2015 - 2018. The empirical evidence of the research is geographically cropped to Finland. Skanska's business in Finland is divided into regional and district units, which are studied as individuals, sub-entities and as a whole in this thesis. The results of this study may be used for decision-making on how to improve the company's ability to forecast, as well as to deepen the understanding of the nature of financial forecasting in construction business.

The research does not consider the theories of activity-based budgeting, zero-based budgeting due to the fact that study aims to focus on the underlying theories of budgeting only to the extent that is essential to chosen setting of the research problem. The criticism of budgeting is presented selectively and appropriately. This approach is justified under the guise of maintaining the focus of the thesis. In addition, the literature review excludes a more detailed exploration of the themes of strategic management, which is a really broad theoretical field. However, elements of strategic management are tied in to the themes of forecasting and analytics since they act as enabling factors of strategic decision-making and business planning. Budgeting and financial forecasting are extremely widely researched and published topics, which justifies this thesis to focus on studying the phenomenon of forecasting through the empirical data in a multi-level business environment. However, when interpreting the findings of this study, its limitations due to the method of research should also be considered.

1.3 Research Methods and Data

This research is grounded on triangulation, combining elements from quantitative and qualitative research. This research consists of two sections of which concurrent objective is to define comprehensive answers to research questions through earlier academic research, known theories and empirical case study (see figure 1, 7). The purpose of the literature review is to form a theoretical basis of the research. Chapter 1.4 briefly presents the most relevant theories of this research, which constitute the theoretical framework of the study.

The empirical part of the thesis has been implemented as a case study, which is particularly well-suited research method when investigating emerging phenomena (Lillis & Mundy 2005, 119). The empirical case study analyses the mixture of quantitative data and qualitative material. Secondary, quantitative data is collected from financial management systems of the case study company. Qualitative data is based on the interviews with ten professionals from the case study company. In addition, the self-acquired business and industry experience of the author may be heard in the thesis. Thus, background knowledge for example on the current state and challenges of forecasting in the case study company has arisen from discussions with colleagues during the past 6 years. This has considerably helped in the rewarding formation of the research problem and set-up of the interview questions.

Examining the forecasting process as a case study is carefully considered approach angle. Case study as a research strategy helps researcher to obtain abundant comprehension of the research context (Saunders 2011, 146). Research method leaves room for diversity and complexity of the phenomenon while increasing the understanding of the research problem. Based on reflection and observation of the obtained qualitative and quantitative results, the objective of this thesis is to answers thoroughly to the research questions.

The research is conducted in a close co-operation with construction company Skanska in Finland. First, study aims to demonstrate the forecasting ability and characteristics of construction stream of Skanska Finland through quantitative data.

Thereafter, qualitative data is engaged to thoroughly investigate the current status, challenges and development visions of the future revenue forecasting in the company. How the accuracy of financial forecasting can be further improved to be an increasingly robust and significant part of strategic decision-making?

1.4 Theoretical Basis

The theoretical basis of the thesis is built on the earlier studies of the themes of this thesis. Academic framework of the thesis is formed around the key words of financial forecasting, business analytics, budgeting, rolling forecasting and demand management. Characteristics and processes behind these topics as well as their contribution for business planning and management decision-making are regarded. The most important terms and theories concerning this study, and the connections between them are outlined in figure 1.

THEORETICAL FRAMEWORK

Financial Management & Control

ALTERED THEORY OF BUDGETING

Beyond Budgeting

Budgeting & Forecasting Processes

CODP in Construction Business

Intelligent Business Information

FORECASTING & ANALYTICS

Rolling Forecasting

Traditional Budgeting

DEMAND DIRECTS BUSINESS PLANS

Data-Driven Forecasting

Strategic Decision-Making

Advanced Data Analytics

Predictive Analytics

Demand Management & Forecasting

RESEARCH AREA & METHODOLOGY

EMPIRICAL RESEARCH

SECURED REVENUE IN CONSTRUCTION

CHALLENGES OF FORECASTING

NEEDS & FUTURE OF FORECASTING

RESULTS & CONCLUSIONS

Figure 1. The Structure of Theoretical Framework and Empirical Research

Alongside the peer-reviewed journal articles and books from the fields of management accounting, strategy management, operations management and economics, are used to endorse the theoretical basis of the thesis. The purpose of the literature review is to disclose the most relevant subjects related to the topic of this thesis.

1.5 Structure of the Thesis

Thesis consists of five main chapters. Figure 1 (see page 7) presents overview of the thesis split into the theoretical and the empirical part. The introduction chapter presents background, objectives and delimitations of the research. Furthermore, the research methods and data are introduced together with the summary of the most important theoretical sources that are affected by this research. Chapters two and three present the theoretical basis of the research starting from traditional budgeting through various perspectives of forecasting and financial business analytics. Theoretical framework of the research proceeds with the reflections related to the dominant role of demand forecasting in business planning particularly in construction industry. At the end of the chapter three, theoretical reflection to case study takes place creating fundamentals for the empirical research and presenting the hypotheses of the study.

The empirical part of the study starts with the presentation of the research area, methodology and data used in the case study. Empirical analysis in chapter 4.4 is divided in six subchapters, all of which aim to gain an in-depth grasp of the studied phenomenon and to provide instruments to answer research questions. First subchapter analyses the effects of secured revenue in construction industry from the financial forecasting point of view. The second, third and fourth subchapters disclose the current status, characteristics of target work forecasting and time horizons and the dares related to financial forecasting in the case study company. Fifth subchapter focuses on features and existent utilization of rolling forecasting. Final subchapter outlines the future visions and needs of financial forecasting which were brought up during the research. The last main chapter presents the summary and conclusions of the thesis, the synthesis of the results, answers to research questions alongside the criticism of the results and approach for further study.

2. FROM BUDGETS TO DYNAMIC FORECASTS

"Budgets are formalized plans of management's objectives"
(Raghunandan et al. (2012, 111).

Budgeting is a widely used and essential financial management tool that enables companies to set financial goals, implement related measures, and monitor their achievement. The role of budgeting in decision-making is academically widely emphasized. Budgeting is one of the most important tools that influence the organization's management and steering (Malmi et al. 2001, 487). Budgets also allow you to compare the financial outcomes of different options and play with the scenarios before final decision-making (Shim & Siegel & Shim 2012, 20). Horngren et al. (2010, 789) describe budget as a quantitative action plan for a specific time period, which is utilized in coordination, planning and decision-making by the all management layers of the organisation

Although the budget reflects the development of the past, its ultimate purpose is to determine and predict the future events as accurately as possible and to allocate the available resources to achieve the goals of the organisation (Wildavsky 2002, 7-8). Aforementioned interpretation, where the definitions of forecasting and budgeting are very close to each other, differs from mainstream. Generally, traditional budgeting literature separates budgeting from forecasting and strategic planning. The role of budgeting is often described as an operational management tool, which includes binding and restrictive factors. The culture of fear if cost budget is exceeded, government and management approvals and using the budget as a tool for managerial commitment are characteristic features or traditional budgeting culture. (Becker 2014; Hope & Fraser 2003; Morlidge & Player 2010) At its best, budget is used simultaneously for all of its macro functions: operational planning, resource allocation and performance evaluation (Becker, Mahlendorf, Schaffer & Thaten 2016, 1493). When budget works optimal for business support, it covers all of its purposes.

Micro functions of budgeting may be divided to six tasks. Budgeting is a control tool, which helps management to perceive the actual and previously forecasted costs of

different activities. Budgeting allows organisation to match its short-term targets and day-to-day operations with a long-term strategic plans. Budget as a performance measurement tool meters the achievements of the managers and combined with the performance bonuses encourages to both better performance and more accurate budgeting. Achievable, realistic budget is designed to increase commitment of the employees to work towards the goals. Coordination enables the different functions of the company to foster a common goal and thus harmonises the overall operations of the company. The communicative role of budgeting is to improve both strategic and target communication through the organization and help employees to understand their role in the company. (Ikäheimo et al. 2011, 106-107)

The most relevant previous academic articles for the objectives of this thesis are disclosed alongside the scope and main findings of each research in table 1.

Table 1. Previous Studies on the Subject

Researchers	Article	Scope of the Research	Findings
Barton & Court (2012)	*Making advanced analytics work for you*	• Data-driven decision-making • Potential of big data for business functions • Implantation of advanced analytics	• Organisational transformation is a key for successful data analytics • Simple tools may deliver complex analytics
Becker, Mahlendorf, Schaffer & Thaten (2016)	*Budgeting in times of economic crisis*	• The role of budgeting in relation to strategic planning and forecasting • Budgeting as operational management tool	• Effects of 2008 economic crisis on budgeting • Useful macro functions for future budgeting research • Changing budgeting practices
Croxton, Garcia-Dastuge, Lambert & Rogers (2002)	*The Demand Management Process*	• Implementation of demand management using strategic & operational sub-processes • Balancing between customers' need and supply chain capabilities	• Companies should aim to reduce demand variability and increase operat. flexibility • Benefits of the demand management through supply chain and EVA
Hansen, Otley & Van der Stede (2003)	*Practice developments in budgeting: an overview and research perspective*	• Practise developments in budgeting • Benefits of rolling forecasting as a management control tool • Limitations of traditional budgeting	• Budgets to link with operat. and strategic planning • Use of relative performance standards rather than fixed budgets as incentives

Hope & Fraser (2003)	*Beyond budgeting: how managers can break free from the annual performance*	• Beyond Budgeting Round Table • Abandoning traditional budgeting and embracing new adaptive processes • Target setting: actions and lessons learned	• Rolling and advanced approaches for future forecasting and goal-setting • Use of effective governance and management model • Key performance indicators provide two levers of control
Liberatore & Luo (2010)	*The analytics movement: Implications for operations research*	• Analytics movement drivers • Science of logical analysis • Broad influences and prospects of predictive analytics	• Process of analytics – data-driven insights enable action & strategic redirections • Operations research behind new analytical models
Moon & Mentzer (2005)	*Sales forecasting management – A Demand management approach*	• Need of sales and operations planning • Managing the sales forecasting process • Sales forecasting performance measurement	• Extent benefits of accurate demand forecasting in organisation • Forecasting techniques are outdates and companies lack of forecasting evaluation
Player (2009)	*Managing through change: The power of rolling forecasts*	• Rolling forecasting as strategic compass • Forecasting frequency vs. forecasting variables • Control performance	• Rolling forecasting beats "forecasting to the wall" • 4 pitfalls to avoid and 5 improvement levers of rolling forecasting to organisations
Raghunandan ,Ramgulam, & Raghunandan -Mohammed (2012)	*Examining the behavioural aspects of budgeting with particular..*	• Budgets as part of management control • Budgeting and human behaviour • Nature & need of budgets	• Alternative budgeting processes in the 21st century • Accounting techniques and human relations are bound with each other
Rikhardsson & Yigitbasioglu (2018)	*Business Intelligence & analytics in management accounting research: Status and future focus*	• Implementation on business intelligence & analytics (BI & A) • Literature review of 60 papers - relationship between BI & A and management accounting • Highlight research gaps and future research opportunities	• Technology, data and analytics are transforming forces in business • Relatively low number of papers focus on applications of BI & A in management accounting and minor anchoring to existing theory
Waller & Fawcett (2013)	*Data science, predictive analytics, and big data: a revolution that will transform supply chain design and management*	• Popularity of big data, predictive analytics and data science in business model design • Possible applications of predictive analytics, big data and data science • Research skills needed by data scientists	• Predictive analytics & data science drives forecasting and profitability • Power of big data behind strategic decisions and improved profitability • Opportunities for research where SCR meets DPB

Malmi et al. (2001, 482) conducted a survey for 1000 members of Finnish Association for University Business Graduates with accounting- and controller-related job including financial manager, chief financial officer, financial executive, accounting manager, accounting director, business analyst, business controller and controller. According to Malmi et al. (2001, 487) the work activities that were considered most important among the respondents are: financial reporting (at company or business unit level), budgeting and annual planning. Despite the fact that the research is 18 years old, budgeting, forecasting, and reporting have retained their place as favourite discussion topics among the experts and academic researchers. For example Becker et al. (2016, 1499) highlighted in their recent research the multiple functions of budgeting as part of both strategic and operational decision-making in extreme economic crises.

2.1 Budgeting Process

The budgeting process is a system that leads to the creation of a budget, its approval and finally its implementation based on the underlying decision-making (Ehrhart et al. 2007, 279). With a well-functioning budgeting process, management is easier and potential issues can be detected in time. Typically, the budgeting process begins with an evaluation of the past. After the critical review of last year's actual figures, process is followed by a realistic estimate of the future operating environment and factors affecting it, not forgetting to take into account the company's strategic plan. Hence, budgeting should be based on the company's strategy, which defines the direction and objectives of the future budget (Blumentritt 2006, 73). Thus, the budget can also be seen as a series of numbers reflecting the company's strategy; transforming strategy into data.

In order to maintain a close link between budgeting and strategy, organisation should be able to produce information on strategic uncertainties based on the budget follow-up. In addition, budget should stimulate a debate related to the current activities and way of working amongst the management of the company (Blumentritt 2006, 78). At the best case, the budget highlights the grievances and the achievements that would otherwise be unnoticed.

Raghunandan et al. (2012, 112) recognize three different ways to generate data for budgeting: imposed (top-down) budget, participative (bottom-up budget) and negotiated budget. Imposed (top-down) budget supports an autocratic way of leadership. In top-down budgeting process, which was established in 1990s, the senior management makes all the decisions related to budget and the rest of the organisation responds to these plans with their performance (John & Park 2006, 88). Approach is straightforward and as far from participative as it gets. Even if the autocratic, imposed method might produce results, it is easily seen as a source of frustration within the staff and obstacle for employee development. However, time saving in the budgeting process is seen as the biggest benefit of the top-down approach (Boon et al 2007; Boxall and Purcell 2011).

Participative (bottom-up budget) is a democratic approach for budgeting. In bottom-up budgeting each member of the lower management prepares the budgets of their own and the total budget for the sum of its parts (Raghunandan et al. 2012, 112). Bottom-up budgeting takes more time, but the level of commitment is increased due to an inclusive model in which everyone's contribution is considered important. Third approach: negotiated budgeting is a model of common responsibility where elements from both top-down and bottom-up budgeting are exploited in budget preparation (Raghunandan et al. 2012, 112). The negotiated budgeting process, which is the most commonly used approach in large companies, might consist of several review phases at different layers of the organisation (Albrecht et al. 2008, 878). The selection of the budgeting model is highly influenced by the company culture and the leadership features of the organisation.

Traditional budgeting process starts well beforehand, typically up to six months prior the budgeting due date i.e the start of the year it relates. A mission statement and strategic plan are build on company's vision and should illustrate strategic plans of the company and outline the top-level targets of a group. Next step is budgeting itself as represented in figure 2 (see page 14). Budgeting process is made within the framework that was specified in the first and the second step. Budgeting tends to include multiple rounds of iteration and negotiations between the corporate centre and operating units before the final budget is ready. After approval budget is controlled through the periods budget concerns. (Hope & Fraser 2003, 4-6)

The budgeting process may take up to half a year to complete, taking into account the time required for planning, setting objectives and negotiating, which is why the sufficient amount of time must be reserved (Jensen 2003, 380). One of the ultimate goals in budgeting is to have a budgeting process based on the real-time data.

The Traditional Budgeting Process

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        ┌─────────────────────┐
        │   Mission Statement  │
        └─────────────────────┘
                  │
                  ▼
        ┌─────────────────────┐
        │   Strategic Plan     │
        └─────────────────────┘

               "Budgeting"

                  ▼
        ┌─────────────────────┐
        │       Budget         │
        │  Goals and rewards   │
        │     Action plans     │
        │ Resource allocation  │
        │    Coordination      │
        └─────────────────────┘

             "Keeping on Track"

                  ▼
        ┌─────────────────────┐
        │      Control         │
        └─────────────────────┘
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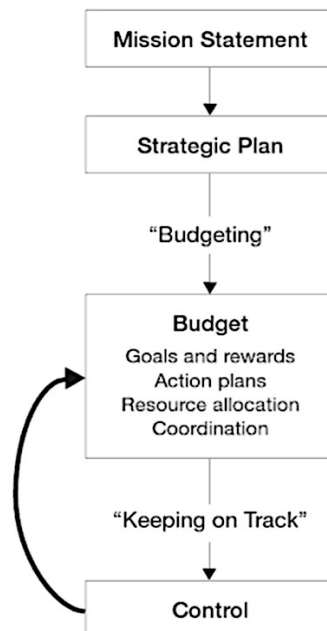
Figure 2. The Traditional Budgeting Process (Hope & Fraser 2003, 5)

Simple approach is to add frequency to budgeting process (Player 2003, 4). By reviewing budgets every six months or once a quarter, budgeting becomes a more follow-up method than a one-off operation. On the other hand, it increases the time spent for budgeting even more, which has been identified to be one of the biggest problems with traditional budgeting. Budgeting simply consumes too much time from the management (Hope & Fraser 2003, 6).

The global operating environment, which requires flexibility and agility, requires yielding forecasting processes that are not covered by the traditional, rigid budgeting process. However, also many modern approaches on budgeting and forecasting suffer from the fact that even more time than before is spent in order to create more real-time data based budgets. Hence, these forecasts are created precisely with good grace and the results are most likely more accurate than the ones achieved

with traditional budgeting. However, it is accomplished with increased workload and costs. (Albrecht et al. 2008; Ehrhart et al. 2007; Hope & Fraser 2003)

2.2 Life Cycle of Traditional Budgeting

When measuring the subject hits of academic databases, it can be seen that budgeting is constantly blistering topic making it one of the most widely studied topics in the history of management accounting (Luft & Shields, 2003, 177). The theme of budgeting has been addressed from many theoretical perspectives including sociology, psychology and obviously economics (Covaleski et al., 2003, 3). Hambrick (2007, 193) underlines the multidisciplinary approach while operating in human linkages between individuals, organisations and their competitive environments.

Despite the prevalence of budgeting, studies have shown that companies are often very dissatisfied with budgeting and the value it adds to the organization. The operating environment of companies has changed in a more competitive and uncertain direction, which in turn undermines the conditions for using traditional budgeting methods (Neely et al. 2003, 22). Businesses need to be more agile in fulfilling their ultimate goal: value creation for stakeholders.

The budgeting process was created in the early 1900s by large industrial organizations to meet the emerged need of cost and cash flow management. Changed budgeting needs have led to the situation where traditional annual budget is being challenged for its inability to give a sufficiently broad picture of the future and to act flexibly in uncertain situations. (Ekholm & Wallin 2000, 519) It has been widely represented that the use of traditional annual budgeting leads mostly to a mediocre result (Zeller & Metzger 2013, 299). The most radical budgeting critics have also suggested that budgeting should be abandoned, which in most cases would require reforming the management philosophy of the entire company.

Naturally, the first loud opponents of traditional budgeting were consultants who wanted to sell their own services. In the 1970s and 1980s, new approached like the zero base budgeting (ZBB) became popular. The underlying idea of zero base

budgeting is first and foremost to evaluate and prioritize the needs of all businesses before carrying out the actual budgeting (Drury 2004, 305). In zero base budgeting, forecaster begins to think about the discretionary expenses from zero with the blank paper. Approach has turned out to be particularly applicable when reviewing overhead costs (Player 2003, 4). For example in Sweden, a number of large companies decided to terminate traditional budgeting completely already in the 1990s (Ekholm & Wallin 2000, 519).

However, given the fact that academic researchers had shown very little interest in this phenomenon until the early 2000s, todays' forerunner companies have come a long way from traditional budgeting culture at short notice. Drivers for development may be found on changes in world economy, regulation, technology but the key factor behind the evolution is upgraded need of information and quite different frequency of information flows than 20 years ago. For many people, both from academic and business environment, budgeting has been an endless source of criticism for a long time. Criticism may be found in several academic sources and literature (Anthony et al. 1998, Becker 2014, Covaleski et al. 2003, Ekholm & Wallin 2000, Morlidge & Player 2010).

In a relatively short period of time, traditional budgeting has changed from one of the most important organizational control tools to a controversial instrument and a topic of comparatively significant criticism. Budgeting has been criticized for being rigid and restrictive, time-consuming, irrelevant, history-focused, not strategy-oriented, not taking external factors into account and causing questionable activity such as budget manipulation (Clarke 2007; Hope & Fraser 2003; Libby & Lindsay 2010; Neely et al. 2003).

Growing criticism of traditional budgeting has aroused interest in developing and deploying alternative budgeting models such as rolling forecasting and beyond budgeting. While both business processes and organizational structures are changing due to transformations of business environment, the development of management control systems have broadened the concept of traditional budgeting (Kanthi Herath 2007, 895). Thus, the new era of management control systems forces

the old practices to change. Although a heavy organization emphasizes the negative effects of an inefficient budgeting process, the change does not only concern large multinational companies, but also smaller organizations.

The most of the new appellations in budgeting include the same idea of breaking the traditional, unambiguous framework of budgeting and shake the old stubborn way of budgeting. However, interpretation of new changes and way of thinking in budgeting does not mean that all the ideology characterized by traditional budget has been abandoned. Preferably, traditional budgeting has been enriched and supported by new advanced control tools (Neely et al. 2003, 23). The transition from traditional budgeting to more modern forecasting methods is a challenging process. According to studies, organisations have very rarely been able to implement this change of culture as a whole (Libby & Lindsay 2010, 67). According to Henttu-Aho & Järvinen (2013, 765) even though, there is a clear change towards the new tools of management accounting, which replace parts of the traditional budgeting system, the core functions of budgeting system: planning, controlling and evaluation will remain, despite the shift.

