Business Intelligence, Predictive Analytics and Management Accounting: A Field Study

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Abstract

Recently, companies have begun adopting business intelligence (BI) tools for predictive analytics. This study is motivated by the fact that so far we know very little about how these new technologies influence management accounting, especially forward-looking practices such as budgeting and rolling forecasting. We study the reasons why BI tools have been acquired on top of enterprise resource planning (ERP) systems and how forecasting is currently performed. Specifically, we investigate how predictive analytics tools affect the integration of sales numbers in budgets/rolling forecasts and operational forecasts. In order to answer this question, we address potential enabling and hindering aspects for integration, such as the role of initiator of PA project, location of responsibility for forecasting procedures, and forecasting horizon.

We interviewed accountants and other personnel responsible for the forecasting process in eight companies that have recently adopted predictive analytics tools for sales forecasting (a field study). Our empirical material suggests that introduction of PA tools can enhance potential for the convergence of budgeted/rolling forecasted sales figures with operational sales forecasts. In other words, they may facilitate "one set of numbers". We add to the scarce accounting literature on the convergence of diverse accounting practices by extending our analysis to the sales forecasting process and the adoption of predictive analytics tools. The central contribution of the paper is to explicate and unpack the aspects related to the enabling vs. hindering the convergence of various forecasting numbers.

Key words: Predictive analytics, Business Intelligence, ERP, Management accounting, Budgeting, Rolling Forecasting.

1. Introduction

Recently, business intelligence (BI) systems[i] have been implemented on top of enterprise resource planning (ERP) systems in order to enhance utilization of the wealth of information stored in ERP systems. However, initial effects of business intelligence on accounting seem lagging (Elbashir, Collier and Sutton, 2013). This is not surprising, given that similar time lags between implementation of information technology and changes in accounting systems have existed before (Granlund and Malmi, 2002).

One key application area of BI has been sales forecasting (Halladay, 2013, p. 1). In a turbulent business environment the role of sales forecasts is essential to manage uncertainty by predicting what will be sold to whom and when. While a number of surveys has indicated that quantitative sales forecasting methods may not be preferred (Sanders and Mandrodt, 2003) there seems to be nevertheless an upward trend in using these methods (McCarty and Davis, 2006; Davis and Mentzer, 2007). Hence, with the advent of BI software solutions by vendors such as SAS, IBM Cognos and Qlick, the prior trends are picking up speed.

This study aims at shedding light on sales forecasting in companies that have adopted predictive analytics (PA; a part of business intelligence) tools on top of their ERP systems, and to discuss what effect this might have on management accounting. Traditionally, many accounting textbooks have assumed that there is a natural link between forecasting and budgetary planning (see e.g. Atkinson, Banker, Kaplan and Young, 2001, p. 413). However, recent research suggest that while the importance of forecasting is increasing, the forward looking estimates may not be connected directly to the firms budgeting process, but can be e.g. disconnected from budgetary planning and target setting (Becker, 2013; Bourmistrov and Kaarbøe, 2013). All in all, we seem to know little about how these new technologies (PA tools) influence forward-looking procedures, even though the technologies have recently become quite common in companies.

Specifically, in spite of the significant role that PA adoption potentially has for the (dis)integration between diverse forecasting procedures, our knowledge about their relationship with management accounting practices is still in its infancy. Consequently, the core research question of this paper is "*How predictive analytics tools affect the integration of sales numbers in budgets/rolling forecasts and operational forecasts.*" In order to answer this question, we address aspects potentially

affecting the integration, such as the role of the initiator of PA project, location of responsibility for forecasting procedures, and forecasting horizon.