Many researchers emphasize that traditional budgets should be replaced or supplemented by rolling forecasts (Hansen et al. 2003, Jensen 2003). Fortunately studies have introduced a number of new appellations and trends for budgeting. Advanced budgeting and beyond budgeting are examples of these developments (Bunce et al. 1995, Hope & Fraser 2003). Particularly forced attack against budgeting was represented by Hope & Fraser (2003) in the Beyond Budgeting Round Table (henceforth abbreviated as 'BBRT') claiming budgeting process is fundamentally flawed and that it presents the result of dysfunctional behaviour. Several studies support this sort of claims against traditional budgeting, as more and more organizations have introduced rolling forecasting models as part of the organisation's control tools to support or replace traditional budgeting (Hansen et al. 2003, Libby & Lindsay 2010). In order to understand that there is not just one right way to do budgeting and forecasting, next chapter 2.3 takes a closer look to fierce approach demonstrated in BBRT by Hope and Frase (2003).

2.3 Beyond Budgeting

Historically budget has been in the centre of management control system for all kind of organisations (Otley 1994, 367). In recent years, companies have implemented more sophisticated and more streamlined forecasting tools and budgeting processes (Player 2003, 4). Beyond budgeting, has been a key word for consultants and practitioners of management accounting in 2000s (Sandalgaard & Nikolaj Bukh 2014, 409). Beyond Budgeting, which is founded in 1998 by the Beyond Budgeting Round Table, provides an alternative for traditional budgeting. Effectively, beyond budgeting may be considered as an extreme implementation of modern forecasting.

Ideology behind beyond budgeting is to manage company's performance without traditional budgeting by replacing the old processes budgeting with more appropriate options for each situation (Hope & Fraser 2003, 212). Traditional budgeting may be replaced with a more efficient performance management system by implementing practices that have been proved to respond to customers' demand and needs more effectively. If implemented at its heaviest, beyond budgeting means the complete abandonment of the traditional budgeting. (Hope & Fraser 2000, 33-34)

The supporters of modern forecasting and beyond budgeting criticize yearly-based traditional budgeting for being fixed performance contracts that offer neither adaptivity nor tools to add value by forecasting in a changing business environment (Sandalgaard & Nikolaj Bukh 2014, 409-411). Beyond budgeting gives freedom to the implementer, whilst it is not precisely defined mode of operation. As a whole, beyond budgeting offers an alternative approach for strategic management of the organisation and the ability to lead the performance of the company without traditional budgeting. The goal is to replace traditional budgeting processes with more appropriate options for each situation. (Hope & Fraser 2003, 19-20, 212)

For organizations where budgeting has a long tradition, beyond budgeting may sound like a scary, radical alternative. Beyond budgeting encourages the transition from traditional fixed goals towards a more open and interactive culture that gives leaders more freedom to lead their activities in the optimal way at each situation

(Pilkington & Crowther 2007, 29). However, it must be bear in mind that beyond budgeting does not mean arbitrary use of financial resources in the organisation. In order to function, financial governance system must support the management of non-budgeting organisation.

Beyond Budgeting method encapsulates the differentiation between goal setting and performance evaluation in order to get rid of traditional budget control, and move towards a more strategic, non-cost-oriented and forward-looking goal setting (Bourmistrov & Kaarbøe 2013, 196). The future aspect is also highlighted in the key principles of BB, which recommends to set ambitious goals for the medium term, not short-term fixed goals. Beyond Budgeting aims to share responsibilities within the organisation, highlight the decentralized decision-making and by doing so, reform the corporate governance to a more self-governing direction (Hope & Fraser 2000, 35). Performance measurement does not have to rely solely on the financial gauges. Many researchers have emphasized the use of relative metrics, for example benchmarking and also non-financial metrics such as balanced scorecard for performance management rather than solely budget-based guidance (Bourmistrov & Kaarbøe 2013; Hansen et al. 2003; Hope & Fraser 2000; Østergren & Stensaker 2011).

The need for a detailed budget varies by organization and in some cases replacing fixed budgeting may be difficult. For example an ultra-goal-oriented organization where solid, measurable goals are seen as the best practice to ensure the predictability of the expected result, the budget-neutral option must be able to cover organisation's need for financial goals in other ways. Hence, budget neutrality is not suitable for all organizations. (Sandalgaard & Nikolaj Bukh 2014, 421) Beyond budgeting may help companies get rid of the philosophy that traditional budgeting encourages to spend the entire budget within the year in order to avoid downward pressure on next year's budget (Østergren & Stensaker 2011, 163).

2.4 Rolling Forecasting

The change in the business environment is continuous. Changes related to organisational structures, business processes, management systems and patterns of management control are inevitable if company urge to survive in a changing business environment (Kanthi Herath 2007, 895). As a result of the changes, the entire culture of management of the organizations had to adapt and evolve to meet the changed requirements. Traditional budgeting has undergone significant changes as a result of its gradual fragmentation since many companies have replaced traditional budgeting with new budgeting tools (Østergren & Stensaker 2011, 153). The traditional operating budget covers planned income and costs for one year at a time (Anthony et al. 1998, 370). Player (2009, 6) describes the phenomenon as "forecasting to the wall". Quarterly, monthly or even weekly basis rolling forecasts offer a more dynamic and flexible support to disadvantages of traditional budgeting (Sandalgaard & Nikolaj Bukh 2014, 410).

Rolling forecasting in practice means forecasting certain occurrences over a period of time that extends to fixed-period for the future. While the first forecasting horizon decreases; the second forecasting horizon increases by the same amount, i.e. forecast rolls forward. (Hansen et al., 2003, 108) As a result of rolling, the entire forecasting horizon has always the standard length as represented in figure 3 (21). The rolling forecasting horizon may be divided into two parts. The first horizon includes forecasting and updates until the end of current year. This horizon does not have to differ form the traditional budget ideology (see figure 3, 21). However, it might include more modern elements such as split forecasting periods, tighter frequency and rolling forecasting parts. The second forecast horizon covers forecasts over the budgeted year. The length of the second forecast horizon is dependable on both the length of the standardized forecast horizon and the current time of the year.

Rolling forecasting is most commonly characterised by the standard forecast horizon that tends to be between 12-36 months, to which a new month or quarter is added on when the old month or quarter ends. The most common approach for rolling forecasting is 12-month forecast horizon, which is updated once a quarter (Player

2003, 4). Actual outcomes are more often than not updated monthly, but depending on the industry even weekly or daily frequencies are possible.

The early adaptions of the model of rolling forecasting have been used in organizations for decades. For example, in terms of business strategy planning, rolling forecasting has a long tradition and it has been in use for a long time, partly unconscious (Montgomery 2002, 42). Reflecting the history of rolling forecasting, its role as a solder of strategy and budget is actually pretty obvious. Although, rolling forecasting has already a long history, deeper interest in its use as a short-term tool has only increased dramatically during the last decades (Clark & McCracken 2009, 365). Rolling forecasting has the potential to quicker response time when smoother anticipation and reaction to changes in the business environment are needed (Åkerberg 2006, 59). Besides, shifting from traditional annual planning to continuous planning has the tendency to tone up the operational control and efficiency.
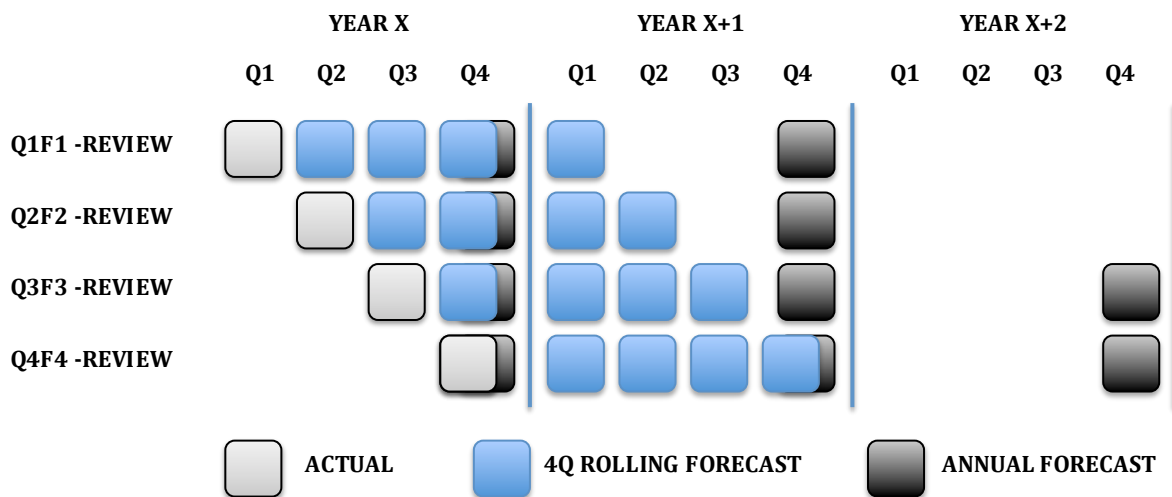
Figure 3. The Framework of Rolling Forecasting – Skanska Group

Rolling forecasting embraces a lack of performance of the original budgets, which may evaporate due to successive revisions, which are rarely in line with the original expectations of the revised budgets (Hansen et al. 2003, 108). Hence, due to business uncertainty, fixed budget figures do not necessarily provide reliable information because they could become obsolete in the early phases of the budget period. Hence, the ultimate essence of rolling forecasting is to act as a tool for

updating plans (Åkerberg 2006, 76). However, rolling forecasting should not be merely an updated version of the traditional budgeting process. Therefore, the underlying reason for the implementation of the rolling forecasting must be a strategic urge to genuinely eliminate the ineffective practices of traditional budgeting (Montgomery 2002, 44). In practise, rolling forecasting can be implemented to support the traditional budgeting as financial steering tool, or it may replace the traditional budget entirely (Zellerin & Metzgerin 2013, 299). However, many studies show that traditional budgeting is still considered as an important part of the company's financial management and therefore should not be completely disabled (Becker et al. 2016; Ekholm & Vallin 2011; Raghunandan et al. 2012).

The rolling forecast always reflects the latest changes in the company's operations and financial situation. These changes may be caused by internal or external factors of the company. For example, problems in the company's production or supply chain, sudden fluctuations in demand and overhead cost pressures may change the future prospects quickly. Hence, forecasting cannot be based solely on past developments, but should rather compel continuous assessment of the situation to which rolling forecasting encourages. Thus, two key factors drive companies towards the rolling forecast: measurability of the impact of actions taken on business development and its utility to identify future risks and opportunities of the future. (Clarke 2007, 22)

Rolling forecasting, like any other planning, should indicate the strategic direction of the company at a high frequency (Player 2009, 6). Montgomery (2002, 44) highlights the connective role of rolling forecasting between strategic planning and cost centre specific operational budgeting. Rolling forecasting may be used in order to test the effects of business decisions in advance and monitor their implementation in order to respond quickly and flexibly to market changes and non-achievement of goals. After all, the fundamental idea behind rolling forecasting is to continuously monitor the success of an enterprise's operations and to anticipate the result and financial position by regularly updating forecast data (Partanen 2007, 176). All in all the most characteristic features of the rolling forecast are continuous planning and forecasting throughout the year, focus on future, a coarser level of precision, and a more accurate response to changes. Rolling forecasting makes performance comparison

between the actual outcomes and forecasts easier and more accurate since comparisons are always made with updated forecasts (Drury 2004, 286).

From the controlling point of view, relevant forecasts are necessary, for example, in order to execute the critical review of controller's ability to generate reliable forecasts that adapt to reality. Transparent and updated information produced in rolling forecasting process enables management to challenge the accuracy of information generated, which enhances the effectiveness of management control (Byrne & Pierce 2007, 471). From the group management point of view, rolling forecasting has the tendency to improve the predictability of the annual result (Åkerberg 2006, 60). If the company is heading in the distinct direction on the basis of the changed actualities, changes for rolling forecast can be made immediately despite the figures in the annual budget. More frequent, rolling forecasts give managers more confidence in the budget figures used in operational planning and increase organizational learning (Sivabalan et al. 2009, 856).

Rolling forecasting has been found to improve organizational guidance by enabling continuous, fast-updated planning and forecasting throughout the year, thanks to sharpened focus and frequently less detailed content. Organizational guidance comprises dynamic resource allocation, of which rolling forecasting may open the eyes of management to look at their resources and take action more frequently than once a year over budgeting period (Hansen et al. 2003; Hope & Fraser 2003; (Østergren & Stensaker 2011). In the practical implementation of rolling forecasting, the company must consider their key business drivers that need to be monitored continuously and systematically. Forecasting of additional, "nice-to-know" variables is not desirable and takes the concentration away from the essential variables (Player 2009, 15). Overly accurate and multivariate rolling forecasting has a tendency to be just heavily implemented add-on of traditional budgeting (Hope 2009, 10). In addition, when rolling budgets are used alongside the traditional budgets, rolling budgets tend to be more numerical calculations than genuine goal-oriented budgets, which reduce the potential steering effect of the forecast (Montgomery 2002, 43). Rolling approach may be easily overshadowed by the traditional budgeting and thus organisation does not take full advantage of it.

As its best, dynamic resource allocation directs managements' attention towards both the constant discovery the profitable projects and seamlessly trains financial resources to the best projects within the organization as a whole, not within a single business stream or organisational unit (Bourmistrov & Kaarbøe 2013, 204). In the worst case rolling forecasting is just poorly implemented add-on for budgeting, which requires even more resources than traditional budgeting solely without additional benefits. Nonetheless, the results of the studies have resulted in contradictory results on the time-consuming effects of rolling forecasting process (Hope & Fraser 2003; Player 2009). Providing that rolling forecasting replaces traditional budgeting at least partially and is done on a coarser level, also time-consuming benefits are achievable.

Rolling key figures offer management a sharp vision for longer-term trends of the company. Long-term rolling ratios are principally convenient for examine the long-term trends and development of the company. However, the recent major changes for example in the balance sheet structure, may go unnoticed because it takes time for changes to appear in rolling figures due to the long time horizon of the ratios. Short-term rolling ratios offer more dynamic view for company's financial figures by bringing recent trends to the figures faster than long-term ratios. When selecting the rolling key ratios, like any other ratios, attention must be paid not only to the operational and financial structure of the company, but also to the industry, as all sets of key figures do not work for every occasion. (Clark & McCracken 2009; Player 2003; Zellerin & Metzgerin 2013)

In order to succeed, the introduction of rolling forecasting requires cultural change and precise concentration on implementation in the organization. If organisation does not focus on both identifying the opportunities related to rolling forecasting and the critical factors that have the most impact on the implementation process, rolling forecasting does not add value to the company. (Partanen 2007, 176-177) The expectations related to rolling forecasting must be made clear at all organizational levels (Åkerberg 2006, 75).

3. FORECASTING & BUSINESS ANALYTICS

In the short history in mankind, the Renaissance has been identified for the time when people systematically begin to realise that certain occurrence may have different probability than other. World was realised as a place with an endless number of uncertainties that lead to the variable probability of events. (Lapide 2009, 18-19) Comparison of probabilities led to the formation of forecasts.

Forecasting verily entered the business world under the guise of game theory in 1940s. Game theory shaped people's way of thinking. Organisations started to consider their business as a series of actions all of which have different outcome and probability depending on which option is chosen. Time series analysis became everyday tools for companies at the latest when Journal of Time Series Analysis was published its first release in 1980. The importance of forecasting accumulated in the business management and culture of looking at the future instead of the reverse mirror, created a strong foothold among business leaders. The progress of business forecasting has been accelerating during the past few decades and the concept of forecasting in relation to probabilities and uncertainties has come a long way since Galileo Galilei's time (Hald 2003, 41).

All forecasts are images of the future. Forecasts try to describe the status of an object at a certain future time. Forecasts are made because people want to have some sort of assurance about the visions of the future. Human desire to anticipate and desire to manage and keep the situation under control emphasizes the popularity of any kind of forecasting. DuBrin (2000, 3) defines management as the process that uses organizational resources to achieve organizational objectives through the functions of planning, organizing and staffing, leading, and controlling.

Control as a term means different things for different people. Merchant (1985, 1) defines control as "keeping things on track". The right track may be found either with strict surveillance or more liberate approach or most likely with a stance between the extremes. Thus, control may be perceived from as many alternative points of views as there are reviewers. Nonetheless, anticipation and forecasting contributes to the

formation of control in business environment. Anthony, Dearden and Bedford (1989, 5) define control as follows:

> *"Control is the process of guiding a set of variables to attain a preconceived goal or objective. It is a broad concept applicable to people, things, situations and organisations. In organizations, it includes various planning and controlling processes."*

This definition highlights the omnipresent nature of the control. All parties in the organization, together with the defined control process are responsible for the formation or non-formation of the control within the organisation. In the academic management literature, the word "control" may be understood as difference between the forecasted and actual performance (Kanthi Herath 2007, 897). The same interpretation is general in financial management systems, where the existence of controls with countless purposes is inevitable. Increased control needs are often the reason for introducing modern forecasting methods in addition to traditional budgeting (Neely et al. 2003, 23). The significance of built-in controls will be highlighted at the latest if controls are able to identify possible corrective actions, which eventually lead towards the planned performance. It is likely that control might be the most import element of the successful management in the long run.

An alternative standpoint for forecasting was presented by Sterling in 1975. According to Sterling (1975, 31) for example the value of the final depreciation is unknown until the asset is sold. The same ideology applies to the actual profit of the company, which according to Sterling (1975, 31) becomes fully realised only when the company stops its business not during the active years. Nowadays, the elements of Sterling's ideology may be found in life cycle thinking (LCT). Most commonly, processes of forecasting and analytics begin with the measurement of the current state. Measurement is a process in order to find the present status of the company. On the other hand, prediction is the allocation of historical data to the time series, based on the predicted future values. Thus, it can be assumed that the determination of the current state of the company is strongly based on the determination of how company sees its future. (Sterling 1975, 32)

3.1 Intelligent Business Through Big Data

"Data-driven decisions are better decisions – it's as simple as that"
(McAfee, Brynjolfsson, Davenport, Patil & Barton 2012, 64).

In general, big data means loads of data that can be gathered from abundant sources and utilized through computing power. Big data as a term refers not only to a large amount of data, but also to the complexity, diversity and speed of data collection and processing (Sakr, S. & Zomaya, A. Y. 2017, 102). The volume, variety and velocity of the data, which has become exceedingly accessible during the past decade, make big data a unique source of analytics (McAfee et al. 2012, 63-64). According to Frizzo-Barker et al. (2016, 403) big data is still fragmented area of research in academic literature due to rather challenging theoretical framework and shortage of empirical research. Mello et al. (2014, 1844) encourages researchers and companies to further investigate the connection between big data and performance measurement to the end that results new performance metrics, analytic instruments and data visualization.

One of the biggest challenges of big data is to understand its immense potential and value in different business functions. Barton & Court (2012, 81) stated in the early 2010s that the wave of big data is mounting with the speed that cannot be despised by senior leaders, if they fancy seeing their companies to flourish in the future. Building information modelling (henceforth abbreviated as 'BIM') is a prodigious example of using big data to smoothen the gap between planning and operations in the construction industry (Zhang et al. 2015, 31). In the framework of this study, big data will not be dealt with in greater detail, rather raise it up as a factor that plays a key role when finding attributes of forecasting, modelling and analysing business.

Business intelligence is a key data analytics term that dates back to the late 1950s. At that time, Luhn (1958, 314) defined business intelligence as a process based on statistical procedures that can be performed mechanically and with which organizational problems may be solved. After Luhn's time, business intelligence as a term has been defined countless times again. Irrespective of the interpretation and

the era in which the definition of business intelligence is made, the connective factors of the definitions have been its use as a decision-making tool and data exploitation for business with the help of information management.

Term 'intelligent delivery' refers to the fact that business intelligence information should be available for efficient decisions at the time when it is needed (Bose 2009, 159). Generally speaking, business intelligence and analytics may be considered as an exercise where data is systematically excavated and analysed, which supports company's management to make data-driven decisions (Acito & Khatri 2014; Wang 2015). Based on the surveys of business practitioners and the recently pronounced role of BI and analytics in education, academic researchers are quite unanimous of the mounting need of BI and analytics professionals in the business environment (Davis & Woratschek 2015; Wilder & Ozgur 2015; Wixon et al. 2014).

Business intelligence is a complete process where the right information reaches the right people at the right time, which enables effective decision-making and enhances the performance of the company (Bose 2009, 156). Business intelligence may be described as the processing and use of information to support business. Intelligent business information is crucial for performance measurement through the organisation. The goal of performance measurement is to evaluate how well the company is managed and how the company manages to generate value for shareholders. Measuring performance plays an indispensable role in setting goals and making better business decisions. (Mello, Leite & Martins, 2014, 1838).

Wilder & Ozgur (2015, 186) identify three levels of professionals needed in the organisation to implement a workable business intelligence and analytics. In the first instance, organisation needs data scientists with a quantitative and mathematical proficiency in computer science. Hereafter, data specialists who understand how data is managed and business analysts to frame business problems, to identify prospects and to exploit results with a data-savvy state of mind. It is noteworthy that the communication between the parties has to be strong. (Wilder & Ozgur 2015, 186)

Most business intelligence systems are based on the three-phase process. The first step is data collection from different sources. The original data can be widespread information in the organization layers, found in different formats, and very large in quantity. In the second stage, the data is converted to standardized and measurable format in order to meet the objectives and interests of the organization. In the final step, the findings that can be made of the data are presented in patterns. When making findings and conclusions, it is important to note that they are clear and straightforward for the organisation's management in terms of the further communication and usability of information. (Chiriac et al. 2007, 3)

Large-scale academic researches affirm that data is generally considered to be the driving force behind better managerial decision-making and improved profitability (Waller & Fawcett 2013, 77). Data mining, whether it is text, pictures, numbers or web mining, creates the base for advanced analytics (Bose 2009, 156). The greatest benefit of data mining is obtained when the technology and discoveries from mined data is used to develop analytical models, for example forecasting patterns (Wang & Wang 2008, 624). Data science as a term refers to the application of quantitative and qualitative methods, of which purpose is to unravel discovered problems and forecast possible future outcomes (Waller & Fawcett 2013, 77). From aforementioned point of view, the concepts of data science and data analytics are very close to each other.

3.2 Predictive & Advanced Analytics

Early adaptations of data analytics have been used to support business for a long time, but since the emergence of big data in the 2010s, the popularity of data analytics has grown strongly. Even if the amount of research on the subject is emerging, there are still many interpretations of what big data and analytics will mean for organizations in the future. (Frizzo-Barker, Chow-White, Mozafari & Ha 2016, 403)

"As a general term, analytics refers to the science of logical analysis"
(Liberatore & Luo 2010, 314)

Development has taken analytics from the traditional rear-view mirror set-up towards predictive analysis, which may also provide guidelines and future visions for organizations to support their decision-making (Bose 2009, 155). The time window when the information is available and whether the information concerns the future or the past can make all the difference for the consumer of the data. Driver to execute data analysis according to Tien (2013, 128) is the volition "to obtain or derive information from data, knowledge from information, and wisdom from knowledge". In other words data analytics is characterized by the desire to shape the data in order to learn from it.

Predictive analytics is considered as a subcategory of data science (Waller & Fawcett 2013, 79). Predictive data analytics means converting data into the predictions of the future events (Lawless 2014, 44). Predictive analytics offers a way to transform risks and uncertainties into opportunities. Prevalence of advanced and predictive analytics has been emerging exponentially since the terrible occurrence of September 11, 2001. Advanced and predictive analytics were employed first in the fight against terrorism and crime, and subsequently in improving the efficiency and predictability of everyday business operations of the companies. (Jonas & Harper, 2006, 5-6) Advanced information and data analyses are the fundamentals of the fast-paced modern business environment in order to comprehensively understand business dynamics and systematically manage the performance of the company (Schläfke, Silvi & Möller 2012, 110). Nevertheless, large amounts of data also pose challenges for analytics, whereas the application of data in business is not unambiguous. Sophisticated predictive analytics may be a powerful tool in financial performance forecasting in the construction industry.

Advanced analytics as a concept is moderately challenging to define. Generally, advanced analytics may be understood as a way of implementing altered advanced analytics techniques to data in order to crack problems (Bose 2009, 156). Therefore, it may be difficult for an organization to identify possible applications for advanced analytics because the concept of advanced analytics can be built together from dozens of small sources and tools. Generally increased urge towards the use of analytics has raised a lot of discussion among academics and professionals about the influences and prospects of predictive analytics (Liberatore & Luo 2010, 313).

Predictive analytics is used in business environment in different ways. Businesses use historical data and real-time data to gain a deeper understanding of their operations, customers, and commodities. However, no matter how sophisticated model, no predictive analytics offers exact certainty of the future. Thus, the purpose of the predictions and predictive data analytics, corresponding the purpose of forecasting in general, is to provide a reasonable assurance of what might happen next (Lawless 2014, 44).

3.3 Exploitation Process of Analytics

The concept of data analytics as a whole covers the collection, analysis and use of data as business support. Process of analytics starts with the data phase where information is collected both from external and internal sources. More often than not, collected data needs extraction and manipulation since analytics has not been the primary reason why data has been created and stored in the first place. The rapid growth of large data flows poses challenges for both data collection and decision-making. However, at the same time new opportunities for analytics are created. (Liberatore & Luo 2010, 314) Thus, it is highly beneficial if the quality of the original data is decent and requires only marginal adjustments. Otherwise, data phase may require a lot of resources. The saying "you get what you measure" applies particularly well in analytics: bad data leads to incomplete analyses and false conclusions (Hummel, Huitt, Michael & Walters 1994, 10).

The second step of the process is analysis, which is divided into three phases: visualization, predictive modeling, and optimization. Initially, the data is presented visually using different dashboards and diagrams, which facilitates data analysis and makes it easier for analyst to focus on the essentials. Hereafter, predictive modeling techniques, such as statistical methods and artificial intelligence practices, are used to discover fluctuations, correlations and classifications from the selected data. Optimization wraps up the analysis and given the postulations and delimitations leads to the selection of the best models with whom to proceed. (Liberatore & Luo 2010, 314-315) Functional data analytics are essential capabilities for organisation to edit data into the decision-making format (McAfee et al. 2012, 64).

After analysis, the third step of the process offers insights for decision-makers. Insights strive to provide answers the unanswered questions through visualisation of the former performance, predictive modeling techniques and future optimisation methods with the intention to display the right track for decision-maker. Step four is where the actions based on the analysis are realised as decisions, changes in a way of working or strategic redirections. Phases three and four are highly linked since insights have no tangible value if they do not lead to deeds. (Liberatore & Luo 2010, 315) Desirable results of the analytics process may include, for example, accelerated information flows, upgraded decision-making quality and enhanced forecasting accuracy. Well-executed process of analytics responds to the urge of discovering answers to identified problems. The four steps of analytics process according to Liberatore & Luo (2010, 314) are represented in figure 4.

Data		**Analysis**		**Insight**		**Action**
Collection Extraction Manipulation	→	Visualization Predictive modelling Optimization	→	What happened? What will happen? What should happen?	→	Operational decisions Process changes Strategic formulations
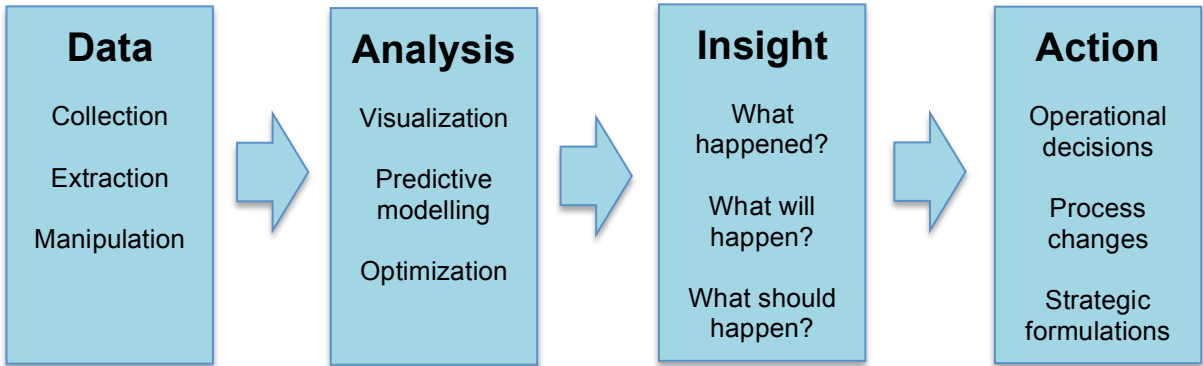
Figure 4. Process of Analytics (Liberatore & Luo 2010, 314)

During their cooperation with dozens of companies that are operating in exceedingly data-rich industries, Barton & Court (2012, 80-82) explored three fundamental phases of organisations' full exploitation of data and analytics. As in the scheme of Liberatore & Luo (2010), Barton & Court (2012) also give high priority to data quality, data processing and visualisation in the analytics process. While Liberatore & Luo's (2010) approach of analytics process focuses on data-driven insights that facilitate strategic decision-making and operational changes, Barton & Court (2012) are more dedicated to organisational adaptability and competencies to execute efficient data analytics.

First and foremost the important sources of external and internal data, which seems to affect the performance of the company must be found from the infinite data jungle and taken advance of. More often than not, this requires updating of company's information technology architecture in order to allow extensive access to data. Furthermore, the editing and merging capabilities of data must be in condition. Next, accessible data is structured into an understandable form from which the prevalent drivers of performance could be picked up. Selected drivers may be used as explanatory factors of forecasting models. A general dilemma in model-creation is the balance between complexity and expediency, and therefore user-friendliness. Built models enable optimization by presenting alternative business outcomes and scenarios. (Barton & Court 2012, 80-81)

The third focus area of data and analytics is organisational transformation. Common concern within organisations is the lack of trust in big data models. Hence, created tools must understandable and easy to use for professionals who should benefit from them. A clear border between managers using the data-driven insights and data scientists and developers is vital to the success of the model. Furthermore, big data exploiting and analytical capabilities must be continuously developed as well as the advent of an analytical culture, which is a long, demanding process. (Barton & Court 2012, 82)

When it comes to the culture of forecasting and analytics within the organisation, it is possible to distinguish between two options. Either it is declaratory or influencing. If the forecaster wants to know the future and just prepare for it, he will try to find out what is the most likely future. Any influence in future development will not take place and the forecaster accepts the most likely status of the future as it is. If we assume that future development can be influenced, we talk about guiding forecast. In this case, the forecaster already has an idea of his goals, but he is not aware of how they can be achieved. Guiding forecast includes two phases: declaring review, which is done in order to understand the future development and planning, which aims to identify the measures that will lead to the achievement of the desired results. (Schläfke et al. 2012; Morlidge & Player 2010)

3.4 Demand Management

During the 1980s, business forecasting began to emphasis demand-driven forecasting (Lapide 2009, 18-19). The role of demand management has been gaining ground among the business forecasting ever since. Two core elements have been pushing this evolution forward. Firstly, the compulsion and thirst of information from the stakeholders, media and customers have forced companies to produce and share business information, such as more detailed future prospects. Secondly, as a result of companies' built-in curiosity about their own activities and operations, the efficiency in supply chain management and demand forecasting has improved. (Crum & Palmatier 2003, 2)

While new technologies have enabled efficient data access and processing, business forecasting as a whole has become more diverse and eye-opening process for modern companies (Frizzo-Barker, Chow-White, Mozafari & Ha 2016, 403). Data that was once inaccessible is now helping companies to plan their future. Therefore, organisations are willing consume a great number of resources in an attempt to forecast the market movements. The information technology development has enabled new dimensions such as the utilization of data created by individuals containing partly questionable information such as geographic information, personal preferences, browsing history, search trend and social media behaviour (Li, Pan, Law & Huang 2017, 59-60). Precise demand management is an inevitable encouragement for companies in order to success in global business environment. Hurtling trends create huge shifts of the market and volumes of the world trade are bigger and more global than ever (Lapide 2009, 19). Thus, it is increasingly problematic to succeed in managing demand in a modern lively market.

Demand forecasting plays a crucial role in the strategic and operational demand management. Demand management consist of three fundamentals: demand control, demand planning and development. Furthermore, demand forecasting aims to foresee customers' buying behaviour and consequently, the turnover of the company. However, demand management, as a complete process is much more than solely forecasting. Demand management consists of interconnected strategic and

operational processes (see figure 5, 35). Collaborative sub-processes form an overall process that serves a common goal: effective and in time demand management where supply meets the demand. (Croxton, Garcia-Dastuge, Lambert & Rogers 2002, 53)
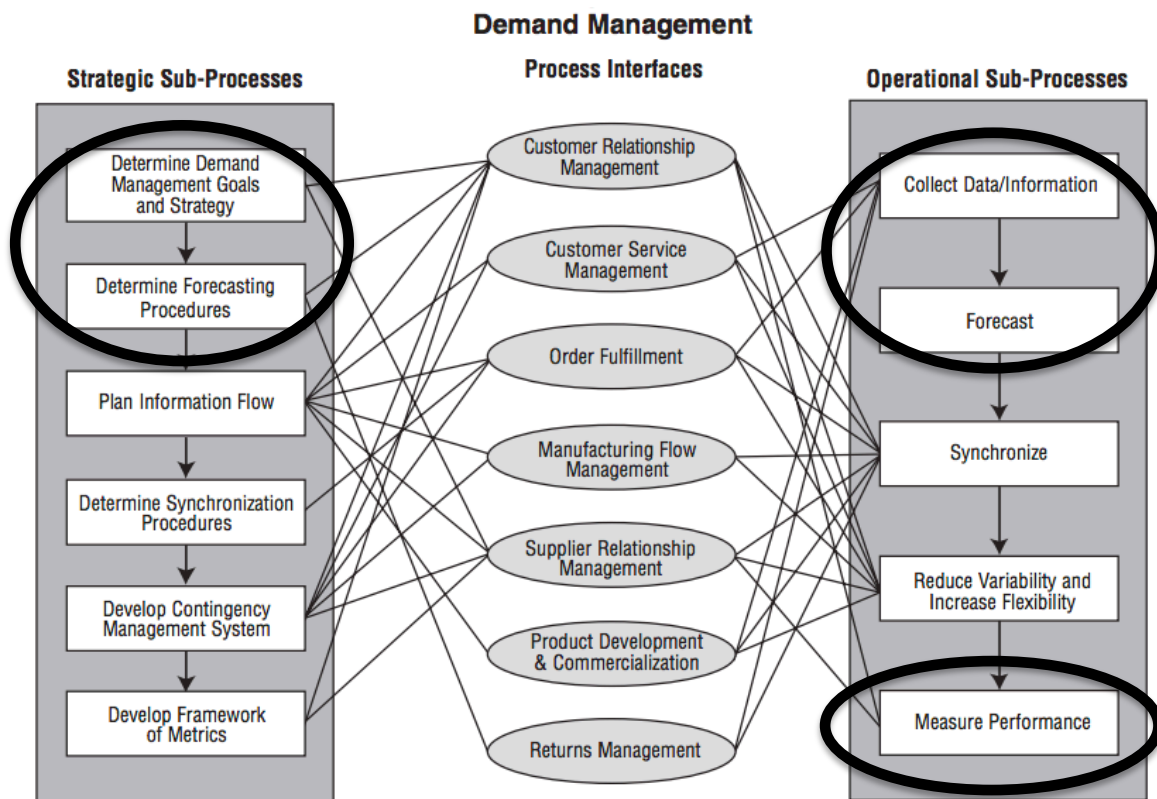
Figure 5. Demand Management Process (Croxton 2001, 19)

Strategic sub-processes begin with the specification of the demand management goals that should be linked with the corporation's strategy (Croxton et al. 2002, 54). Successful demand management requires a lot from people implementing executing the process. The general justification for forecasting is the better understanding of the business operations it produces. During the forecasting process, people will become more aware of the long-term consequences of their own decisions, which helps them to make better decisions in the future. Customer knowledge, operational business flows, market awareness and industry knowledge are vital aspects to dominate. (Lawless 2014; Wilder & Ozgur 2015) Furthermore, the focus of the forecasting process must be well targeted to avoid getting the wrong things in the forecast.

After the strategic guidelines of the demand management process are set, the second strategic sub-process focuses on procedures used for forecasting. The appropriate selection of researchable variables, forecasting methods and essential control and review levels of the forecast form the core of procedures. After a thorough review and identification of these strategic sub processes, the walkthrough of operational sub processes begins. (Croxton et al. 2002, 53-55)

The operational demand management process starts by reviewing available information, both external and internal. Right information is assembled when the data collection procedure follows the parameters determined in the strategic sub-processes. (Croxton et al. 2002, 61) Extensive data collection from different sources and combining all the gathered information is essential for the forecasting process. Data collection is the single most sensitive part of any analytics work. Bad data leads to lamentable analysis and incorrect conclusions and actions. The validation of data refers to organisations ability to separate good data from bad data. In the best case, the identified, poor quality data can be edited to a usable form. Occasionally corrupted data is better to reject thoroughly. (Braunstein, Bretas, Rossoni, & Bretas 2015, 1) After data is collected, selected and validated, analysing and forecasting process shadows.

Forecasting consists of repeatable four phases: data analyse, forecast development, tracing miscalculations or data faults and providing accurate feedback (Croxton et al. 2002, 61). Forecasting is often only executed without thinking more precisely of its goodness, badness or development. Continuous learning loop where forecasting errors are tracked and forecasting methods adjusted for better results is prerequisite for the development of company's forecasting ability (Croxton et al. 2002, 61).

The operational demand management process ends with the measurement of the performance with the metrics defined in the management strategy. Performance measurement metrics must be linked to company's economic value added (henceforth abbreviated as 'EVA'). Developed asset management, better product availability, improved investment deployment and in-time resource planning are examples of benefits gained through successful demand management. (Croxton et

al. 2002, 59, 63-64) The desired top-level consequence of performance measuring is overall process development. Through identifying the grievances and sweet spots of the company, optimization gets more sophisticated and performance improves. (Croxton et al. 2002, 64) It must to be bear in mind that functional operating process as a whole, always follows the defined strategy.

3.5 The Role of Demand Forecasting in Business Planning

Today's business procedures are chains of operations. Every component of the chain has its own occupation in a series of actions that aim to add value for the end commodity and to shareholder. Even if the operations in the chain are independent, they are also interdependent. Demand is a factor that has an indisputable tendency to dictate boundary conditions to the business operations. A value chain encloses the entire range of activities that are prerequisite from the early conception of the commodity to the after-use disposal (Kaplinsky & Morris 2001, 4).

Depending on the nature and the breeding value of the commodity, the value chain varies from long and complex to short and straightforward. If the value adding performance of the company is at high level, the company achieves a competitive advantage compared to its rivals. As customer dictates the supremacy between commodities and companies behind them, business decisions should be made as customer-oriented as possible (Woodruff 1997, 141). Continuous and successful market making without customer-oriented mind-set is genuinely impossible.

Customer order decoupling point (henceforth abbreviated as 'CODP') is the phase in the chain of operations where a commodity links to a specific customer order. Hence, CODP dictates the point where company start to use forecast to adjust its operational activities instead of actual orders. The position of CODP is highly dependable on the characteristics of the industry such as the quantity and volatility of demand and the elasticity of production and planning. CODP is located in the beginning of the value chain in the industries with volatile demand and long delivery times and vice versa. (Olhager 2003, 320-322)

Based on the location of CODP in the value chain, companies and their operations may be roughly split between order-driven and forecast-driven (Olhager 2003, 320). Construction industry represents the ultimate end of order-driven business. Fundamentally, each project is ordered and built to the identified customer. When commercial and residential buildings or civil engineering projects are custom-built for private or public customer using for example hard bid or negotiation contract form, it is clearly order-driven business. However, the construction company may also make an order to itself. In this case, company starts to build a development project to the land it owns and searches the buyer, for example institutional investor or the buyers, for example private home buyers, later in the process.

Development projects contain more risk than external contracts because they are built into company's own balance sheet. Nonetheless, the return potential of the investment goes hand in hand with risk. When it comes to the split between order-driven and forecast-driven, development projects contain elements from both. Order is made by company itself, because organisation believes that it is a healthy business case with profit potential. Therefore, it is forecasted to be sold at the right price within a reasonable time. If the forecast of the business case seems too risky for example due to market forecast, location, project model or lack of potential buyers it will probably not start. Unsold, completed projects bind large amounts of capital and the value of empty premises tends to fall as time passes. Thus, companies are not willing to take unnecessary amount of risks in their own development projects, despite the attractive return potential.

Undoubtedly one of the most important operators of demand forecasting is the supply chain management. Companies' strong focus on their core competencies and the need of flexibility both in production and fixed cost items has led to the spread of subcontracting. Competition that used to be between companies is now held amongst the entire supply chains (Hazen, Boone, Ezell & Jones-Farmer 2014, 73). The most proficient supply chain management creates significant competitive gains for each member of the chain. Increasing intricacy of supply chains directs companies to steer resources to procurement and supply chain management. Demand forecasting plays a key role when trimming the proficiency of supply chain

operations. (Christopher 2012, 3-5) Nevertheless, subcontracting and sophisticated supply chains construct negative impacts on demand management. Complex supply chain network has a tendency to interfere the accuracy demand management with phenomena such as the bullwhip effect.

Today's mavens of supply chain management are overwhelmed with big data that offers wide range of possibilities for decision-making, production optimization and process improvement (Hazen et al. 2014, 73). However, there are opposing opinions. Waller and Fawcett (2013, 84) did not see the direct link between big data and supply chain management as important but emphasized the character of data science and predictive analytics as part of supply chain management.

Supply chain management has encountered critic because it concentrates primarily on costs and on process development that ignores the customer and the market. Demand chain management offers complementary approach to this issue by analysing the overall demand of the market in contrast to the current commodities company offers to its customer. Many researchers accuse term demand chain management should replace supply chain management based on the fact the chain of operations should be driven by market and demand, not driven by suppliers. Christopher (2012, 33)

Demand chain management focuses on finding the elements where company creates value to the customer. Process starts with the definition of micro- and macro-market characteristics. Value profiling and value proposition leads to the definition of commodity features, where the solutions are customer-oriented and based on the market conditions. Product and category management of a commodity, which is based on the customer needs, provides a good foundation for successful customer relationship management. (Rainbird 2004, 238) The contradictory approaches of supply chain management processes and demand chain management processes are detailed in appendix 1.