We interviewed accountants and other personnel responsible for the forecasting process in eight companies that have recently adopted predictive analytics tools for sales forecasting (a field study). Our empirical material suggests that introduction of PA tools can enhance potential for the convergence of budgeted/rolling forecasted sales figures with operational sales forecasts. In other words, they may facilitate "one set of numbers". We anticipate to add to the scarce accounting literature on the convergence of diverse accounting practices (Taipaleenmäki and Ikäheimo, 2013; Bourmistrov and Kaarbøe, 2013) by extending our analysis to the sales forecasting process and the adoption of predictive analytics tools. In doing this, we also response to Taipaleenmäki and Ikäheimo's (2013, p. 341) call to explore the ICT technology-driven convergence in the crossroads and interfaces between various fields of business economics (accounting, operations, sales). The central contribution of the paper is to explicate and unpack the aspects related to the enabling vs. hindering the convergence of various forecasting numbers. Also, as urged by Granlund (2011, p. 16), we add to the accounting information system literature by discussing the potential and realized changes that the development of IT may cause for accounting and control practice.

2. Literature review

2.1 BI and predictive analytics as a part of the information systems

While a substantial amount of organizational data is normally stored in the organization's information systems, it is still a challenge to understand and make use of that information (Elbashir, Collier and Sutton, 2011, p. 156). Business intelligence systems strive to combine data from multiple sources in order to enable a comprehensive view of the organization that has the potential to support strategic decision making (Halladay 2013, p. 1). For instance, Elbashir et al. (2011) studied the possibilities of integrating BI to organizations' other information systems. Their results indicated that the ability to absorb new information and to make use of external data are the most important factors enabling BI integration and use.

BI entails several different types of analysis techniques, one of which is called predictive analytics. This technique has been suggested to have potential for significant improvement in financial planning practices (Halladay, 2013, p. 1). According to Eckerson (2007), predictive analytics is an aspect of business intelligence that focuses on the future (see Figure 1). Thus, predictive analytics

is a set of complex but potentially value adding BI -tools that makes use of various forecasting methods to enable better planning and decision making.

In this study we adopt a view stated in prior literature that includes predictive analytics as one important aspect of business intelligence systems. Balkan and Goul (2010, pp. 17–18) state that traditionally the BI function as a part of IT department has been the administrator of predictive analytics within the firm, but lately there has been interest in accounting departments[ii] to take responsibility over such systems. What differentiates predictive analytics from other BI tools is the emphasis on proactive forecasting, whereas the rest of BI is mainly concerned with reporting and