The demand forecasting is particularly important part of the business planning. Thus, regardless of the characteristics of the company, it should be applied in the decision

making process (Szozda & Werbińska-Wojciechowska 2013, 77). Companies' strategic and operative plans are often made to reflect the expected level of revenue. When the amount of resources is based on the assumption of a certain level of turnover, it highlights the important of demand forecasting (Stevenson & Sum 2014, 12). In the case where approximation of the revenue level is imprecise, it may cause idle in the processes that are crucial to business. Hence, idle results the wastage of both resources and efficiency evidencing the importance of the accurate revenue forecasts.

Business planning should start with an appraisal of future sales. Business plans related to each compartment of the company must be utilized and proportionate to the assumption of future business volume (Stevenson & Sum 2009, 12). Conceivable applications are numerous since business units, processes, and functions require resources to work. Furthermore, resources must be proportional to the volume of the company. Particularly important is to utilize forecasts of future volumes in departments that are in direct contact with sales and manufacturing processes such as procurement and production management (Makridakis & Wheelwright 1989, 20-21).

Based on the location of CODP, for forecast-driven companies demand estimates are exceptionally well suited to avoid either underproduction or overproduction (Olhager 2003, 322). If company's business model is exclusively driven by orders, one might say that company does not anxiously need revenue forecasts. However, heavily order-driven companies may take advantage of revenue forecast for example in resource planning and while determining the levels of fixed costs. Furthermore, demand forecasts are highly applicable for occurrences such as analysis concerning company's financial and market position, industry trends and cost structure. (Makridakis & Wheelwright 1989, 19-22) All things considered, demand forecast is a great tool of business controlling, planning and scheduling for management through all levels of the organisation.

Sales and operations planning is the beating heart of the company maintaining a process that aims to balance both supply and demand of the company while making

a profitable business. To some extent, sales forecasting affects on all the levels of operational and strategic planning. When studying the business operations of any company, it is not difficult to find the decision-making moments in which a functioning crystal ball would be useful. Particularly, production-intensive companies and heavily subcontracted business operations benefit from accurate forecasts when managing demand and supply chains through sales and operations planning (see appendix 2). (Mentzer & Moon 2005, 10-14) Altogether, a forecast that company may count on produces better decisions at all the levels of the organisation. Business operations as a whole are hard enough to manage without great uncertainty concerning the potential range of future demand.

3.6 Characteristics of Demand Forecasting

Demand forecast is an approximation of the level of demand for a commodity at a specified period in the future. Accurate demand forecast creates stability and predictability in the organization. The objectives of the forecast, what organisation wants to achieve with the forecast, dictates all the choices that are made in its development. Time dimension of the forecast is one of the fundamental decisions to be made in the early phases of the process. (Buffa & Sarin 1987, 54) Demand management consists of various process interfaces, which is why users often have different expectations about the forecast. Consequently, forecasts with different characteristics and time dimensions are essential to meet the needs of each user group of the forecast. (Croxton 2001, 19) The longer the time dimension of the forecast is, the more strategic level decisions should be able to be made based on the forecast. In turn, forecasts with short time horizon are particularly useful for detection of rapidly changing trends, and thereby enable dynamic operational response of the organisation.

Makridakis & Wheelwright (1989, 20) have identified four separate time dimensions of forecasting. The shortest time dimension, which is called an immediate period, stands from one day to one month, and a short period settles from 30-days up to three months. Due to their tendency of detecting the seasonal fluctuations particularly well, immediate and short period forecasts are valuable for quick, operational fine-

tuning related production levels, resource allocation and pricing. In addition, characteristics of the short-term forecasts are more precise, easier to tailor, more cost-efficient and more detailed than long-term forecasts (Lapide 2001, 18-19).

Medium forecasting period stands between three months and two years. Forecasts with medium-length periods are particularly well suited for fundamental decisions related to production levels, resource allocation and cost-structure as well as for profit optimisation, balance sheet and cash flow calculations and budgeting. Attention to trends, seasonality and cyclical fluctuations is crucial in medium and long period forecasting. (Makridakis & Wheelwright 1989, 378-385) More often than not, forecasts with immediate, short and medium length are used for time series analysis purposes. Time series may go a long way in history, but towards the future, extrapolative power of time series may weaken due to increased uncertainties (Box, Jenkins, Reinsel & Ljung 2015, 2).

Forecasting period is titled a long period if it reached over two years to the present. Frequently, forecasts over two years from present are always comparable to strategy work and long term business planning related to long-lasting decisions such as investments, divestments, sales and ensuring healthy financial position. (Makridakis & Wheelwright 1989, 20-21) In order to improve the accuracy of long-term forecasts, which have a lot of built-in uncertainties, also qualitative and macro-level input must be taken into consideration (Buffa & Sarin 1987, 55). Since each forecasting situation is unique, the barriers between the time dimensions of the forecasts are fading and it is not even necessary to make a precise universal alignment (Granger 2014, 6). Extensive time horizon boosts inaccuracy of the forecast. Therefore, making too detailed forecasts far into the future is not desirable.

Chopra & Meindl (2010, 199) have introduced the four main principles of demand forecasting, all if which are more or less related to the impreciseness of forecasts. First principle states that forecasts are always inaccurate and that must be accepted. There is no method or model advanced enough in the world that is able to forecast exactly right repeatedly. Inaccuracy encourages forecaster to create a forecast range (high case – most likely – low case) or forecast with fuzzy numbers. Approach takes

forecast error into consideration when assessing the reliability of the forecast. Forecasting error must be measured and monitored and forecast should include information about its presumptive forecast error. (Chopra & Meindl 2010, 199) The more uncertainties the forecast contains, for example related to the length of the forecasted period or external factors, the more inaccurate the forecast is.

According to third principle total demand forecasts tend to be more accurate than sub-demand forecasts. Phenomenon is due to the law of large numbers, where excessive dividing of datasets and urge to reach the level of detail leads to a loss of accuracy. Bullwhip effect is the last demand forecasting principle of Chopra & Meindl (2010, 199). Bullwhip effect has the tendency weaken the precision of demand forecasts. Even if inaccuracy is one of the attributes of forecasting, they should not be fated. After all, focusing on forecasting accuracy is likely to improve it in the long run, and the purpose of forecasting is to give prospects for the future, not the absolute truth.

Bullwhip effect is an inherent part of demand management. In a nutshell, bullwhip effect generates errors to the demand levels and forecasts (Grabara & Starostka-Patyk 2009, 132). Errors happen due to multi-layer supply chain where each actor in the supply chain places greater orders than their actual demand estimation suggests. This safety factor piles up in the chain and increases the inconsistency of orders and demand as illustrated in appendix 3. As a result of the increasingly distorted demand information, more complex the chain is and the greater the gap is between the end customer and the company, broader is the gap between the actual demand and the up front achieved demand information. (Chopra & Meindl 2010, 199)

Bullwhip effect originates from four different sources: order batching, pricing, shortage gaming and demand forecast updates. Order batching problem is a consequence of order delays and deplorable predictability of orders, which lead to under-, and overestimation of demands. This happens due to practical reasons: when order arrives, it rarely takes place instantly upon request. Lack of real-time order status and weekly or monthly basis order cycle leads to order assembly, which creates operational inefficiency. (Lee, Padmanabhan and Whang 2004, 1877)

Reductions in commodity prices have a negative effect to exchange in a supply chain because actual needs of the company and bought quantities do not meet. Consequently, stocks are piling up and capital is committed. Swollen stock and varying prices lead to a problem where the supply does not meet the demand. Domino effect of shortage gaming begins when companies regulate their products to the customers in a situation where demand exceeds supply. Customers are returning the favor by placing oversized orders and if necessary cancelling orders when demand is falling. Insufficient update frequency weakens the quality of demand information. While demand information goes through numerous stages of the supply chain, the cognition changes as it passes adding the variance and reducing the reliability of the information (Lee et al. 2004, 1877). All the reasons together behind the Bullwhip effect disturbs coherent decision-making and causes inefficiency and additional costs for the organisation. (Lee et al. 1997, 97-99)

Bullwhip effect may be reduced with active and open discussion and information sharing amongst the organisations in a supply chain. Information sharing reduces issues related to all the major reasons behind bullwhip effect: order batching, pricing, shortage gaming and demand forecast updates. Small batch sizes helps to control order-batching problem. Furthermore, non-discount strategy and a common desire in a chain not to unnecessarily wave prices damper price fluctuations. Customer allocation based on the past sales is one way to moderate the shortage gaming. Various actions may be made in order to restrain the bullwhip effect in a supply chain. If Bullwhip effect is powerful and cannot be curbed, the entire chain may be cut off. Nevertheless, it is not probable to wipe out the phenomenon as a whole if company has a tendency to it. (Lee et al. 1997, 99-102) In the context of this research the Bullwhip effect appears first and foremost in the causal relationship between order bookings, order backlog and revenue.

Careful definition of demand forecasting process and finding the right prediction method are crucial elements behind the successful demand management. According to Armstrong (2001, 8) the forecasting process starts when the problem emerges in the organization (see figure 6, 45). At first, grievance needs to be accurately described. After the problem to be resolved is formulated, all the relevant information

and data concerning the issue must be brought up. Gathered data is further processed in order to understand the substantive pieces of information for problem solving. Furthermore, selected data must be converted into the format that serves the forecasting purposes.

| Formulate Problem | → | Obtain Information | → | Select Methods | → | Implement Methods | → | Evaluate Methods | → | Use Forecasts |
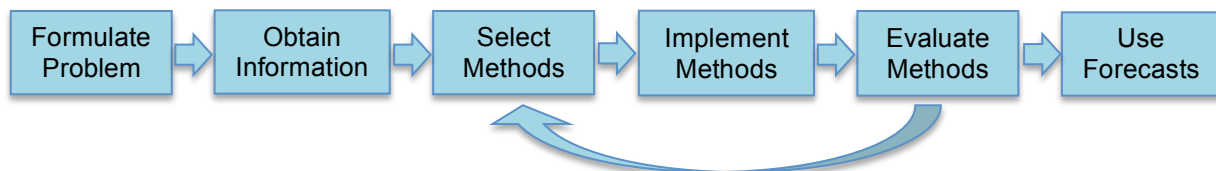
Figure 6. Stages of Forecasting (Armstrong 2001, 8)

It is necessary for the forecaster to understand the nature of the data so that it can be taken into account in building the forecasting model. All the major variables affecting the prediction and the inconsistent variations in the data must be taken into account. Information gathering and data processing is followed by the selection of forecasting methods. Thereafter the use of forecasting models and further development may begin. (Hanke, Reitsch & Wichern 2001, 69-70)

The fifth step of the forecasting process: evaluation of forecasting methods is able to destroy the entire forecasting process. If the critical evaluation of the model miscarries, there is a high probability that it results a prediction model that does not serve the purpose for which it was built. Accuracy evaluation between the information produced by the forecast and the reality is the most obvious way to expose the exactitude of the forecast. If the models used are proven to be inaccurate, few steps will be taken back in the process. The loop from method selection through implementation to method evaluation must be repeated as long as the desired accuracy is achieved. (Armstrong 2001, 8)

Subsequently, the method evaluation creates the most promising forecasting models for further improvement. Generally, the most accurate models are selected. However, also other factors than accuracy such as complexity of the forecasting method, forecasting costs, contentment within the organisation, desired forecasting period, purpose of the forecast and data accessibility must be bear in mind throughout the forecasting development (Hanke et al. 2001, 71). Thereafter, the accuracy of

forecasting and all aforementioned factors should be frequently estimated in the event of errors made throughout the forecasting development process.

There are multiple elements affecting the sales forecast. Macro level factors such as market and business environment are more or less given, uncontrollable features to company. Market shares and demand balance are either primarily or secondarily influenced by the actions of other players in the market and in the supply chain, regulation form government, company's own actions. All factors together impact on the structure of sales and profits. Hence, time and reflection should be used in to develop forecasting model that takes all the affecting elements in to account. Thus, by comparing forecasting methods and combinations of factors, model becomes more and more accurate. (Armstrong 2001, 6) Even if the forecasting process starts from the problem nativity and ends to the usage of well functioning forecasting model, it is fundamental to realise the important of continuous development and revaluation of the model when there are constant, minor changes in the operating environment.

3.7 Analytics in Construction Industry

The construction industry is accountable for executing the most expensive projects in the world. Construction projects are filled with complex processes from excavation till the finishing works in order to build a skyscraper, bridge or underground metro line. While abundance resources are needed to accomplish the projects, construction process generates huge amounts of data for analysts to crunch.

Analytics have always been part of the construction business. However, construction industry does not have a reputation to implement modern tools among the first. Big data, advanced analytics and machine learning are good examples of the modern tools that have shone in their absence in the construction industry, while other sectors have taken great steps forward in exploiting them. (Bilal, Oyedele, Qadir, Munir, Ajayi, Akinade & Pasha 2016, 500)

The importance of big data analytics has been emphasized in both academic and business environment over the last two decades (Li et al. 2017, 62). Construction

industry creates massive amounts of complex data every day. Projects generate a lot of data, which has been stacked away to companies' hard drives without greater exploittation. Thus, it seems that in most cases due to data inactivity, the quality of the stored data does not meet the expectations of modern needs such as predictive analytics, machine learning or artificial intelligence. Incomplete and unstructured datasets make the progress of the company extremely hard to track. Siloed data makes it more difficult to utilize information to achieve greater benefit through analytics. (Soibelman et al. 2008, 15) Conclusions that are made based on these datasets are highly unreliable, less transparent and prone to miscarriage.

Analytics are converting the construction industry and possible applications are countless, from architect drawings, design control and building information modelling to construction work flows, procurement planning, financial management home buying with augmented reality applications. Industry volumes are huge, projects are expensive and characterised with tight time schedule. Even tighter than the schedules are margin levels of the construction industry. Applicability of big data and analytics in construction industry is further improved with the emergence of BIM, augmented reality technologies and smart buildings (Bilal et al. 2016, 516). All industry and universal trends combined, these changes ought encourage to the use of big data and more sophisticated analysis of the operations in the future.

3.8 Theoretical Reflection to Case Study

Strategic and operational demand management create the foundation of this thesis as defined in Croxton's (2001) process chart of demand management (see figure 2, 14). Demand management is a cohesive scheme that guides management to evaluate, control and track their business units (Crum & Palmatier 2003, 4). In 2007, Davis and Mentzer discovered that in most organisations, there is a gap between the theory and practice of sales forecasting. Thus, study aims detect the practical applications of forecasting and reflect them to theoretical framework.

Generally, two types of material are used behind the forecasting: on the other hand, updated current state of the phenomenon based on the recent data, and on the other

hand, information on the long-term evolution of the examined phenomenon. This research utilizes data series and interviews to understand the past, the current state and the desired future of the phenomenon. Long-term evolution may be verified on the ground of the theoretical model and the development history of the predictable phenomenon using for example data time series. Hence, theoretical model describes the normal development of phenomena to which the deviations can be reflected.

The purpose of the quantitative part of the research is to answer to research question related to the first sub-objective by discovering regularities on how revenue forecast accuracy improves over time. Quantitative analysis is executed by measuring the accuracy of the revenue forecasts made in different time periods. Hundreds of forecast series and actuals from different levels of the organization are used to form a forecasting funnel. Forecasting funnel should work as a bell curve of revenue forecasting. *Hence, research hypothesis of the first sub-objective is that the accuracy of revenue forecasting improves when moving forward in time from the previous forecast cycle to the next.* This is due to the fact that the amount of construction contracts that company seeks to sign for forecasted year, target works, is reduced. (Chopra & Meindl 2010, 199) As a result, the relative share of secured revenue increases and the confidence in the construction starts of booked orders is improved.

In terms of financial steering of the company, data analytics particularly often focused on management and finance accounting, cost management and strategic financial management functions. The findings of this research would make it possible to construct preliminary scenarios of revenue forecast statistically. Preliminary revenue forecast would be the baseline estimate from where the forecaster starts with hers/his own vision to shape forecast forward. Bell curve of revenue forecasting would also allow for an objective scenario approach. Therefore, the level of uncertainty in an overall forecast of a multi-level organization would be taken into account at the group level in strategic decision-making. Throughout the year, for example profit recognition planning, tax planning and resource planning could benefit from the knowledge of how certain is this forecast we are looking at.

In January 20, 2018 George Benaroya, the VP of Finance and Global Controller of P&G, posted a topic called "CFOs are overconfident in their ability to forecast results" to Business Control -community in Linkedin. Sensational headline was based on the Duke University's survey that consists of 11,600 forecasts from S&P 500 corporations made by company CFOs. It was proved that CFOs were heavily overconfident of their ability to forecast the market for the next year. Research was executed using bell curve theory with the 80 % confidence interval. In practise, CFOs were asked a level of revenue, which they felt 90 % sure to be too high, and a level of revenue they felt 90 % sure to be too low for next year. The actual error rate was three times higher than CFOs expected. Topic raised a vivid conversation in the community and many controllers identified the benefits of a broader scenario thinking compared to the single forecast approach in their organisations. (Benarova 2018)

Thus, one of the main areas of research in this case study is to recognize the thoughts related to conservative forecasting, over-optimism and scenario thinking in forecasting. Furthermore, this research aims, through interviews, to seek the balance between healthy conservatism and harmful prudence and techniques to overcome the identified challenges of revenue forecasting. The purpose of the qualitative part of the research is first and foremost to answer to them main research question and the second sub-objective of the thesis. The second sub-objective takes a position on the role of rolling forecasting as part of the financial forecasting process. *Hypothesis for the second sub-objective is that the role of rolling forecasting is to act as supporting forecast and additional information for annual forecasting. When it comes to reporting, it is assumed that rolling forecasting is merely done on controller's desk based on the project data and it would be used to detect internal trends over the year. (Bourmistrov & Kaarbøe 2013; Hansen et al. 2003)* Hypothesis for the main research question is most challenging to form in advance: *Improvement of forecasting accuracy is considered as challenging, but possible task for an organization. Hypothetically, the suggestions for improvement would relate to more detailed project control, training of the people, system support and better distribution of best practices within the organization. It is assumed that different sentiments within an organization occur.*

4. EMPIRICAL ANALYSIS - FORECASTING IN SKANSKA

Business never stands still. Empirical research has a crucial role as a verifier and recorder of the changes that are happening in management development (Kanthi Herath 2007, 895). The purpose of the empirical part of the study is to define answers to research questions introduced in chapter 1.2. The main objective of this study is to examine the forecasting ability of construction stream of Skanska Finland and how the accuracy of financial forecasting can be further improved to be an increasingly robust and significant part of strategic decision-making. The secondary research questions are created to support the main objective of this study.

The research focuses on the accuracy of financial forecasting in construction, the challenges related to forecasting and the problems caused by inaccurate forecasting. Predominantly, the research focuses on the importance of revenue forecasting and how organisation may utilize accurate forecasting in strategic decisions. This study focuses on revenue forecasting, as many of the forecasted items under revenue in the income statement include a lot of emotions and adjustments, for example reserves that effect on the profit accumulation. A case study can be defined as a research of an active event. Empirical case study uses a variety of acquired information in order to study the current event in a particular environment. In the case study, the aim of the case study is to collect information in a variety of ways and to gain more profound comprehension of the phenomenon. (Metsämuuronen 2001, 16-17) The case study is grounded on triangulation, combining elements from quantitative and qualitative research.

The research focuses on looking at forecasting from the executive management point of view. In addition, the roles of operative middle management and financial management are wielded in order to provide a comprehensive view of the processes that affect the generation of forecast information. The study focuses neither on evaluating the professional forecasting performance of individuals, nor on seeking superiority. On the contrary, the target of this thesis is to objectively analyse the various levels of the organisational information within the constraints of triangulation that uses both qualitative and quantitative data sources.

The empirical part of the study is divided into five chapters. The research area and general information of the case company Skanska and construction industry are presented in the chapter 4.1. Alongside the research methods, data is presented in chapters 4.2 and 4.3. Chapter 4.4 includes the analysis of the research divided in five subtopics. Chapter 4.5 introduces synthesis of the results and encloses answers to all research questions alongside the criticism of the results and approach for further study. Finally, the conclusive main chapter 5 presents the summary and the conclusions of this study. In conclusion, the focus is on the interpretation of causal relationships and comprehensive but sharp summary of the thesis.

4.1 Case Study Company and Its Operating Environment

Skanska is one of the world's leading construction and project development companies founded in 1887 by Rudolf Fredrik Berg in southern Sweden. It operates in selected home markets in the Nordic countries, Europe and the United States. Skanska operates based on its strong value base and builds for a better society in cooperation with the customers and the communities around. Skanska's aim is to be the leader in corporate responsibility in the construction industry by offering innovative, sustainable solutions for both simple and complex projects. Skanska employs circa 38,000 people and the Group's net sales in 2018 amounted to approximately EUR 16.6 billion. Skanska Finland started its operations in 1994. Skanska's operations in Finland may be categorized to three business streams: construction services, residential development and commercial development. Construction services include building construction, civil engineering and maintenance and engineering. In 2018, Skanska Oy Group generated revenue circa EUR 1 billion and employed 2,152 people in Finland. This case study focuses solely on the construction stream that is by far the largest stream of Skanska in terms of revenue and obvious choice of scrutiny due to the research layout. (Skanska 2019a)

In order to understand the requirement of this empirical case study it is important to disclose the dynamics of industry. Construction industry is highly affected by its post-cyclicality, economic situation, consumer confidence, environmental responsibility and governmental decisions. During the periods there is uncertainty in the economy,

it reflects to construction industry due to tail away of construction investments. When the resources are limited and there is a certain amount of uncertainty in the market, fewer investments are made by the public and the private sector. The lack of investments can be seen in the construction industry characteristically about a year after the market situation has weakened. (Forecon 2019a) Naturally, individuals are more agile to withdraw their investment decisions than companies, of which hands might be already tied and budgets locked.