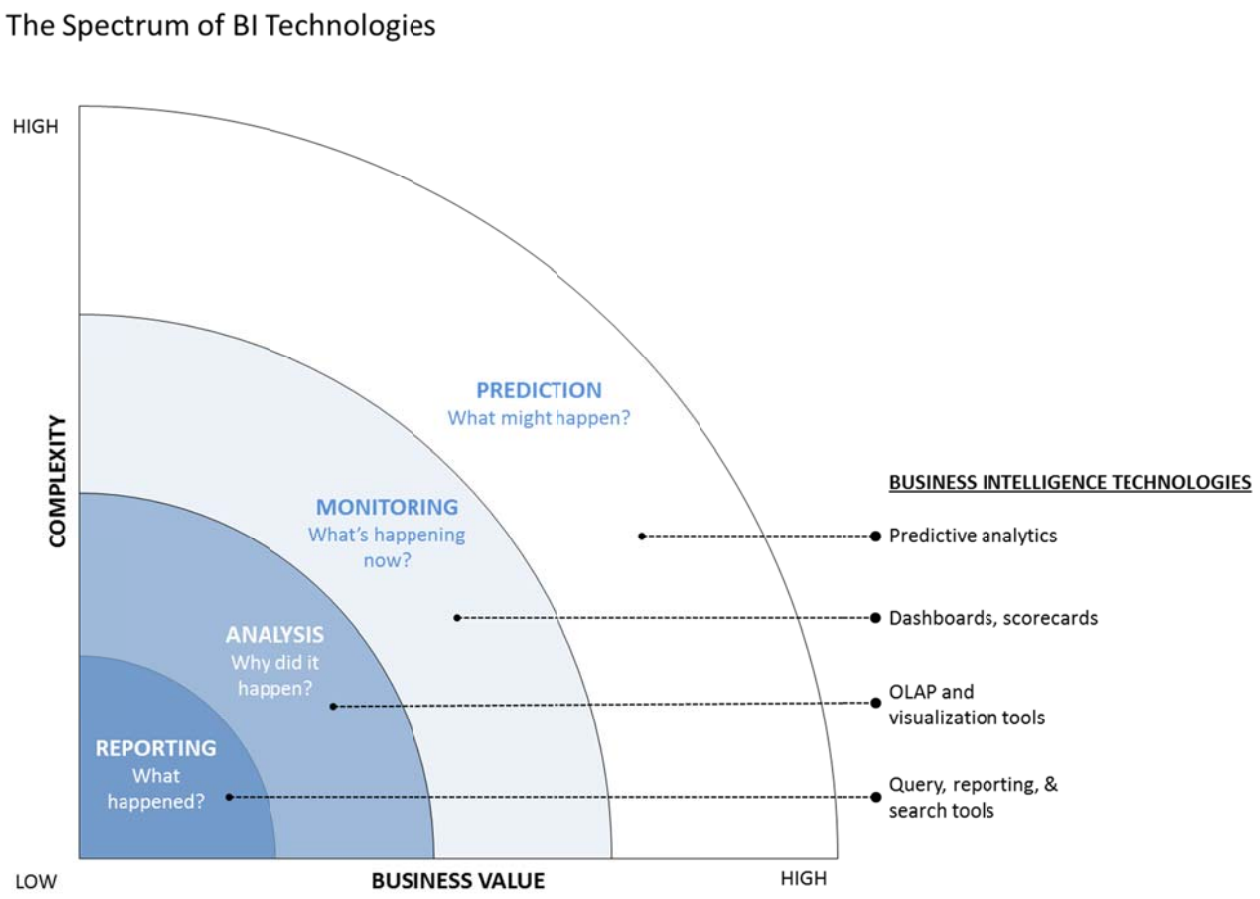

Figure 1. Predictive analytics as a part of business intelligence. Adopted from Eckerson (2007)

analyzing historical data (Halper, 2013, p. 6). Thus, while the majority of BI techniques use deductive logic where a manager seeks 'facts' from past events to assist in decision making, predictive analytics entails the use of more inductive logic. In this case, the decision maker seeks

interesting information that can be developed into more general models that enable to make sense of situations where uncertainty is high (Eckerson, 2007).

In principle, the use of predictive analytics in an old idea. However, recent technical developments and enhancing abilities to perform complex calculations of extremely large data sets have enabled companies to make better use of such ideas. The increase in the amount of available data has also been a significant factor. For instance, IDC[iii] predicted in 2011 that the total amount of data will double every two years so that by 2020 companies will have 50 times more data to process than in 2011. This development provides opportunities but also challenges in processing information usable for planning and decision making, given that information needs of managers are quite diverse and firm-specific. Academic literature about predictive analytics in accounting context is almost non-existing. However, Lee, Elbashir, Mahama and Sutton (2014) suggest that realizing the potential of predictive analytics requires not just investing in supporting IT –systems but also strong commitment to new ways of managerial thinking.

There are recent non-academic studies about the adoption rates and perceived benefits from predictive analytics tools. *Computer Economics Report* published in 2011 reported that only a relatively small part of respondents (22%) had implemented predictive analytics as part of their BI-solution, but 28% were considering to invest in it[iv]. In the 2013 report by TDWI 34% of respondents were making use of predictive analytics, 52% were considering its use, with only 14% having not considered it at all (Halper, 2013, p. 2)[v]. In a similar TDWI study in 2007, the implementation rate was 21%. Loudhouse (2013) reported also a high expected growth in PA usage.[vi] Namely, 80% of the respondents believed that they will invest in predictive analytics during the next five years. Thus, we can conclude that growth in predictive analytics has been significant and is still expected to accelerate during the coming years, which is also in line with results by Halladay (2013).

With regard to the benefits of predictive analytics, 85 % of companies using predictive analytics reported having benefited from it (Loudhouse, 2013). According to the Loudhouse report, the most important benefits related to better performance, understanding business dynamics and making use of existing data more extensively. Almost 75% of respondents agreed with the statement that predictive analytics entailed more mapping business possibilities than risk management. Importantly, accounting and sales functions were reported to be the two most important users of predictive analytics within the companies (46% and 46% of respondents reporting such a use). In

addition, according to the TDWI study (Halper, 2013), the most important benefits were seen to arise from understanding future trends, customer behavior, performance management and the support of strategic decision making.

2.2 ICT, management accounting and sales forecasting

Prior literature concerning the relationship between ICT systems and management accounting has suggested that technological change is likely to result in changes in both management accountants' roles as well as how management accounting is carried out at the system level. Regarding management accountants' roles in companies, implementation of new ICT systems has been shown to have potential to facilitate profound changes (Scapens and Jazayeri, 2003; Chapman, 2005). For instance, Caglio (2003, p. 145) has proposed that the role of management accountants will develop to a direction in which the controller is involved "less with traditional accounting activities, devoting more time advising and supporting line people as internal consultants whilst previously having acted as independent monitors and controllers of the operating activities". Likewise, Järvenpää (2007) proposes the ERP-enabled centralization of routine accounting tasks is a potential driver of new business-oriented controller role. However, such centralized IT and accounting process have also given rise to shared service centres that may possibly enable business partnership for some, but offer routinized and even de-skilled job descriptions for others (Howcroft et al., 2012; Herbert and Seal, 2012).

On the other hand, there is also a link from accounting profession to ICT system implementation. The results of the survey by Hyvönen (2003) indicates that the initiator of new ICT system implementation might have impacts on what kind of system will finally be implemented. His results indicated that accounting departments have been more interested in traditional stand-alone systems (Best of Breed, BoB), while other departments have concentrated more on ERP solutions. For instance, when the initiator was accounting department alone in 83 % of the cases the solution was BoB. In the case the initiator was either accounting department with some other department or any other department than accounting department the solution was more often ERP, 57 % and 61 %, respectively.

The sales forecasting[vii] needs of accounting function are commonly related to predicting the profit levels for profit centers (see e.g. Mentzer and Moon, 2005).[viii] The horizon for profit plans is typically generated for the coming 1 – 5 years. With regard to forecast intervals, the nearest periods

are often shown on a monthly basis, whereas the later periods are reported on a quarterly or annual basis (Wallace and Stahl, 2002). Regarding the use of forward looking information in management accounting, the forecasts can be updated and consolidated for the division and corporate reporting purposes, depending on company policy, every month or quarterly (e.g. a rolling forecast company) or even only annually in connection with budgeting process (e.g. a traditional annual budgeting company). In some instances the distinction between annual budget and rolling forecasts may not be obvious, as one of the sales forecasts of the company may be 'frozen' and made to serve as the budget for the year (Henttu-Aho and Järvinen, 2013).

With regard to using sales forecasting for operational purposes (not primarily for profit planning), the forecast horizon can range from a month to one year, depending upon the raw materials purchasing order cycle or other constrains, for example. The interval for the forecast can be as short as one day, even though weekly or monthly planning intervals are more common. The frequency for updating the forecasts is related to the interval; the shorter the interval, the more often the update takes place. For production planning purposes the level of forecast is the number of units (e.g. stock-keeping units, SKUs), not euros. To sum up, the primary focus of production forecasts are commonly related to predicting SKUs for very short period (day, week, month), whereas accounting needs sales information for longer periods in monetary form. (Mentzer and Moon, 2005).

Budgeting literature offers two contrasting views for conducting budgeting. The more traditional view holds that budgeting is a comprehensive process that includes sales forecasting as a starting point. Thus, the ideal state is that forecasting and budgeting are integrated (Atkinson et al., 2001). Budgeting starts from a sales forecast, which is translated into a sales budget. Then, other budgets are made, and the process culminates in an enterprise-wide budget summary or master budget. Anthony and Govindarajan (1995, p. 370) provide a definition for the operative annual budget that 'usually covers one year and states the revenues and expenses planned for that year.' Its main characteristics include managerial commitment to objectives, the review and approval by a higher authority, binding and restricting nature of the process, and the periodical analysis of budget variances.