In addition, the post-cyclical nature of the construction industry is due to the fact that already started works will naturally completed. Thus, order backlog is usually sufficient for at least a year ahead enabling revenue recognition and continuation of the business despite the beginning of the economic downturn. Nonetheless, as this research will show, the post cycle will only continue for a limited period of time. Ordinarily, the same post-cyclicality applies to the market behaviours pattern in the upward market. However, the latest economic upturn in Finland was exceptional in the sense that the construction sector, instead of post-cyclicality, was a clear economic driver of the country. (Forecon 2019b)

In a highly competitive market area, such as construction industry, knowing your customers and competitors is everything. Construction industry is both driven by private and public customers. Private customer may be further divided into institutional private customers and individual homebuyers. The battle for market shares in Finnish market has been quite active, since many companies strive to grow in the wake of the recent construction market pick-up. In addition, it must be remembered that the construction industry is one of the easiest sectors to enter as a one-person entrepreneur and start growing your business. When it comes to the size and mode of operations, the main competitors of Skanska in the Finnish market are YIT, NCC and SRV. After the merger with Lemminkäinen, YIT (2018 revenue EUR 3.8 billion) is by far the largest company on the market followed by Skanska and SRV (2018 revenue EUR 1 billion each). Thereafter, next biggest players in the domestic market are NCC, Lujatalo and Lehto Group (2018 revenue EUR 0.5 – 0.7 billion each) with altered business models. (Balance Benchmarking 2019)

All three aspects of corporate responsibility: ecological, social and economic, are strongly present in the construction industry. Responsible business is driven by tightening regulations, customer needs and awareness, as well as stakeholders and investors. Thus, the environmental responsibility is a solid part of modern construction industry. Construction business in general necessitates profusion of natural resources. The challenge of modern construction business is to build green homes, offices and infrastructure with a slightest ecological footprint possible. (Saieg, Sotelino, Nascimento & Caiado 2018, 791) The demand of houses built in an environmentally responsible manner continues its progress, while construction companies are trying to develop more cost-effective and environmentally friendly ways of working. In 2017, Skanska AB started using global UN Sustainable Development Goals to assess its responsibility work. (Skanska 2019b)

Despite the macro factors, the volumes of construction industry are fairly steady. This is due to constantly aging building stock. Balance between new construction and renovation has been developing recently to the direction where renovation has increased to a greater extent than new construction. In the civil stream, the civil construction is both unremitting and vital in order to maintain the form of roads, bridges, tunnels and other infrastructure, whose obsolescence is necessary and the need for repair continuous. Governmental decisions have a fundamental effect of civil business, since the public sector practically owns the entire infrastructure in Finland. (Forecon 2019a)

When it comes to macroeconomics, factors like GDP growth, consumer confidence, geographical differences and the growth of construction investments could imagine to correlate with both the volumes and the profits of construction companies. However, as seen in recent years, the construction market has been vigorous, but not every enterprise has been able to maintain their market share. The same rule of inconsistency applies to operating margin. Despite the construction boom of recent years, for example year 2018 was profit-wise very disappointing for large and medium sized construction companies in Finland. (Balance Benchmarking 2019) Dejection may be said to be consequence for the increase of raw material and labor prices caused by the overheated market. Many companies accused the good market

for bad results in the year-end 2018 press releases. One might say that the business that characteristically has low margins should do better when the market pulls.

"Due to the market situation, it is great to see that we are able to think really far into the future, which proves how systematic construction business can be at its best. However, this is entirely geographically dependent. In Helsinki metropolitan area, the situation is completely different than for example in Kuopio." (Group Mgmt A)

4.2 Triangulation: Qualitative Research

Qualitative methods are highly subjective as they are based on the individual competence, intuition and judgement of the experts. Qualitative data is based on the interviews that were chosen as the primary data collection method of triangulation case study due to its immerse potential to get deeper information about the phenomenon, for example by asking additional questions and clarifications from the interviewees. Furthermore, interview as a data collection method is flexible and leaves room for a more informal answer, which the interviewer did not initially plan or even ask. (Hirsjärvi, Remes & Sajavaara 2001,192)

Data is collected with a semi-structured interview, which is characterised by pre-defined framework of the interview that is both flexible and gives room for deviations (Hirsjärvi & Hurme 2001, 47). The theme interview, which is used in this study as a data collection method, is the most common method of semi-structured interviews (Ruusuvuori & Tiittula 2005, 11). The theme interviews are characterised by pre-set themes, not precisely delimited with specific questions. Thus, it is possible to collect information in a way that leaves room for the interviewees' own thoughts and interpretations. In order to ensure that each interviewee's voice is heard without being influenced by the opinions or thoughts of other individuals, each interview is conducted as an individual interview.

The interviews are themed in four parts: current status of financial forecasting, challenges of financial forecasting, rolling financial forecasting and future visions and

needs of financial forecasting. The first theme covers the state of forecasting in the case company aiming to understand how financial forecasting is used to guide the organization at the moment and how the forecasting process works. Thereafter the main focus of the interview shifts towards the encounters and future visions of forecasting. The second theme explores the challenges of forecasting that organization has encountered. The third theme aims to outline the status, challenges and more efficient use of rolling forecasting in the organization. The fourth and final theme is a free-form mapping of development ideas and ideas.

The themes aim to stimulate an honest debate about the current state of forecasting, the challenges related to forecasting and what measures could be taken to meet the future expectations for forecasting. Thus, some of the interview questions are fairly open in order to enable the natural formation of the answer. The purpose of the interview is neither to direct the interviewee in a particular direction by interviewer nor by the setting of the question.

Interviewees include four individuals from group management: Chief Financial Officer, Group Controller, Group Finance Manager and Group Accounting Controller. The group management perspective is important in order to understand how the information generated by forecasting influences in managing the people and steering the organization. In addition, interviewees include six individuals from regional management, focusing on regional unit controllers who act as financial managers for their own unit and are an important part of the unit's management team. Part of their job is to participate in strategic decision-making and executive teamwork of the unit. Controllers' point of view is particularly applicable since they have the best knowledge and understanding of the current state of financial forecasting and potential challenges in the organization. Specification of all interviewees is listed in table 2 (see page 56).

The themes are based on the key points raised in the literature framework. Two different types of interview frames were built according to these themes (see appendices 4 & 5). The interview frame of group management and group administration focuses more on strategic decision-making and future goals of

forecasting. The interview frame of regional controllers merely focuses on evaluating the current process and identifying the challenges and future needs of financial forecasting. However, interviews are not strictly limited, i.e. a particularly strong vision of the future from regional controller would get space in an interview if interviewee wants to bring it up.

Table 2. Specification of Interviewees

ID	Job Title	Duration of the Interview
Group Mgmt A	Chief Financial Officer	• 30 min
Group Mgmt B	Group Controller	• 28 min
Group Mgmt C	Group Finance Manager	• 24 min
Group Mgmt D	Group Accounting Controller	• 21 min
Controller A	Controller (Regional Unit)	• 37 min
Controller B	Controller (Regional Unit)	• 26 min
Controller C	Controller (Regional Unit)	• 27 min
Controller D	Controller (Regional Unit)	• 27 min
Controller E	Controller (Regional Unit)	• 49 min
Controller F	Controller (Regional Unit)	• 60 min

The research material consists of ten interviews in the Skanska Group. Interviews were conducted as individual interviews in May 2019 at the company's headquarters or via Skype. Interviews lasted from 20 minutes to one hour. All interviewees gave permission to record interviews, which were transcribed. The semi-structured interview method guided the discussions and additional questions were asked from the interviewees, which were spontaneously defined by interviewer on the basis of the discussion. Further questions were aimed at gaining an even deeper understanding of the subject of the investigation and, consequently, more justified answers to the research questions. The interviewees were instructed to reflect everything they have seen in the case study company when answering the questions and to take advantage of their industry knowledge while answering to questions with broader issues. Interview questions were not sent to the interviewees in advance, because the purpose of the interviews were to reactively find out the first things that come to mind rather than processed, "lesson learned"-type of answers to the interview question.

The collected material was structured under research questions and different topics according to the answers. Firstly, frequently recurring issues were raised, followed by the most essential, one-time entries of the interviews. When the material was structured according to the four topics, it was further divided into themes under the following headings: Skanska's way of forecasting, forecasting frequency and horizons, project forecasting, regional unit forecasting, group level forecasting, target works, conservative forecasting, Bell curve –thinking, forecasting horizons, risks in revenue forecasting, secured vs target revenue, consequences of inaccurate forecasting, resource planning, management's point of view, current role of rolling forecasting, future of rolling forecasting, external requirements for forecasting, success factors of forecasting, importance of communication, system support, strategic decision-making and future visions and actions.

On the basis of the analysis, the desire was to find interesting similarities and differences both within the regional units and between the regional units and the group management. The objective of these discoveries was to provide an analytical description of the current state of financial forecasting and structured development suggestions for the case organization. Conclusively, the results were reflected in the synthesis of the results paragraph.

4.3 Triangulation: Quantitative Research

Lee (1999, 414) identified one of the top concerns of management accounting to be the enabler of comparison between financial forecasts and financial actuals. Even if the evaluation of forecasting is much more than calculation of forecasting error, it is an appropriate place to start. It is important to know the history data and the current situation after which the definition of the future direction is easier. Mentzer & Moon (2005, 145) separate two different directions of forecasting: qualitative and quantitative. Similarly, statistical quantitative methods and judgment-based qualitative methods are the main groups identified in the field of forecasting methods (Armstrong 2001, 9). Situations that suffer the absence of historical data, qualitative methods are frequently used (Mentzer & Moon 2005, 145). In addition, the deficiency of data may preclude the possibility of quantitative analysis and research.

Forecasting error is the difference between forecast and actual outcome. Actual outcome is combination of two factors as presented by Chase (1995, 2) in formula 1:

$$\text{Actual Outcome} = \text{Pattern} + \text{Randomness} \qquad (1)$$

The accuracy of the forecast can be measured in various ways. A widely accepted common practice is to trace the errors of the forecast by comparing the actual value with the forecasted value (Mentzer & Moon 2005, 44). Frequently used tools for the accuracy identification and measurement are demonstrated briefly as follows. The simplest way to calculate the errors of the forecast is to use following formula by Hanke et al. (2001, 75):

$$e_t = Y_t - \widehat{Y}_t \qquad (2)$$

Where e_t is the error of the forecast, Y_t is the actual value and $\widehat{Y}_t$ is the forecasted value of time period t. Ordinarily, the accuracy is measured with the mean error tools (Mentzer & Moon 2005, 46). The main idea behind these tools is to calculate the mean error, either the absolute error or the actual error, and present it as a bare number or as a percentage.

Mean absolute percentage error (henceforth abbreviated as 'MAPE') is a derivative of mean error, mean absolute error and deviation formulas. MAPE indicates the average of the absolute percentage errors. 'PE' stands for percentage error between the actual and forecasted value, whereas 'n' stands for number of observations in the sample. Percentage errors are particularly useful tools when the magnitude of the forecasted variable is essential part of the accuracy measurement since average formulas remove the issue of mean error that result is frequently close to zero. This study uses the mean average percentage error (MAPE) value as well as non-absolute value version of the calculation formula: MPE (mean percentage error), as forecasting error instruments. The calculation formula of the MAPE is represented as follows by Mentzer & Moon (2005, 53):

$$\text{MAPE} = \frac{1}{n}\sum_{t=1}^{n}|PE_t| \qquad (3)$$

The quantitative measurement of the forecasting accuracy is the most common way to evaluate the forecasting performance. Other natural ways to measure forecasting is either through customer satisfaction or costs of forecasting. Nevertheless, both the forecasting costs and the customer satisfaction are exceedingly problematic to measure. (Davis & Mentzer 2007, 478) In the case study company, the customer satisfaction related to forecasting results have not been quantitatively measured and separation of forecasting costs from all project and overhead costs would be highly theoretical. Hence, in the context of this study, the quantitative measurement of current forecasting accuracy using the forecasting error is particularly applicable approach to answer the first sub-objective of the thesis. Although the MAPE has its frailty, it is a comprehensible accuracy indicator for the data presented in this study.

The quantitative, secondary data, more specifically financial forecasts and actuals of multiple layers of the organisation, originates from financial management systems of Skanska. Project management software Aino is key forecasting tool for site personnel. The quantitative research data is collected from Skanska's financial consolidation and reporting software Hyperion Financial Management in May 2019. The quantitative study is implemented using Oracle Hyperion Financial Management, Hyperion Smartview and Microsoft Excel software. Clear outliers were removed and data was sorted quarterly to serve the purpose of the analysis. Because of the data protection, this study uses relative values and indexed data instead of the actual values. The revenue index uses the base period (2015). Research data consists of numerous datasets based of the entity hierarchy of construction stream of Skanska Finland. In compliance with the delimitations of the research, financial data geographically cropped to Finland and limited in time from year 2015 to 2018.

4.4 Analysis

The first subchapter "Secured revenue dictates financial forecasting" is merely based on the quantitative analysis performed with the examined dataset. Data analyses are performed on both the entire material and the sub-materials that focus on exploration the selected variables. Other five subchapters are merely based on the qualitative data from the interviews. Analysis is done according to the knowledge of the

researcher based of the review of the entire research material. Study is carried out in a close collaboration with the construction company Skanska.

4.4.1 Secured Revenue Dictates Financial Forecasting

A careful analysis of data is a crucial part of well-functioning forecasting process (Jain 2006, 18). Consequently, this case study analyses the dominant dataset behind the revenue forecast: the amount of secured revenue. First, dataset will be analysed with statistical and graphical tools in order to see what kind of correlation is between the accuracy of revenue forecast and the amount of secured revenue in different forecast rounds. Thus, the main objective of the quantitative analysis is to provide the answer to the first sub-question.

Skanska's business is project business. Each project is its own entity and specified individuals are responsible for carrying out the project and creating the forecasts during the lifecycle of the project. Controller, together with the management of the region, is responsible for making a summary of project forecasts of the districts and the entire region and forms the regional unit forecast. Group accounting combines regional unit forecasts first to the form of business stream forecasts. Business stream forecasts together with the elimination entity will eventually form the Skanska Finland Group forecast as a whole. Skanska Finland is part of the global Skanska Group where all the Skanska countries together form the forecast of global Skanska Group.

The idea of shaping a way of forecasting or building a forecasting model infrequently starts with the data. Frequently it originates from operational uncertainties and awakening to the situation that there would be a chance to improve predictability and performance through analysis. (Barton & Court 2012, 81) This is also the case in this research. The organization has always calculated the amount of secured revenue out of the revenue forecast. However, the systematic review of the financial indicator and its impact on forecasting accuracy has remained unexplored. Quantitative part of this research uses the amount of secured revenue and the time-based distance of forecasted moment as explanatory factors. Dependent factor is the accuracy of revenue forecast.
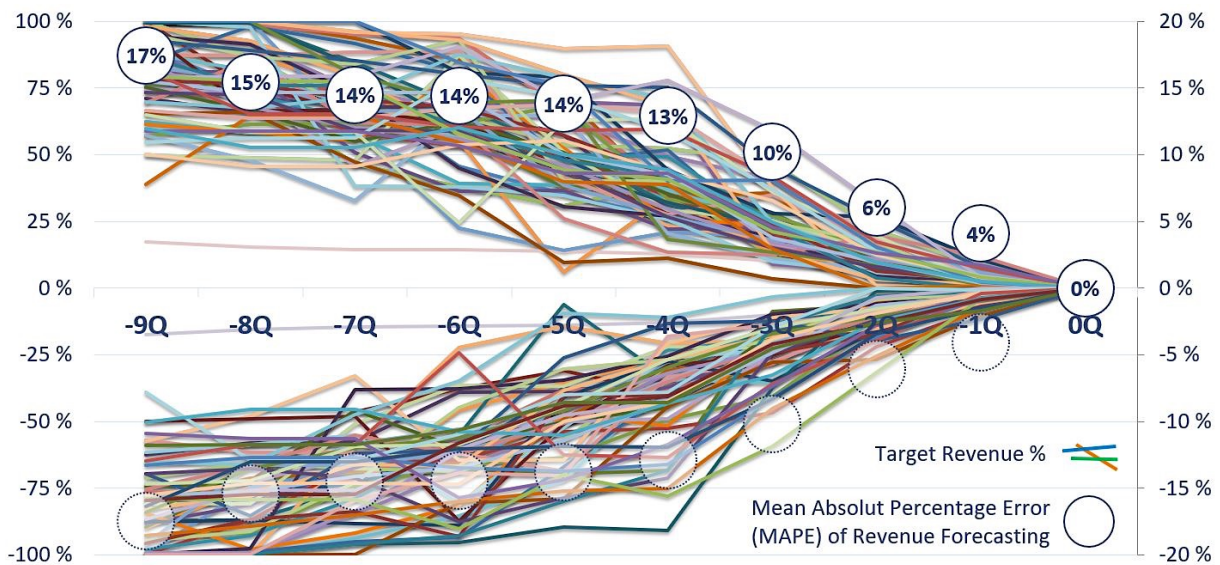
Figure 7. Revenue Forecasting Funnel by Quarterly Reviews

Figure 7 presents the revenue forecasting funnel of construction stream divided by quarters. Time series starts at the beginning of 2015 and ends at year-end 2018. Each line in the graph is time series representing the percentage of target revenue related total revenue forecast. Variable colours represent different units and forecast years. For each of the seven variables listed in table 3 (page 62), raw data includes 590 observations; one per entity and per quarter when forecast is made. Statistics of both raw data and monthly-based index data are represented in appendix 6.

Data analysis discloses that starting from nine quarters afore the annually forecasted year-end, the linear trend line of the mean absolute percentage error of revenue forecasting has the slope value of -0.0194. In other words when moving from quarterly forecasting review period to the next one, the accuracy of revenue forecast increases by 1.9 percentage points each quarter. The risk of the forecast error is at its maximum (MAPE 17 %) nine quarters before (-9Q) the realization and at its minimum (MAPE 4 %) one quarter before (-1Q) the actuals. Additionally, the time series of mean absolute percentage error of revenue forecasting comprises noticeable change over time: when the forecasted period is less than 4 quarters (-4Q) away from the forecasting time, the error begins to decrease faster with slope value of -0.0340 i.e. on average the value decreases linearly with aforementioned amount every quarter. Whereas, between nine (-9Q) and four quarters (-4Q) interval

from the forecasted period, forecasting accuracy only increases nominally and the variance is significantly reduced, as can be seen in the Box and Whisker diagram in appendix 7. Furthermore, it seems that considering the outliers, six quarters before (-6Q) the actuals the variance is smaller than in -5Q and in -4Q.

Table 3. Attributes of Revenue Forecasting Accuracy

	-9Q	-8Q	-7Q	-6Q	-5Q	-4Q	-3Q	-2Q	-1Q	0Q
Mean Target Revenue %	81 %	77 %	68 %	63 %	50 %	39 %	23 %	10 %	3 %	0 %
Mean Secured Revenue %	19 %	23 %	32 %	37 %	50 %	61 %	77 %	90 %	97 %	100 %
MPE	-7 %	-7 %	-7 %	-9 %	-6 %	-7 %	-5 %	-1 %	2 %	0 %
MAPE	17 %	15 %	14 %	14 %	14 %	13 %	10 %	6 %	4 %	0 %
Mean Forecasting Accuracy Rate %	83 %	85 %	86 %	86 %	86 %	87 %	90 %	94 %	96 %	100 %
Mean Forecasting Error (MEUR)	-1.5	-2.2	-3.2	-4.6	-1.5	-1.8	-1.2	0.3	2.3	0.0
Mean Absolut Forecasting Error (MEUR)	13.2	11.6	10.6	10.0	8.3	8.2	6.7	4.7	3.4	0.0

As presented in the revenue forecasting funnel by quarterly reviews in figure 7 (see page 61), when the relative share of target work decreases, the mean absolute percentage error of revenue forecasting decreases as well. The phenomenon has been further studied using Box and Whisker diagram. As presented in appendices 7 & 8 the variance of both explanatory and explainable factor decreases when moving closer to the forecasted period.

On the basis of the data analysis, correlation between the secured revenue and the accuracy of financial forecasting is undisputed. However, it must be borne in mind that there might be a lag between the moment when project is booked to order backlog and the moment when construction and revenue generation starts. This creates uncertainty between the secured revenue and forecasting error and thus weakens the correlation between the variables. Nevertheless, lag should be taken into consideration when forecasting secured revenue. The research focuses on the factors that improve forecasting accuracy. Correlation between the secured revenue and the accuracy of financial forecasting creates an urge for a closer research of target work forecasting, which is highly emphasized in the interviews. Hence, research propositions may be formed and utilized in interviews and interpretation of results as follows. Based on the observation it is default that the earlier the number of target work will be diminished, and the relative amount of secure revenue is high, the better the forecasting accuracy of the unit is. Thus, besides the forecasting manners of on-going work, study focuses on the dilemma of accurate target work forecasting.