Alternatively, the relation between sales forecasting and budgeting can be weaker, as is the case in the process of stretching targets (Bourmistrov and Karbøe, 2013). This means that budgetary targets are adjusted on the basis of latest forecasts and discussed by the controllers and the management. Authors such as Bourmistrov and Kaarbøe (2013), Henttu-Aho and Järvinen (2013)

and Becker (2013) illustrate the unbundling of target setting, forecasting and resource allocation decisions, which the companies in their case studies claim to enable better decision-making. Hence, if forecasting and budgetary processes become separate, the relationship between forecasted numbers and figures expressed as budgetary targets may begin to differ from each other, potentially resulting in two (or multiple) set of numbers. Hereinafter in this paper we call only the traditional annual budget as "budget" and the other "budget variants" rolling forecasts. Hence, here rolling forecasts include the updated alternative budgets described above and also the rolling forecasts reaching over the annual budgetary period.

2.3. One versus multiple sets of sales numbers

The key indicator of the degree of integration of sales numbers between forecasting and budgeting/rolling forecasting is the similarity of these numbers. At the extreme, a company may use only one set of numbers. Accordingly, there is a tight link between these two procedures, i.e. budgeted/rolling forecasted figures are directly derived from forecasts. Nevertheless, it is also possible that the company use two sets of numbers (one forecasted and another budgeted/rolling forecasted) and these may or may not be compared against each other.

Integration and one set of numbers have been researched in relation to financial vs. managerial accounting. In financial accounting, this theme has emerged in connection to fair value accounting because of its future orientation. For instance, valuation of assets requires information about the future cash the asset is projected to generate. Thus, it could be speculated that the adoption of IFRS would foster integration between forecasting and accounting processes. Relating to this, Ikäheimo and Taipaleenmäki (2010) use institutional theory to explain the increasing harmony of numbers. They conclude that traditionally, financial and management accounting had been on a diverging development path but integration has taken place at the digital era. Additionally, they illustrate how IT facilitates and enables the convergence of financial and management accounting, with forward looking techniques as the common core (Taipaleenmäki and Ikäheimo, 2013). Accounting practices have been converging across countries in publicly quoted companies, because financial reporting standards are international and increasingly harmonized, and companies are globally adopting very homogenized MA techniques, technologies and practices, as well as information systems and software packages.

Relating to relationship between forecasting and budgeting, many management accounting textbooks such as Atkinson et al (2012) argue that sales budgets are based on forecasts and there is a logical link between them. As such, the actual numbers may vary, since budgeting process is likely to include setting challenging targets and negotiation, which are not always the characteristics of accurate forecasting. However, since both forecasting and budgeting systems are likely to be embedded in integrated information systems, a logical link will be established between the figures.

To sum up, companies appear to more and more acquire predictive analytics tools on top of their ERP systems. Simultaneously when companies develop new future oriented forecasting methods their integration to accounting numbers becomes an issue. The forecasted numbers may be compared with, and potentially integrated to management accounting. Nevertheless, we know very little whether and how these new technologies influence management accounting, especially forward-looking practices such as budgeting and rolling forecasting. Consequently, in this paper we specifically address the potential convergence of sales numbers in operational sales forecasts and budgets/rolling forecasts, and the role of predictive analytics tools in this integration. Hence, our research question is *"How predictive analytics tools affect the integration of sales numbers in budgets/rolling forecasts and operational forecasts."* In order to answer this question, we address potential enabling and hindering aspects for integration, such as the role of initiator of PA project, location of responsibility for forecasting procedures, and forecasting horizon.

3. Data and method

Considering the study's objective to obtain a wider picture of the phenomenon, a case analysis method[ix] that investigates only one or a few companies would not suffice (Yin, 1994). On the other hand, there appeared to be still only a limited number of organizations in Finland that had implemented Business Intelligence tools for Predictive Analytics on top of their ERP. Hence, we decided to conduct a cross-sectional field study to cover all the eight organizations that we identified to have implemented a PA tool for sales/demand forecasting and had gone out with this information.[x]

According to Lillis and Mundy (2005), a cross sectional field study, which lies somewhere between an in-depth case study and a broad-based survey, can be particularly appropriate when there is doubt about the precise specification and measurement of variables, their empirical interpretation, or the relationships among them. This is the case also in our study. Importantly, compared to a

single case study, a field study enabled us to make cross-case comparisons using replication logic (Eisenhardt, 1989). Additionally, relative to surveys, the adopted method allowed us to pose important "how" and "why" questions. Specifically, face-to-face interviews facilitated us posing further questions, returning to earlier questions, and going through the use of PA software and predicting procedures in our case organizations.