4.4.2 Current Status of Revenue Forecasting

The review of current status of revenue forecasting started with the open description of the way of forecasting in Skanska. The interviewees raised both realistic and diverse perspectives related to forecasting structure and characteristics.

> *"We are forecasting and reporting cost-based using a partial recognition of revenue in project business." (Group Mgmt B)*

Revenue is generated through the cost and profit recognition. Standard construction contract includes production schedule according to which costs accrue and revenue is recognized. Bell curve –thinking, that originates from probabilities and risk awareness, was descriptive feature of observed forecasting ideology. Many inter-viewees believe that there are a lot of in-house differences in the way of forecasting. Still, the in-house expertise in forecasting is strongly trusted through the organisation.

> *"Forecasting is unit-specific, project-dependent and person-centred. It is steered and scheduled, but ultimately intensified with the forecaster's personal qualities and the way to do it." (Controller F)*

> *"There is no common defined way of forecasting on a regional level. Everyone does it the way she/he sees fit. However, we have learned to do forecasting well, because the process is often repeated." (Controller D)*

The process of forecasting was described as a long, bottom-up information flow where the detail orientation is noteworthy particularly in project level. The life cycle of revenue originally starts from the bid where project is tendered with a specific tender margin. The target setting for individual project originates from bid calculations. When the target estimate transforms to a cost estimate, cost reserves are added by site manager or production engineer. Financial reporting is done conservatively, and profit forecasts are raised as project progresses and uncertainties diminish. Cost forecasts, and subsequently revenue forecasts, for a specific point of time are generated through project transcripts, which are detailed breakdowns of costs. Furthermore, Skanska's way of forecasting was described to be accurate.

"Forecasting process goes bottom-up, starting from projects after which they are summed up and questioned by unit management and controller." *(Group Mgmt B)*

"Occasionally, there is a risk of losing the whole picture if we focus too much detail." (Controller E)

Although the forecasting was theoretically seen as a straightforward process where the top-level forecast is the sum of its parts, other influential factors were identified. Depending on the situation of the forecasted project or business unit, both over optimism and over conservatism are seen to occur.

"To some extent, forecasting may also be directed top-down if the project manager or regional unit has a need to achieve a particular goal. Regional managers are strongly guiding the level of revenue by directing project managers to seek potential contracts or to take a closer look on POC (percentage of completion) of the current projects." (Controller E)

"Adjustments may be made on each of the forecasting levels. In addition, profit pressure increases the risks for forecasting." (Controller F)

"Financial forecasts are generally conservative and signs of old budget thinking can be seen in the organization. Forecasting is a process that needs to be carefully focused." (Group Mgmt D)

For the project, the most important thing to follow should be the entire project life-cycle forecast, not any part of the project. Partial optimization within a project can lead to unnecessarily hefty revenue and profit recognition. Behaviour may be due the performance and bonus agreements that that creates pressure and obscures rational thinking. Furthermore, forecasting confronts appear inversely at various project models, different levels of the organization and the impact of macro factors on operational activities was considered significant.

"In principle, revenue forecasting of on-going project should be fairly easy. This applies particularly to ordinary construction work contracts. When talking about more complex target- and roof-priced projects and alliance agreements, the challenge factor of forecasting increases. In addition, when we go bottom-up from the project forecast and talk about the regional unit and group revenue forecast, the challenge is growing. This is due to pipeline and market management and how to make pre-selection of which projects are must-win for us. After all, it's a huge puzzle. We need to see when situations change, plan our resources right, find the potential customers and deal with the market competition around." (Group Mgmt A)

When it comes to the conservative safety margins when forecasting revenue, evaluation is done case-by-case based on the project portfolio. Regional manager together with the project manager most commonly determine how secure each project on the short-term pipeline is, which creates the base for financial forecasting of target jobs. Moreover, conservative safety margins are dependable on calendar year. For example, if it is assumed certain job should be signed to the order book in the last quarter of the year, there is a risk that it will flip into the next year. Constant shift of the construction starts makes forecasting more challenging.

"If contract is signed during the last months of the year, project has neither the ability nor the time to generate lots of revenue instantly." (Controller E)

Conservative and realistic might be the best pair of words to describe the way of forecasting in Skanska. Principle is particularly suitable considering the risk of excessive income recognition.

"At least let's not promise too much. It's essential to think about where we really have a chance." (Controller D)

Conservatism in forecasting is particularly focused on the project margins. On the other hand, over-conservatism in forecasting has its drawbacks such as profit recognition that does not reliably reflect operational activities of the company.

Particularly target works are brought into the forecasts rather conservatively, depending on the certainty of getting the job. For example, alliance projects that are in the development phase can be brought into the forecast a little more briskly when the possibility of getting the contract is at higher level than in the standard competition. The loss of target work can greatly affect the unit's forecasting accuracy if the job has been overestimated in forecasts. In the best case, regional unit has fast-start backup projects. In that case losing a tender does not automatically mean a significant decrease in the forecast. In the worst case, over confident forecasting of target work scraps the profit of the year. In difficult situations, the potential of cooperation beyond the regional unit boundaries was widely emphasized.

> "What if the job is not won? In the worst case, if there is no contingency plan, we have nothing. Help could be available from other regional units, which I would rather see to happen more often." (Controller E)

> "We have a target job, but we should also have plan b and plan c, all of which must be taken into account when forecasting. The biggest risk is in units that are financially weaker and slightly forced to win projects in order to generate the profit needed. If the unit has APGI, it's easier to keep calm and not to take projects in at any cost." (Group Mgmt B)

Both project level and regional unit level forecasters are in danger to be too caught in the present moment. Consequently, they do not have enough time to focus on the future. This may be due to a lack of resources or that a small unit puts all its resources into a large project. According to the interviews the units that are generating good profit are able to make plans averagely further to the future than those with a worse financial position. Uncertain situation of the unit is seen increase the focus on the current year, while a stable unit can afford to focus on the future.

> "There should be more resources for planning and managing operations. If organisation has organic pressure to grow, there should be courage to over resource momentarily and take young people in to develop their skills. Too rarely we think thoroughly what projects we will be doing two years from now. I think we should." (Controller E)

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Revenue scenarios are based on project scenario forecasts since projects assess their own risks and opportunities. The high scenario of revenue lean on imagination that practically no risks or only minor risks are realized. In the low scenario of revenue, the most of the identified risks for forecasting period occur. According to interviews there are different ways to estimate scenarios depending on the organization and the characteristics of the projects.

"The current order backlog forms a low case, high scenario takes into account the possible target works optimistically." (Controller C)

"First, it is considered how much revenue is certain, after which the potential forecast errors in on-going projects will be evaluated. On top of that, target work in the best case and the worst case scenario will be added to create scenarios." (Group Mgmt B)

There is a clear link between the risk concentration of the projects and the forecast accuracy. Theoretically, from the forecasting point of view, target work includes more risk than on-going production. Furthermore, interviewees were unanimous that the high and low scenarios of revenue are merely based on pipeline and target work management than volatility in the forecasts of current production. One major pitfalls to avoid in scenario forecasting is the over-optimism with target works.

"In theory, winning a tender is never certain. Over-optimism in winning the tender competitions often leads to negative surprises." (Group Mgmt B)

"Particularly large projects are conservative forecasted as target works until they are 100 % certain." (Controller D)

"When creating revenue scenarios, it is important to understand what is the share of target work in the revenue forecast and what is the most likely construction start of the target works. In addition, jobs of which construction start are likely to be delayed must be identified." (Controller E)

According to interviews there are several ways to use bell curve of forecasting in the organization. In some instances, high and low cases are based on the theory of 10 % probability to exceed high case and 10 % probability to go below low case. On the other hand, some estimate the scenarios more as absolute revenue thresholds where high presents the ultimate high scenario and low scenario is the lowest imaginable outcome for the forecasted period. Different approaches on the estimation of high and low scenarios may be seen as a risk when interpreting scenarios in order to make strategic decisions for the future. The procedure behind scenarios might also differentiate based on the project size the general availability of the detail information.

> *"In the largest projects, forecast is based on regularly updated bell curve analysis, whereas in smaller projects scenario forecasting is lighten up. In small projects, the scenario ranges are rather small and the estimate is merely based on the experience of the project organization." (Controller F)*

> *"The unit's management must understand how the market behaves and preferably build scenarios based on projects. If a project-specific review is not possible, a rough overall estimate of the project portfolio will be made". (Controller E)*

Furthermore, criticism and development ideas concerning the current accuracy and way of forecasting revenue arise. All in all, the answers exposed that forecasting is a project-oriented process that goes through risk concentration and uncertainty creating different scenarios.

> *"Frankly, revenue scenarios are poorly forecasted. The forecasting goes more through the result. For example, a low scenario is sketched out by removing some of the target work from the forecast." (Controller D)*

> *"Maybe we should start to think about quadruple analyses through efficiency and probability, so that we could also mathematically approach forecast scenarios, whether it is through Monte Carlo analysis or something else". (Group Mgmt A)*

4.4.3 Characteristics of Target Work Forecasting and Time Horizons

Interviewees described the frequency of financial forecasting in different levels of their business units. In general, quarterly reviews are considered more closely than monthly review on regional unit level.

> *"Project can update its forecasts with small changes even daily. Unit's management reviews the forecasts on a monthly basis." (Controller E)*

> *"Each project updates the forecasts at least once a month and forecasts are reviewed in detail at least once a quarter. BU level review runs quarterly. Depending on the unit, for example if the regional unit is a geographically wide, it may not go through the forecast monthly as accurately as a geographically compact unit. The general time guideline for unit-level forecasting is at least once a quarter." (Group Mgmt B)*

Widely, project forecasting is done on a monthly basis, but more accurate forecasts are done quarterly at regional unit level and above. However, regional unit-specific differences exist and processes of each quarter are not necessarily identical. Some interviewees thought that on a group level, one month is a rather short period in construction industry for massive changes to occur. In addition, special features within construction stream were highlighted.

> *"Once a year, the process goes down to the roots. This is happening on the F4 forecast round." (Controller F)*

> *"The biggest focus is on the next 12 months. In civil engineering the quantity of jobs to be done depends largely on government decisions, which is why too far-reaching plans are difficult to do." (Controller B)*

All the interviewees were asked what are the most important time horizons for which forecasts are made in their opinion. The interviewee was then guided to compare long and short term forecasting in addition to their views on the annual, quarterly and monthly forecasts. Furthermore, interviewees were asked how they see four different

forecast times (F1, F2, F3 and F4) and their characteristics. The reviews of F1, F3 and F4 are seen as the most important of the year from the controllers' point of view.

> *"F4 closes the year. F1 takes the first decent view of the year and F3 already outlines the financial statements of the full-year. F2 is the most superfluous forecasting round because it does not include a hard close and it does not introduce any new forecasting horizon." (Controller A)*

Common opinion among the interviewees was that the primary focus shifts towards next year in the F3 forecasting round at the latest. Nevertheless, controllers used the most time for forecasting the current year regardless of the stage of the year since the most accurate calculations can be made for the current year. Even if the biggest concentration during the F2 is still in the current year, focus already moves strongly towards the next year at the strategic level.

> *"In F1 we forecast seven quarters forward, in F2 only six quarters, then in F3 forecasting round it increases to nine quarters. Thus, the focus in Q3 is clearly moving towards the next year." (Group Mgmt A)*

> *"The chain from bidding to construction start can be very long. Conceptually, concentration moves towards next year at a time when the ability to influence this year's business is slim. In the last quarter, there is not much to be done with revenue for the current year." (Controller C)*

Strategic key figures related to order backlog and volume were seen to help outline the revenue forecast. When forecasting a unit that has a tradition to generate steady revenue, revenue of rolling 12 months were seen as a good starting point for forecasting. However, not forgetting to review carefully the amount of secure revenue for the forecast period. Secured revenue were considered as the most important key figure on which an accurate revenue forecast can be built. In addition, book-to-build is considered important in order to identify the trend of future revenues.

> *"Knowledge of the timely spread of long projects is important in order forecast the future." (Controller E)*

"Secured turnover creates the foundation for everything, then depending on the volatility, unit's revenue history can be either informative or completely irrelevant. Information about the capacity of the unit may be drawn from history. In addition, you need to understand your own pipeline, market situation and the position of your competitors." (Group Mgmt B)

Discussion related to forecasting of on-going projects and secured revenue was followed by vivid conversations on target work forecasting. Interviewees were asked how do they estimate the amount of target revenue per year in their business units. At the beginning of the year, the amount of target works is largely determined by the unit's will and mirrored in historical performance and current state of the unit. Targeted work should be evaluated on the basis of how the market looks and the probabilities of clinching individual contracts. Towards the end of the year, reality increasingly steers the reporting of target works.

"Sometimes forecasts are influenced by target setting and revenue levels from previous years. It is easy see the revenue level as standard, that distorts the realistic forecast." (Controller F)

"If the work has not been booked by June, it will have only minor impact on the revenue for that particular year. There must be a good reason for forecasting significant amounts of revenue to current year from the order that is booked during Q3 and Q4." (Controller E)

General observation lead to two approach angles of target revenue forecasting: balancing between set goals and realities. First, project managers have personal revenue targets in a regional unit that reflect the current resources. The difference between the revenue target and the secured revenue forms the objective for each year. Standpoint emphasizes the correctness and justification of the revenue targets since the target works consist of hypothetical works on pipeline and purely scratch work that have not been identified yet. If organization gets caught up in a specific revenue target without reasonable grounds, the consequences may be bad. Particularly when estimating target contracts, smooth information flow and active communication is widely seen as the driver behind successful forecasting.

"Forecasting target revenue is all about discussion with regional and project managers who have a view of the target work for each time horizon in the future." (Controller D)

"For example, regional leadership and project managers may have a different view on target works when one wants to keep the goals high and the other's view is more conservative." (Controller C)

On the other hand, the objective of target jobs is to challenge the business. However, realistic view must be preserved: it is not a good thing if the goal is too easy to achieve. Interviewees highlighted the diverse set of target works must be noted.

"Target works are not a homogeneous group. Sometimes a single goal work can be very sure, for example if the development phase is already underway." (Controller F)

Therefore, target works should be handled differently depending on the contract model and the uncertainty of getting the contract. On a group level as well as within regional units, differences between regions were observed and the idea behind target work forecasting was crystallized as follows. In addition, more theoretical approaches were presented.

"In theory, the forecasting of target work should focus on what is going to be offered and what is the area's hit rate normally." (Controller C)

"Target works are harder to forecast because hit rate in some units is lower than others, which leads to the fact that one way to predict target works is not suitable for every unit. Forecasting of the target work must begin with the review of the current resources and the stage of the year. The competitors must also be monitored, as the position of competitors contributes to the probability of winning the tender competition. Forecasting is complex process that takes time master. Forecast is always a compromise." (Group Mgmt B)

4.4.4 Challenges of Financial Forecasting

Over 20 years ago, engrossing challenge was given to the business world by Woodruff (1997, 139) to think company actions through customer value. He thought that every organisation should consider customers as a driver behind business. Interviewees strongly share the aforementioned view.

"First of all, we have to have a customer and how well we can convince our clientele with our expertise and reliability. In this sense, successes and challenges come largely from branding and marketing, and above all from our business knowledge. If it does not work, the future road becomes short." (Group Mgmt A)

When it comes to the forecasting of regional units, the group management sees the challenge of forecasting clearly growing. Forecasting new jobs may be challenging because in construction industry, business needs to be recreated again and again. New opportunities have to be found in business, which also creates uncertainty for forecasts. Units must be aware of their own project pipelines. Interviewees thought that the units where personnel are pipeline-oriented and able to look further and further to the future are most likely to succeed.

"The fact that we have selected the right projects to offer and to built in order to generate turnover. Risk management during the project selection is the most difficult phase. After successful selection, everything is in our own hands and caught up in the forecasting and cost-tracking accuracy." (Controller E)

The risks of revenue forecasting are seen in both on-going projects and future targets jobs. However, clearly higher risk is seen in uncertain target work. Timing emphasizes uncertainty; it is not easy to predict the time when new contract will be won, signed and notably when construction starts to generate revenue. Furthermore, target works include lots of moving parts, such as zoning, which may delay the start of construction. One internal factor that disturbs the forecasting accuracy is over-

optimism related to both contract winning and quick construction starts. Interviewees also highlighted the importance of planning if important bids are not won. The aggressive pursuit of revenue at any price was also considered to be strongly against corporate principles.

"It is good to have a backup plan in terms of targeted level of revenue. If a big contract is not won, let's get start with multiple small jobs preferably with a quick schedule in order to slightly fill the voids" (Controller C)

"In principle, the revenue target is not the hardest target to reach. More often the revenue which the unit pursues is doable, the real question is at what price the volume is reached." (Group Mgmt A)

Even if the target works are widely considered as more challenging to forecast, also on-going production creates a risk within the forecast. Particularly high-quality POC forecasting of the on-going projects is seen as a critical factor behind the accurate revenue forecast among interviewees. Furthermore, depending on the sub-organization, it seems that the comprehension of overall picture of the business is sometimes in danger to be blurred. Long and multiplex forecasting process is seen to include risks: the time from the project planning moment to the point where group reporting is complete is fairly long. Furthermore, shortcomings in system architecture and different modes of operation between regional units pose risks for forecasting. Too cautious forecasting causes problems in consolidation both at regional unit level and group level. Often, the early part of the year tends to be weak, particularly in terms of profit recognition, but also in terms of revenue. Hence, the expectations for the rest of the year tend to grow.

"Conservatism is present in forecasting in Skanska, but there are also exceptions." (Group Mgmt C)

"Hockey stick" -forecasting, where revenue and profit recognition clearly increases during Q4 after a quieter start of the year, is seen as a conscious culture within a company. Actions to change that state of mind have been done the complete change of culture requires more time to change. The challenges of forecasting are also seen

in human judgment and competence not forgetting proper orientation and guidance, for example when a new person comes to the organization. Also attitudes towards forecasting are seen as a challenge.

"The challenges of forecasting may be related to competence. The personal characteristics and experience of the forecaster affect the risks. For example, in scenario calculations, there may be challenges in getting the figures done. Sometimes this is related to uncertainty of the forecaster." (Controller F)

Since controller have a numerous on-going project in their region, it is not possible to monitor each project accurately. Inaccurate forecasting is seen as a result of lack of knowledge and communication problems. The same information does not reach all levels of the organisation. Here, trust and information flow play an important role. Project knowledge and awareness of the remaining risks is key to a successful forecast. The lack of strategic business information is seen as a major risk to the success of forecasting. The core challenges of forecasting identified are summarized in the table 4 (see page 76).

"The order backlog can spread over a long period of time, which forces the controller to be aware of individual projects and their schedules. Communication between controller and business is very important." (Controller C)

"If controller is not aware of the current status of the projects, "stupid" questions are not asked and thereby not taken to financial forecasts." (Controller E)

Table 4. The Core Challenges of Financial Forecasting

Challenge	Quote
Dependence on pipeline, individual orders and customers	*"Due to the project business, volatility can be high compared to, for example, the trade sector. Adapting to volatility is a major challenge." (Group Mgmt B)*
Project selection	*"The biggest challenges of revenue forecasting originate to project selection and project portfolio." (Controller E)*
Ongoing project control and forecasting	*"There will always be surprises in the project business and these surprises change the project forecast immediately. Altered project forecast, in turn, has a direct impact on the forecast for the entire region and thus on the company's forecast." (Group Mgmt D)*
Target work forecasting	*"Target works include numerous moving parts. Consequently the forecasting of the time when new contract will be won, signed and notably when construction starts to generate revenue is not simple." (Group Mgmt A)*
Human judgment, competence, proper orientation, guidance and negative attitude towards forecasting	*"It may not be understood what is the objective of scenario forecasting in general. For some people, forecasting is not at the top of the priority list. In these cases, the forecasts are not updated on time and they are not prepared properly. It is important to make people understand the importance of forecasting." (Controller F)*
Communication and information flow	*"The limited knowledge of the projects makes it difficult to forecast and critically examine its forecast. If project management is lost, regional projections are also wrong." (Controller B)*
Inefficient system support	*"Abundant use Excel of combined with formula errors increases risk. All in all, unstable, non-enclosed systems and reporting environments increase the risk of human risk" (Controller F)*
Over optimism in forecasting	*"People tend believe in higher volumes and better margins than the reality demonstrates." (Controller E)*
Excessive conservatism in forecasting	*"Volatility naturally involves the risk that deferred expectations are never met. The big challenge is to make a sensible, at the same time sufficiently conservative but realistic revenue recognition plan." (Group Mgmt D)*
Long and detail-oriented forecasting process	*"A long process creates a challenge since there are so many levels and information gets out-dated during the forecasting process. This can lead to last minute significant changes." (Controller F)*
Varying forecasting practices	*"If the operating modes of the units differ, temporary replacement and assistance become more difficult and thus unnecessary risks escalate." (Controller F)*

All the interviewees were asked how does the inaccurate revenue forecast effect on the entire financial forecasting from their point of view. The responses highlighted the comprehensive level of business awareness of the interviewees and various impacts were analysed comprehensive at the strategic level not forgetting the detailed effects, for example on the income statement.

> *"All the work and set goals are based on the assumption of a certain level of revenue. Everything starts with resource allocation. If there is not enough revenue, we do not have enough results." (Group Mgmt A)*

If revenue drops, the questions start to arise. How we adjust our operations? What action should be taken? What the situation is and whether it is temporary? What could not have been predicted? Is the poor accuracy due to internal factors or external factors such as the market or competitors?

> *"Inaccurate revenue forecast affects everything" (Controller C)*

> *"If the first line of the income statement cannot be trusted, the costs and thus on the result is compromised. The impact on key figures is significant, particularly the S & A rate becomes vulnerable." (Group Mgmt C)*

> *"If the revenue is very uncertain, the relative key figures will become challenging. Of course, provisions that are not necessarily directly related to revenue may influence the profit." (Controller B)*

Particularly lively was the discussion of the S & A costs in the case where revenue suddenly drops from forecasted value. Consequently, if costs became too high in relation to generated revenue and planned recognitions of reserves do not succeed. In seven interviews out of ten, overhead costs topic was followed by the discussion related to the need of reservations to align the result if forecast errors occur.

> *"Due to unexpectedly low revenue, there is not enough margin to go through the income statement, and subsequently you cannot afford the S & A (sales and administrative) costs." (Group Mgmt B)*

"Already the loss of 10 % of forecasted revenue, which is realised during the last months of the year, has a tremendous impact and the region's result is likely to collapse." (Controller E)

"New reserves don't accumulate if revenue is not generated. Thus, the amount of existing reserves shrinks." (Controller A)

From this point of view, it is very important that revenue forecasting is on an accurate level continuously. The criticality of the revenue forecasting accuracy is even further emphasized if the unit that does not have any reserves in balance sheet to compensate the possible last minute surprises. However, even a financially well-positioned unit will not stand up to surprises year after year. The accuracy of the forecasts for the early part of the year is very important because then it is still time to react to possible problems with the current year.

"Although there is no official revenue target in the organization, the EBIT target exists through the resources of organisation. In order to make the result naturally through projects, not through reserves, the EBIT target guides units to target certain revenue." (Controller A)

When it comes to the resources, the thumb rule of bidding: "no team - no bid" is seen as a very important rule in the organization. Although subcontracting is very popular in the construction industry, key people should always found in unit's own organization.

"It is important to know what turnover can be achieved with the organization's existing resources. This also contributes to the forecasting. There are cases that the unit's order book is already full in terms of current resources." (Controller C)

In the case where unit runs out of resources, it may think about replacing resources from other regional units, additional external recruitments or opting out of the tender. For the management of regional unit revenue forecasting is above all a resourcing exercise. Hence, among the interviewees the after-effects of the uncertainty of

revenue forecasting were seen in particular from the perspective of resource planning and exceeded overhead costs.

> *"Too optimistic or pessimistic forecasts can both lead to hasty decisions in resource planning." (Controller D)*

Problems are seen particularly if the net sales forecast is higher than the actual. On the other hand, too conservative revenue forecasts can make it difficult to plan your earnings.

> *"If the actual revenue is unexpectedly higher than forecasted, the alarm clocks have to ring. What haven't we noticed? Are the profit recognition percentages precise and the POC levels correct?" (Controller F)*

Of course, there are challenges in a Skanska's current way of forecasting. Some of those are particularly characteristic from the group management point of view. If the desired level of revenue is not reached at the group level, the pressure starts with overhead costs. This is due to the fact that organization is build to certain form and it requires a specific level of revenue to cover its overhead costs. At worst, incorrect information leads to wrong actions.

> *"From the management's point of view, the concerns are partly different. The wrong forecast can give a wrong indication of the geographic market situation for the management. On the other hand, you are not able to do strategic resource planning correctly." (Controller F)*

> *"Everything is about adjusting in strategy and support services that are highly revenue-related. It is important to constantly think about whether the support services of our business are properly designed." (Group Mgmt B)*

Wrong information tends to escalate as it proceeds in the organization. Inaccurate revenue forecast may be clearly seen on a group level when everything is consolidated together. This underlines the fact that even in a large organization small things can have a big impact.

"The group suffers when there is less revenue. Consequently, there is less group contribution, which leads to the situation where also group has more uncovered expenses because the revenue is used as a key to allocate the group's overhead costs to the operating units." (Group Mgmt B)

"If the revenue forecast is incorrect, the uncertainty will be transferred to group eliminations, including the elimination of internal revenue. Uncertainty at regional level is multiplied at group level, as many group entries are based on forecasts made by regional units." (Group Mgmt C)

Reacting time for changes is seen as crucial element form the management's perspective. The earlier you have accurate information concerning the future, the more time you have for decisions and actions. Furthermore, the bottom line in precise forecasting is to give a realistic picture of where company is today and to which direction is it going. Forecasts must reflect the stories told. A reliable forecast is also generally seen as a credibility issue.

"You must tell the business story through numbers and the story and the numbers must speak the same language." (Controller E)

"In terms of strategic adaptation and resource planning, it is critical to think about how long you can wait and when the decisions must be made." (Group Mgmt B)

"Future projects cause great uncertainty for group management. It is crucial to realise how quickly changes occur. Have we made the right strategic choices in the past in order to be in the right places to get the desired volume? In the Helsinki metropolitan area, the mind is calm because the market offers opportunities. However, even the best people do not guarantee the winning of the projects in areas where work is simply not available to a large extent and competition is brutal. In line with the company's strategy, we let our competitors rather take the less potential projects by force. Profit before growth." (Group Mgmt A)

4.4.5 Rolling Financial Forecasting

Based on the previous studies, complementing traditional annual forecasting with rolling forecasting is one of the most used techniques to enhance the company's financial management (Ekholm & Wallin 2000; Sivabalan et al. 2009). Thus, rolling forecasting does not need to replace traditional budgeting; two methods may be used in parallel to support each other. This is also the Skanska's way of working. Skanska Group has been using rolling forecasting in some form since early 2000s. The rolling forecasting model has been implemented through all levels of the organization; the use of the rolling model is well established and quite unanimous regardless of the unit. Additionally, the general feeling for rolling forecasting is positive.

"Rolling forecasting has directed people away from budget thinking. The changes in the culture of rolling forecasting are smaller, more controlled, and more justified than before." (Group Mgmt B)

"In the annual forecast, the problem is caused by discontinuity. Rolling forecast slips forward more smoothly and takes future into account more efficiently." (Controller C)

"I like the fact that rolling forecasts are done quarterly for the next four quarters and yearly two to three years ahead." (Controller E)

Nevertheless, incentives within the organisation are built based on calendar year, which drives the interest towards the annual forecast. Forecasting involves year-based profit planning in this sense. Thus, annual forecasts are prioritized and the quarterly forecasts are considered as guiding forecasts.

"Particularly the production people are primarily interested in the current year because the performance bonuses are attached to it" (Controller D)

General interpretation among the interviewees is that the organization does not take full advantage of rolling forecasting. Furthermore, the current ways in which the rolling forecast is utilized around the organization are somewhat unclear. In addition,

more than one interviewee expressed the view that rolling forecasting is done because the parent company in Sweden requires all the business units to do so.

"From my point of view, rolling forecasting is not actively monitored at any level. Each month, even every quarter includes so many changes that direct the organization to look at annual forecasts rather than a shorter time frame, such as quarterly or monthly forecasts." (Controller A)

Nevertheless, the benefits of rolling forecasting are seen in the construction business, as cyclical fluctuations are commonplace in the industry and rolling forecasting is capable of sensing the seasonal variation. Additionally, 4Q rolling forecasting is believed to be more accurate compared to the artificially created quarterly forecast where annual forecast would be split in four parts.

"In our unit, rolling forecast is seen to supporting annual forecast. When we know that something happens every year in a given month, we can manage the whole and provide information about seasonal variations." (Controller B)

"Summer is a good example: quarters may be calmer. Thus, the greatest benefit of rolling forecasting is trend tracking within a year." (Controller A)

Overlooking fluctuations is also seen as a problem at different organizational levels. In quarterly rolling forecasting, both project and regional unit levels often overlook the seasonal variations, such as a quiet beginning of the year or a summer holiday season. This poses a challenge for quarterly cost and revenue forecasting.

"The cost accumulation in the beginning of the project seems to be the most difficult to predict. It is often heard to say from project people: distribute them evenly over the quarters, even though in practice the revenue is never steady." (Controller F)

Annual cycle of reporting and forecasting is seen to trigger problems in the situations where partial optimization leads to over recognition of revenue and profit.

Furthermore, controllers see some risks of inaccuracy in the current way of project forecasting, particularly in quarterly allocation of the forecast.

"Slightly overstretched revenue for the previous year effects negatively on the volume of the first quarter of the next year. If we'd exploit rolling forecasting more than at the moment, it could make the yearend less painful." (Controller C)

"Rolling forecasting is not widely used; it is rather created on the controller's desktop. Quarterly degree of readiness is an estimate, not computational, and systems are not automated to support forecasting in that sense. At present, each project forecasts the percentage of completion of its own based on cost accrual. In the worst case, the controller guesses the degree of readiness of individual quarters based on the annual forecast." (Controller E)

Altogether, individual quarters are not considered very deeply in Skanska. Here, could be potential scarify and look more at the future through the rolling quarters at both the unit and the group level, in order to better manage profitability.

"Even if the focus has to be kept in the future, maybe we should monitor the accuracy of the forecasts more profoundly. What went wrong, what can we learn from this? In this task, rolling quarterly forecasts could be really useful. Performing a post-analysis in a reasonably simple and effective way could lead to improve forecasting accuracy in the long run." (Group Mgmt A)

As the interviewees emphasized, the levels of rolling forecasting should be simple enough. Vision is completely in line with Åkerberg (2006, 60) who stated that it is crucial to identify critical business success factors, which rolling forecasting should focus on. Controllers, who are balancing between the individual project forecasts and regional unit forecasts, raised diligently both the challenges of rolling forecasting and the suggestions for improvement.

"Projects consider project forecast as a whole, not on an annual basis. In this sense, the project world and the financial management environment are very different. On the other hand, the challenge is to combine these perspectives. As project size increases, the importance of individual projects increases. In this case, the forecasting error for a single project becomes really significant for business unit. It is also customary to delay the start of the own development projects, which increases the difficulty of forecasting." (Controller F)

"I don't think that people in the production use rolling forecasting in any way, they are fully focused on the project performance as a whole. In my opinion, rolling forecasting could be utilized more in production." (Controller D)

There are differences between the regional units in the monitoring of the quarterly forecast and actuals. Some units do not take an advantage of observing the accuracy of individual quarter forecasts in organisation. Consequently, there are some best practices within the organisation on how to make most out of the rolling forecasting.

"It is good that individual quarters are forecasted on a project level. When the actual data of the quarter becomes available, we follow up how accurately project managers have forecasted their projects. In this sense, we follow a rolling forecast at a fairly accurate level. I am paying close attention to the inaccurate forecasting of POC, which is directly reflected in revenue. The overall forecast has improved significantly and people have learned to forecast when the accuracy of forecasting is being tracked and best practices are discussed with them." (Controller D)

Furthermore, the scrutiny of rolling forecasting is seen as a great early warning sign for the organisation to notice that something is going sideways in the project.

"If the forecast has not been realized as expected either the costs are undercut or the site schedule is overdue because the POC does not proceed as expected." (Controller D)

The earlier such signs are detected, the better strategic decisions will be made to get over the issue. When it comes to the project control, it is important to be able to look at smaller sub-assemblies than one year or the whole project. Rolling approach is seen to offer great tool for this prerequisite.

"We definitely need those mid-term reviews. Forecasts change so much during the year, so even a monthly-based forecast review is warranted to be in use. In addition, project quarterly forecasts are analysed afterwards, which develops our organisation." (Controller F)

As the interviews revealed, reviewing the success or failure of rolling forecasting depends on much more than just the accuracy of forecasts. Rolling forecasting should above all provide information that can be utilized in strategic decision-making and organisational development. Thus, rolling forecasting offers added value and a new perspective to organisation alongside traditional forecasting and budgeting.

"Hopefully, it would create even more long-term vision for the unit's management and helps them to consider continuity. Culture of rolling forecasting is all about being able to smooth out things and not just optimize for the current year. It is particularly important to be aware of the multi-annual projects and their impact." (Controller F)

Generally interviewees' thoughts were positive related to the forecasting culture of Skanska where company does not only forecast whole years, but always introduce at least one new quarter to forecast when time passes from one forecasting period to the next one. Based on the gained information, it can be said that the full potential of rolling forecasting has not been exempt in Skanska and forecasting may be further developed in this respect.

"The unit and the group level review could develop to be more focused on future through the rolling quarters. This could lead to better manageability and more effective steering in profit planning. A greater focus on corporate management could lead to a better control effect and encourage the rolling

forecasters to focus on forecasting when objectives and effects of the rolling forecasting are commonly known." (Group Mgmt B)

"The idea of rolling forecasting is at the right level, but we could make even more out of it. There should be even clearer audit trail behind forecasting figures, which would allow drill-down from group-level figures to the detailed project level plans and forecasts." (Group Mgmt A)

At end of the forecasting hierarchy, 4Q-rolling forecasts are utilized in management reporting and performance reporting at the group level. Rolling key figures and financial ratios are seen as an integral part of presenting the rolling forecasting mind-set of the company to a larger audience. The use of rolling forecasting enables the use of these rolling economic indicators also to the future, not just as the key figures of historical performance. Typical horizons of rolling figures in Skanska is 12-months.

Rolling ratios related to income statement may be for example 12-months rolling revenue, earnings before interests and taxes or sales and administrative costs. Particularly interesting balance sheet –related rolling key figures used in Skanska are for example rolling level of working capital or capital employed and long term working capital ratio %. When it comes to the order bookings of a company, peculiarly trustworthy idea of the future operative volumes of the company may be found by studying the rolling book-to-bill ratio. This generally used ratio turns in the dictionary of construction industry from book-to-bill to book-to-build ratio, which will be further discussed later in this study. The basic idea of book-to-build –ratio is to divide order bookings of a certain time period by generated revenue of a certain time period. Depending on the industry, this provides a good estimate of future revenue levels, particularly if the industry has rather long production times.

"The ratio of rolling order backlog and net sales should also be more focused on the quarterly level. Furthermore, better communicated and accurate rolling forecasts increases credibility." (Controller E)

All in all, the use of a rolling forecast in Skanska is highly focused on supporting the full year financial forecast. For further research, there is a clear need within the

company to study the model of rolling forecasting, its special features and its role as a part of the entire framework of forecasting in more detail.

4.4.6 Future Visions and Needs of Financial Forecasting

In the final stage of the interview, respondents were asked what would be the benefits of more accurate revenue forecasts from their perspective and how organisation would achieve better forecasting accuracy. Main objective was to find substantial actions to develop forecasting process and to reach future visions and needs of financial forecasting. Prerequisites begin with the owner's expectations.

> *"We have clear targets from the owner. Forecasting and reporting must be transparent, reliable and stable. If the revenue forecast fails, the reliability and the credibility are immediately tested by the owner." (Group Mgmt A)*

Forecasting is seen to facilitate the communication both within the business unit and towards the parent company by giving greater room for future planning, instead of concentrating on the present. Transparency was desired to have even higher position to solve forecasting problems and to adjust company's resource requirements in the long term. Moreover, controls are aimed be based on the fast and frequent feedback.

> *"People may be afraid to tell bad news, such as weakening forecasts. Communication is not always easy. However, bad news communicated in the right way is often seen as a positive way of working rather than telling in the last minute or not telling at all." (Controller E)*

> *"Accuracy brings confidence to the regional unit both externally and internally. The fact that things are progressing as planned makes people feel positive." (Controller A)*

The traditional approach on forecasting is somewhat conservative and the desire is to avoid excesses in the future. The fact that things do not happen unexpectedly is considered as the cornerstone of forecasting. Good relationships, trust, and

functional communication within an organization are seen as very important features that enable effective forecasting. Furthermore, forecasting is widely seen as a matter of credibility. The fact that the controller can rely on project forecasts provides assurance for managing a diverse project portfolio. Hence, partly because of successful past years, it can be heard that the trust within the organization has increased and has led to positive consequences.

> *"You trust what we do and you trust people around you. Trust must run down through the organization. If we would come to a situation where we could no longer rely on revenue forecasts, it would begin to chip away the trust we have built together. Everyone must deliver the news, even if the news are bad. Afterwards analyse what happened and learn from it, the main thing is that communication is transparent." (Group Mgmt A)*

The accuracy of the revenue forecast is seen to have a great impact in strategic decision-making. Strategic decisions are simply better if they are based on more accurate information. Thus, interviewees recommended the importance of forecasting at all organizational levels should be more highlighted by the management. The user perspective was widely emphasized; forecasting should be made easier, more illustrative through visualization and less risky. This applies to all of the holy trinity of forecasting: processes, systems and people.

> *"We know with better certainty where we are and where we are going, making all the operations easier to control. We should be sure not to be in a situation where the measures taken based on the F1 forecast are not relevant half a year later, and the ship has to be reversed due to poor forecasting accuracy." (Group Mgmt D)*

> *"We should make the forecasting as easy as possible for the person who makes the forecast. All computational items should be automated so that the person making the forecast can focus on the essentials." (Controller C)*

Some interviewees thought that from the strategic management point of view, the current focus is not far enough in the future. Altogether, all activities in the

organisation are based on the assumption of a certain level of business. The response capacity is weak and the movements are very slow if focus is solely on the current year. More market-oriented business focus and management reporting was proposed as solution.

> *"It would be good to talk more about the market outlook and market making of Skanska in the future. The long-term forecast should also be constantly visible. One should be able to react to the future, for example, the decline in housing production in the market should be enough time to adapt and change the focus and look for new markets in business. It would be a good idea to have a long-term market view of our forecast. If you are going to make strategic guidance, you should look actively two or three years into the future; not focus on the near future" (Controller E)*

History can help predict the future, but it is not a guarantee of the future, expressly in the construction industry. However, historical data is seen to support forecasting, particularly in the detection of trends and seasonality. Market-oriented approaches for future and close follow-up on revenue structure are both recommended trends.

> *"Furthermore, it is equally important to consider the structure of revenue. What kind of project portfolio we have behind the revenue and whether the structure of our revenue is in line with the strategy." (Group Mgmt A)*

Existing projects are considered rather easy to forecast from the controller's point of view, because the project organization has the best knowledge about the project and they create project forecast. Improving the accuracy of target job forecasting is seen as more challenging task because it always involves high degree of uncertainty. Obviously, there is operational uncertainty also related to the on-going projects. However, target works are always uncertain and that must be seen in forecasted figures. All in all, the predictability of target work is seen to be lower than on-going production, which is why it should be underlined. Detailed categorization and more structured way of evaluating target jobs from the financial forecasting point of view was suggested action for accuracy development.

"Let's define the boundaries where target works with different status will be handled with different weights. We may qualify projects that are very uncertain and projects that are fairly certain and roughly set own forecasting rules for these categories." (Controller A)

Large projects are considered more likely to be forecasting-oriented than small projects. Furthermore, interviewees have often heard complaints that small sites have little resources, many other things to do and too little time for forecasting. Thus, the right resource allocation alongside the expertise is seen as a subject to be developed. Interviewees recognise that Skanska's way of working improves forecasting quality due to the fact that forecasting is made at a precise level – project-by-project and cost-by-cost.

"Controller is not able to be on the site daily basis. Thus, it is extremely important to get information about the projects through reliable project forecasts and detailed discussion. Otherwise, we can't support the business." (Controller F)

As noted above, the role of project organisations in forecasting is considered to be the most important for forecasting success. Thus guidance, training, cooperation and communication are seen as important tools to improve forecast accuracy. In particular, the role of follow-up and discussion of measures to improve accuracy are considered important. Forecasting skills may be improved with sparring by colleagues and management. When you predict inaccurately and understand the reasons for this, the skill of forecasting develops. Forecasting is highly dependable on the people of the forecasting organization, their skills and priorities. Successes are seen to feed even better performance. Trust and general attitudes towards forecasts are more positive if it is commonly known that unit's forecasting accuracy is at good level. The quality of the forecast is caught by both expertise and attitude. Changing the attitude requires a lot from superiors.

"Both training and follow-up of the forecasting process and accuracy on the site level are crucial. When challenges arise, detours can be found.

When resources are scarce for example production engineer can play a greater role in the forecasting process. We have to intervene when needed and be able to ask if another site or person can help and support another site with forecasting. When every participant of the forecasting process understands the importance of it, significant improvements to the forecasts can be achieved." (Controller F)

"It might be helpful if people in production would understand better the importance of long-term forecasting and not just focus on this year".
(Controller D)

The key tools for project forecasting in the organisation are project management software Aino and Excel. The strong position of Excel is seen as a risk and a clear development target for the company. Furthermore, there is no comprehensive controller's tool for regional level forecasting. Controllers believe in the active sharing of the best practises within the organisation. The challenge of launching collective tools is seen in the different needs of the regional units. However, it is believed that congruent way of working would be possible and could have a great potential.