The eight case organizations represent seven different fields of activities (see Table 1). The number of personnel ranged from 500 to 30,000; and net sales from €70 million to €10 billion. Three of the organizations were publicly listed companies, two were private companies and state-owned companies and one was a non-profit organization. With regard to ERP, six of these use SAP and two other ERPs. Five organizations have implemented IBM Cognos and three SAS products as their predictive analytics tool.

	Case A	**Case B**	**Case C**	**Case D**	**Case E**	**Case F**	**Case G**	**Case H**
Field of activity	Food supplies (Coffee)	Food supplies (Bakery)	Forest industry	Blood products	Post	Defence industry	Steel products	Constr. industry
Group Net Sales, M€	900	1700	10000	70	2000	800	2000	1800
Group Employees	2000	15000	30000	500	27000	3600	9000	6000
Ownership	Private	Private	Listed company	Non-profit org.	State-owned	State-owned	Listed company	Listed company
Local/Int'l	Int'l	Int'l	Int'l	Local	Local	Int'l	Int'l	Int'l
ERP	SAP	SAP	SAP	Dynamics Navi	SAP	Logica V10	SAP (Multi-ERP)	SAP (Multi-ERP)
Predictive analytics (PA) tool	IBM Cognos	SAS	SAS	IBM Cognos	SAS	IBM Cognos	IBM Cognos	IBM Cognos

Table 1: Description of the case organizations

19 interviews (including 20 interviewees) were conducted in the case organizations (see Appendix 1). In all the organizations at least two persons – typically one representing accounting and another operations – were interviewed. Additionally, five highly knowledgeable consultants representing leading PA software houses and consultancy firms were interviewed. All the interviews were face-to-face interviews and they were recorded and transcribed (except two interviews). The themes discussed about PA implementation and usage can be found in Appendix 2. Except in three interviews, two or three interviewers were simultaneously present. The interview structure was distributed to the interviewees about one week before the interview.

4. Field study

4.1 Influence of the initiator of the PA-project on integration of sales numbers

In this section our aim is to analyze the impact of the initiators of the predictive analytics project and their objectives to the degree of integration between operational forecasting and budgeting/rolling forecasting (see Table 2).

Our empirical analysis indicate that there are clearly two different sets of companies. In the first group (five companies: cases C, D, F, G and H), the common feature is that accounting department has been the main initiator of the project, either alone or together with another department. All these companies conduct rolling forecasting and their sales numbers in operational forecasts and rolling forecasts appear to be tightly coupled. In the second group (three companies: A, B, E), the role of accounting department has been very small or it has not had any role at all. These three companies use traditional annual budgeting and no direct couplings between sales numbers in operational forecasts and budgets seem to exist.

	Case A	**Case B**	**Case C**	**Case D**	**Case E**	**Case F**	**Case G**	**Case H**
Main initiator(s) of the PA project	Operations	Operations	Accounting	Operations & Accounting	Operations	Accounting	Accounting & Operations	Operations & Accounting
Main objective(s) of the PA project	Replace Excel model	Improve reliability of deliveries	Complete profitability mgt system	Improve demand planning, Support RF	Improve planning of HR needs	Replace Excel model	Achieve one set of numbers	Improve demand and sales planning
Annual budget or Rolling forecast (RF)	Annual budget	Annual budget	Rolling forecast	Rolling forecast	Annual budget	Rolling forecast	Rolling forecast	Rolling forecast
Forecasts and budget/rolling forecasts integrated	No	No	Yes	Yes	No	Yes	Yes	Yes
Forecasting ownership	Operations	Operations	Accounting	Accounting	Operations	Accounting	Operations & Accounting	Operations & Accounting
Short vs long horizon forecasting focus	Short	Short	Long	Long	Short	Long	Long	Long

Table 2: Characteristics of forecasting and budgeting/rolling forecasting in the case companies

In case C (publication paper) the forecasting project was an extension to the accounting department's profitability management system (PMS) project started already in the early 2000s. The forecasting is fully integrated to the accounting department's systems. Since 2008 the company has not had any traditional annual budgets, only rolling forecasting. According to Business Area Controller:

"well, all along our view has turned more and more to the future… we have begun to prepare rolling forecasts…updated every month."