"In order to develop project summary forecasting, I'd like to see the uniform controller tools to be improved instead of the current individual ways of working. Everybody says that I have a unit that differs form others. It's important to find a common way to technically do forecasting among controllers and develop the practises together, using the best know-how we have available in Skanska." (Controller F)

Reduction of manual work phases in forecasting is seen as an important development target. Excessive share of interviewees working hours was considered to be taken by technical execution whereas the time should be spent on analysis. Interviewees dreamed about more accelerated process where changes would be taken to only one system. Proposals for broader deployment of automation, robotics and analytics were heard from almost all the interviewees. Even more advanced development suggestions considered the use of Monte Carlo -simulation as a background of revenue forecasting and the potential of artificial intelligence and

machine learning to support forecasting process. Furthermore, very detailed practical development suggestions were provided, which would be implemented to develop the forecasting process.

"Forecasting process should get more automated. From project pipeline certain projects could be named directly as target works. Hence, the project forecast of target work would be handled quarterly in the same way as on-going projects. It would be easier to handle the forecast on the controller's desktop through concrete target projects with information that goes seamlessly from one system to another." (Controller D)

"If 3D models, resource plans, work plans, and schedules were linked to forecasts, forecasting would be more accurate, scientifically calculated and would make target setting easier. If information systems were integrated, time would be left to monitoring rather than manual forecasting and technical reporting. Automation of the near future and better system support would also leave time for longer-term strategic planning. However, current forecasts are surprisingly close to the actuals; we have learned to forecast by trial and error." (Controller E)

Altogether, organisation is seen to be able to provide support in order to find better ways to forecast the future business. Organization has a lot of know-how to refine and share best practises. Jointly further developed processes and systems are seen to provide good base for user-oriented, well-focused forecasting in the future.

"There is no shortcut to happiness in forecasting. Forecasting consists of many different pieces and projects and experience helps to question and eliminate risks." (Group Mgmt B)

"Processes has to be in good condition and systems need to support the processes. Thus, forecasts could be easily consolidated upwards and effective down-drilled. An adequate level of review should be determined, while being careful not to go too detailed. Systems should enable analytics and even artificial intelligence in the future." (Group Mgmt A)

5. SUMMARY AND CONCLUSIONS

The journey towards data-driven business is underway. Utilization of accessible data for forecasting purposes is one of the key functions for diverse businesses to focus on in the near future. Modern forecasting practices challenge the traditional target setting state of mind. The synergy between practice and research will create superior forecasting practices compared to those developed by each group independently. This study disclosed the versatile theoretical framework; the importance of the future market-orientation in business through the positive effects of secured revenue and the bridge between the current ability and the future visions of revenue forecasting in Skanska Finland.

Transparent, reliable and stable forecasting and reporting are the paramount requirements from the owners of Skanska. The importance of the accuracy of the revenue forecast as a prognostic and directive factor for both operative and strategic decisions such as resource planning, performance planning, target setting, risk management, overhead structure, reserve management and revenue recognition cannot be overemphasised. This justifies the dominant position of revenue forecasting at the core of robust financial management decision-making.

Forecasting as a process is a challenging task that should be continuous and consistent. If successful, it will create significant added value at all levels of the company through better strategic planning and control. Furthermore, an organisation with a shrewd forecasting ability exudes credibility, punctuality and trust. From the perspective of continuity, the most important task of forecasting and analyses is learning. Via learning organisations are able to improve their operations, heal from negative strands and promote their performance by re-steering the direction of the company. All in all, while operating in a market, which is dependable on the decisions of both public and institutional customers and even private homebuyers, forecasting increasingly becomes the principal approach to manage operations and resources of the company. Accurate and efficient financial forecasting equips an organisation with enhanced competence to foresee the changes in its operative environment, to give more time to react and take action.

5.1 Synthesis of the Results

As in many other order-driven businesses, in the construction industry the order book determines the future volume of the company. The order backlog that is large enough in relation to company volume and secured early enough is a factor of paramount importance for business predictability and financial forecasting. Profit margins in the construction industry are relatively low. Hence, the level of revenue gives management a fairly good picture of what the expected profit of the business unit is if everything goes as planned. Throughout the year, the key functions such as resource and profit recognition planning may benefit from the knowledge of the probable error margin in the forecast.

The higher the price of a forecasting error is, the fewer mistakes an organisation can afford. The faster a company can adjust to changed requirements, the higher error is acceptable. (Jain 2006, 18) The purpose of the quantitative part of the research was to discover regularities on the amount of secured revenue affects forecast accuracy in different time horizons. Quantitative analysis was executed by measuring the accuracy of the revenue forecasts made at different times in advance of the actual outcome. Forecast series and actuals from various levels of the organization were used to form a forecasting funnel to work as a bell curve of revenue forecasting. The research hypothesis of the first sub-objective was proved to be correct:

> *As a result of the increasing share of secured revenue and the reduction of more uncertain target work, the accuracy of revenue forecasting improves when moving closer to the forecasted period.*

The findings of this research would make statistically assisted bell curve and preliminary scenarios of revenue forecasting possible for various levels of the organisation. Furthermore, the bell curve of revenue forecasting would also allow for more objective scenario approach. Based on the studied data, the individual characteristics and forecasting tendencies of the units could be objectively considered, for example, if someone systematically forecasts revenue more conservatively. In terms of financial steering of the company, the level of

uncertainties within a multi-level organization would be taken into account in strategic decision-making.

Organizations' ability to renew their operative culture in a more dynamic direction is seen as a prerequisite for success in the modern business world. For organisations and researchers, rolling forecasting is one way to fight against the limitations and challenges of traditional annual budgeting and forecasting. The purpose of the second sub-objective was to clarify the role of rolling forecasting as part of the financial forecasting process and its connection to forecast accuracy in the case study company.

> *Rolling forecasting supports the annual forecast and directs the organisation to focus on continuity rather than fixed periods. However, the incentives force the organisation to prioritize annual perspective. Rolling forecasting improves the forecasting accuracy by offering shorter review period for the organisation to focus on and to intervene in time. The organisation would like rolling forecasting to be a more cohesive part of a strategy process to increasingly support annual forecasting in the integrated planning cycle. Advantages of the rolling approach are commonly known and the case study company has untapped potential related to rolling forecasting, which it can further develop.*

In order to support strategic decision-making, singular quarter forecasts were not seen as important as annual forecasts. However, among the interviewees some sort of rolling approach was considered as a modern forecasting method that should be further emphasized. In addition, the hypothesis related to the ability of rolling forecasting to detect fluctuations within a year was raised several times during interviews. Rolling forecasting combined with data analytics was reckoned to provide new beneficial outlooks for organization's financial forecasting. Skanska needs to refine the purpose of rolling forecasting from the strategic perspective and its role as a part of the entire framework of forecasting. A proper drill-down from group-level figures all the way to the detailed project level plans and forecasts was a highlighted objective where rolling forecasting could play a big role. All in all, the idea of rolling forecasting is well rooted in the organization but the work towards better

manageability and more effective steering through rolling forecasting is still in the early stages.

Because of the fact that revenue has an effect on an infinite number of external and internal factors of the company, it is essential to achieve a high degree of certainty in revenue forecasting. One of the core areas of the research was to recognize the organization's concerns related to scenario thinking in forecasting, the legitimate balance between healthy conservatism and harmful prudence and the substantial actions to overcome the challenges of revenue forecasting. The purpose of qualitative and quantitative researches was to provide an answer to the main research question:

It is essential to recognise micro- and macro –level factors that affect forecasting and process the data that enables the decision-making to be better informed. Multiple ways to improve forecasting performance were elevated: long-term market-orientation that allows earlier accumulation of secured revenue, better system support, automation and sharing of the best practices, and more profound focus on forecasting of target works, communication, training and process follow-up alongside the bolder experimental culture of new forecasting tools. The results of the empirical research clearly highlight the important link between strategic management and well-functioning forecasting process.

Regardless of the business volume, bringing together the goals and forecasts of the multiple operating units helps in understanding the direction of the entire company. Coordination and communication of the strategic plans is easier when everyone knows what is being pursued and in what respects the actuals and forecasts are for these targets. Objectives should be set in a way that pushes towards the desired action. Thus, interviewees endorsed the management to highlight the importance of forecasting and to emphasize future market-making at all organizational levels. After all, Skanska's operations are dependable on the project pipeline and customer's schedule and will. When it comes to market making and early contractor involvement, more accurate forecasting could aim to adjust the cycle and timing of construction to smoothen the operations.

Financial information originates from projects bottom-up; foster focus on the source and the chain of the information was recommended. Most often, carefully implemented project management is behind the accurate forecasts, which give confident that the accuracy level is also good if the problems occur. Thereafter, everything crystallizes for communication. Further development of the culture of transparency and even better communication in order to optimize resource requirements are seen fundamental to decision-making. Attitudes towards the use of new technologies, process development and automation were highly welcomed among interviewees. Above all, there was a clear desire to make forecasting easier for everyone and to remove manual work phases. Furthermore, hunger to allocate time for more productive work such as analysis and strategic planning was obvious. Thus, there is a clear potential seen in concerted forecasting development. Gained results enhance the comprehension of the ability of forecasting in the case study company. The achieved information may be used to help the development planning related to financial forecasting.

5.2 Discussion, Limitations and Approach for Future Research

During the past decade business intelligence and data analytics have secured their position in the agenda of corporate management. (Elbashir et al. 2013, 87) Executives' wish lists include better and better forecasting and data analyses, which are seen as vital tools for decision-making and a part of value creation. As stated by Frizzo-Barker et al. (2016, 403) organisations are willing to resource in order to anticipate market movements. The urge towards more modern way of forecasting and controlling business is clearly visible in the case study organisation, which was much more pronounced than expected in the research hypothesis. People in the organisation want to develop processes and systems and, above all, develop themselves as professionals. This creates a fertile soil for company management to give people the opportunity to export organization and expertise in it to a new eminent level.

One of the basic ideas of modern approaches to forecasting, disclosed in the theoretical framework of this study, is to lead transparently through common values

and sensible judgment, not using strict rules or regulations (Becker et al. 2016; Player 2009). In the case company, the organization's internal trust, responsibility and planning are emphasized. Good relationships, trust, and functional communication within an organization are important qualities to maintain and further develop in order to enable effective and accurate forecasting. Through accurate forecasting, things do not happen unexpectedly, both internal and external credibility increases and strategic decisions are made with better confidence. Once and for all, company's management is able to react in the right way and accurate forecasts make the management's response time longer.

Quantitative analysis revealed that a higher amount of secured revenue improves forecasting accuracy as expected in the research hypothesis. Thus, it was justifiable to raise the dilemma of target work forecasting as one of the key focus areas in the qualitative part of the study. Interviews confirmed that future projects cause great uncertainty for construction business. Market knowledge is particularly essential for improving the predictability of target work as disclosure obligations create a basic need for forecasting alongside the additional anticipation needs from the owner (Eng & Mak 2003, 325). The overall results give strong evidence of the need of more market-oriented business focus and close follow-up on revenue structure to meet the requirements.

The results showed further that it is essential to realize and anticipate how quickly changes occur. However, it is equally important to be able to change when the operating environment requires by reflecting existing operations to company's strategic choices and business environment. On the basis of the study, the case the company has all the capabilities to develop its operations of forecasting by making it easier, high priority task within the organisation for people to execute with well-founded processes and systems. Demand-driven business forecasting has been increasingly emphasized for decades. (Lapide 2009, 18). Accurate revenue forecasting is one of the fundamentals to enhance company's relative profitability through the strategic guidance. The overall results of this thesis showed the indisputable links between accurate revenue forecasting and legitimate strategic decision-making, profound organizational steering and effective financial management.

When interpreting the findings of this study, its limitations should be considered. The generalizability of the study is limited as the research data is only based on the financial forecasting data and interviews executed in one company. However, identified causal relationships and development trends within the research topic may be discretionary generalized outside of the company. Particularly, if the organization to be compared is operating in the project business or in the same industry, the results may be better widespread. However, the results showed that the findings did not even concern all the sub-organizations of the case company, and are dependable on the organizational characteristics, business model and personal attributes.

The reliability of the quantitative data is good, because researcher is familiar both with the case company and the empirical data used in the research. Thus, the possibility of error due to the misinterpretation of the qualitative material or the functionality and reliability of the data source system is limited. However, the reliability of research is strongly influenced by the number of interviews conducted in the case organization. A total of four interviews were collected from group management and a total of six interviews were collected from regional controllers. The interviews revealed a lot of similarities but also clear differences in the responses were found. The fact that two groups can be clearly distinguished from the research reduces the subjectivity of the study and improves the reliability of the results. On the other hand, additional perspectives from other levels and functions of the organization could have been added to increase coverage and reliability of the research. However, research results can generally be considered reliable.

Study raises a number of potential topics for further research. Further research could be carried out later on how and to which direction the organization has started to develop its operations and whether the organisation's ability to forecast has changed due to the influence of technology or other external factors. In addition, the impact of forecasting accuracy on the strategic steering and response rate of the organization would be interesting to explore. Data could be expanded for deeper quantitative analyses of data and subsets of it. In addition, the real impact of forecasting inaccuracies in the organization and more accurate verification of effects in the income statement would be very interesting topics for future research. Corresponding

research from other Skanska-countries and business units with wider sample in order to share the best practises globally would be fascinating idea for extensive further study. Furthermore, the development of the forecasting process, models and techniques would offer interesting topics for the further research.

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APPENDICES

APPENDIX 1: Supply and Demand Chain Management Process (Rainbird 2004, 238)
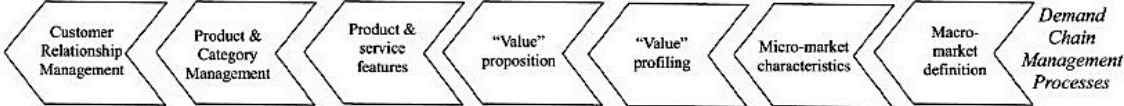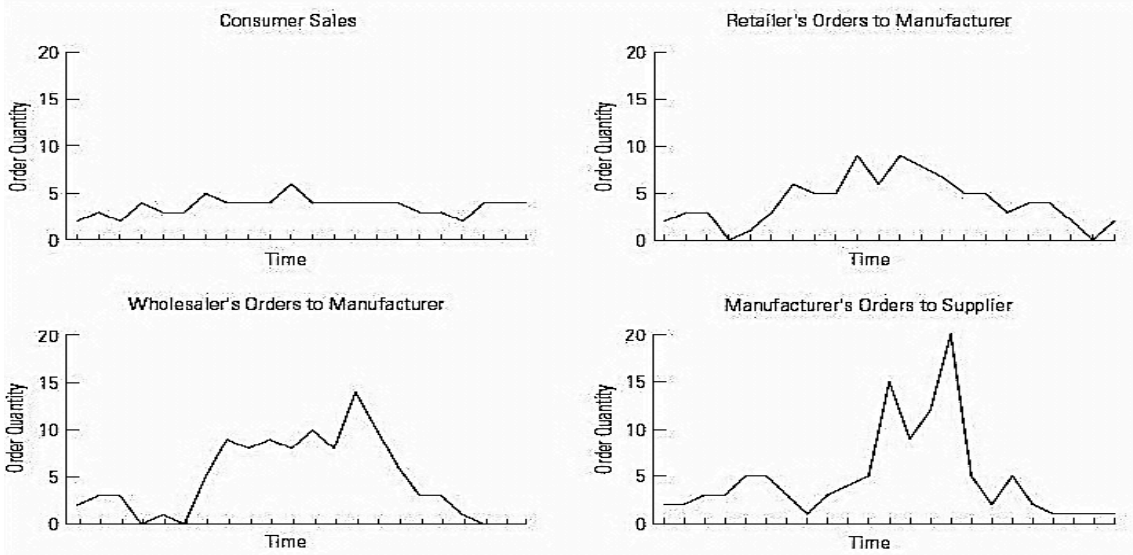
APPENDIX 2: Need of Forecasting and Planning (Mentzer & Moon 2005, 11)

APPENDIX 3: The Bullwhip Effect (Lee, Padmanabhan & Whang 1997, 94)

Consumer Sales

Retailer's Orders to Manufacturer

Wholesaler's Orders to Manufacturer

Manufacturer's Orders to Supplier

APPENDIX 4: The structure of the interview for controllers

Current Status of Revenue Forecasting

- How would you describe the way of forecasting in Skanska?
- When forecasting revenue, how the process flows in your business unit?
- How do you estimate the amount of target jobs/revenue per year?
- Do you use conservative safety margin when forecasting revenue?
- How do you estimate low and high scenarios of revenue forecast?

- In your opinion, what are the most important time horizons for which forecasts are made?
- What is the frequency of financial forecasting in different levels in your business unit? (project level, project manager level, regional level)
- You execute F2 forecasting round; prioritize the following forecasts based on their importance for strategic decision-making:
    - Forecast of the next quarter
    - Forecast of the current year
    - Next year's forecast
- Does order of priority change for F3 forecasting round, and if it does, why?

Challenges of Financial Forecasting

- What are the most characteristic problems related to forecasting in general?
- How does the inaccurate revenue forecast effect on the entire financial forecasting?
- Identify the potential problems of forecasting from the group management's point of view?

Rolling Financial Forecasting

- How 4Q-rolling forecasting is utilized in Skanska and in your business unit?

- How 4Q-rolling forecasting should be utilized for example in order to improve the steering effect of the rolling forecast?

Future Visions and Needs of Financial Forecasting

- What would be the benefits of more accurate revenue forecasts from your perspective?
- From your point of view, what should happen in order to improve the revenue forecast accuracy and how that could be achieved?

APPENDIX 5: The structure of the interview for group management and group administration

Current Status of Revenue Forecasting

- How would you describe the way of forecasting in Skanska?
- How would you estimate low and high scenarios of revenue forecast?

- In your opinion, what are the most important time horizons for which forecasts are made?
- You execute F2 forecasting round; prioritize the following forecasts based on their importance for strategic decision-making:
  - Forecast of the next quarter
  - Forecast of the current year
  - Next year's forecast
- Does order of priority change for F3 forecasting round, and if it does, why?

Challenges of Finanacial Forecasting

- What are the most characteristic problems related to forecasting in general?
- How does the inaccurate revenue forecast effect on the entire financial forecasting?
- Identify the potential problems of forecasting from the group management's point of view?

Rolling Financial Forecasting

- How 4Q-rolling forecasting is utilized in Skanska and in your business unit?
- How 4Q-rolling forecasting should be utilized for example in order to improve the steering effect of the rolling forecast?

Future Visions and Needs of Financial Forecasting

- What would be the benefits of more accurate revenue forecasts from your perspective?
- From your point of view, what should happen in order to improve the revenue forecast accuracy and how that could be achieved?

APPENDIX 6: Summary Statistics

Variable	Mean	Std Dev	Minimum	Maximum	N
Target Revenue %	0.585	0.320	0.000	1.000	590
Secured Revenue %	0.415	0.320	0.000	1.000	590
Percentage Error	-0.046	0.157	-0.599	0.357	590
Absolut Percentage Error	0.109	0.123	0.000	0.599	590
Forecasting Accuracy Rate %	0.891	0.123	0.401	1.000	590
Forecasting Error (MEUR)	-1.346	12.410	-73.351	56.053	590
Absolut Forecasting Error (MEUR)	7.673	9.841	0.000	73.351	590

APPENDIX 7: Box and Whisker - Absolut Percentage Error of Revenue Forecasting

Box and Whisker - Absolut Percentage Error of Revenue Forecasting
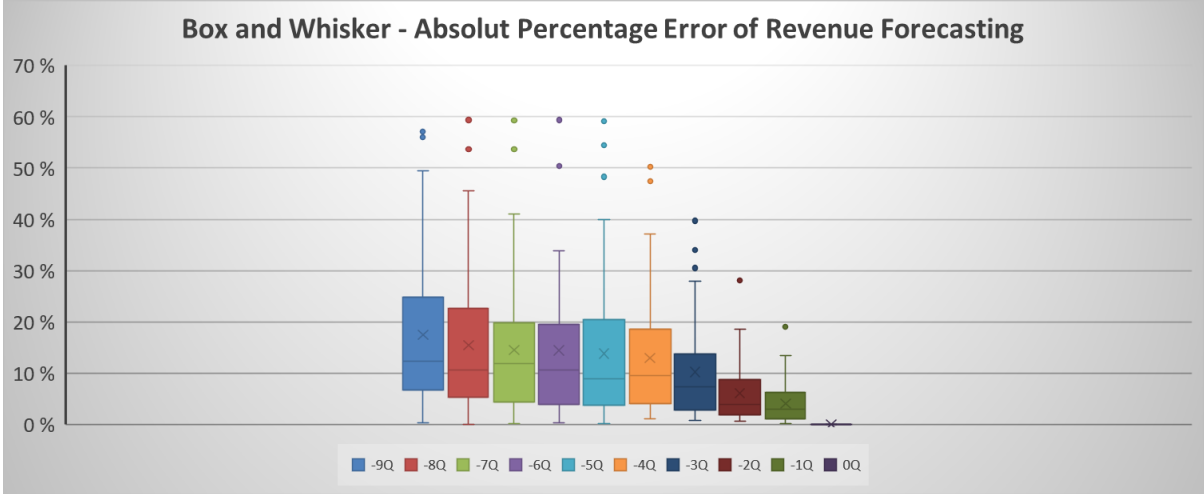
APPENDIX 8: Box and Whisker – Secured Revenue

Box and Whisker - Secured Revenue