At this stage, scenario management features were added to the PMS system. According to the current SVP, business control & IT, who was the original initiator of the PMS:

"Our ideas were more mature then, and I thought that one thing is missing here, and it is the future. [...] We extended the PMS analyses to the future. We called it the scenario management system."

The firm's forecasting system (scenario management) was implemented together with Sales support manager from the sales support department and Business Area Controller from the accounting department of the division.

In case D (blood products) Development Director was the initiator of the forecasting project, and its main objective was originally to improve operational demand planning. However, the responsibility for the co-ordination and managing the project was all the time in the accounting department. According to the Development Director:

"It was particularly about demand forecasting, with the aim of us getting enough products, we would always have them in stock regardless of the fact that demand differs seasonally."

From the accounting department's point of the view the major problem with the old system was its ability to support rolling forecasting. The company gave up using traditional annual budgets in 2009 and currently they are doing only rolling forecasts. According to CFO of the case D:

”When we implemented rolling forecasting in the accounting department in 2009…[…]… we could not get support for that…like data processing in the sense that we could calculate forecast variances…[…]… and we started to think that if we would be able to develop a system that would support our forecast-oriented thinking…[…] …and how the people in operations are quite reluctant to update financial forecasts, they do like they are told, but cannot see what is the link between operations and euros, they are not always synchronized, and I have begun to develop a philosophy of finding cost drivers for the linkages, and thus being able to present the operations people a view that he or she understands. And only ask them to provide input for the figures we cannot automatically calculate on the basis of operative plans.”

Thus, in case D where the accounting department was not the original initiator of the forecasting project, but where the department was an active actor and was in charge of the project, the integration between operational demand forecasting and rolling forecasting at the accounting department seem to have been integrated intensively.

In Case G (steel products) both operations and accounting had been heavily involved with the demand/sales forecasting project already from the early beginning. The overriding objective of the project was to achieve one set of numbers; to integrate different sales forecasts in the firm as Director of Supply Chain Management and Sales Planning explains:

“We have made a tremendous job to integrate data in our operative and financial planning systems. Before 2008 we had two separate processes. We had always different figures and people were very confused. Then we decided to integrate these.”

Hence, in this firm operational (sales) forecasts are tightly coupled with rolling forecasts.

The case F (defence solutions) and case H (international construction services) have different business models than all the other cases because they are operating mainly project businesses, and do not have two similar projects. The duration of the projects may also be quite long, e.g. 10 years. Thus the forecasting plays very crucial role in their business. In case F the initiator of the PA-project was the Vice President of Business Controlling:

“The reason why we originally started the project was very simple. We had huge projects and we used only Excel as our forecasting tool. It was always a one man show. We didn’t receive any variance reports. It was always Excel. When I started here in 2008 I realized that there is no sense to do it this way. We have problems e.g. with partial income recognition. Duration of a project can be e.g. 10 years. It is difficult to do partial income recoqnition if you don’t know what is the actual gross margin.”

She continues on the integration between operational forecasting and rolling forecasting:

"In our systems they are tightly coupled. For example when we are planning strategic figures I always receive input from our sales department… They are long processes and they are very expensive … It is quite systematic …"

In case H the forecasting project was a joint project, Financial Director and Development Director acted as initiators of the project. Operational forecasting and rolling forecasting are fully integrated in the firm. According to the SVP Development Services:

"This is both and … This is the first project in our Group when financial department and business have been working together. That is the reason why it works so well … everything is integrated and we have been working together from the beginning of the project."

The SVP Finance, International Construction services confirms that by saying:

"They are fully integrated. We receive our cash flows at the project level. Then we have the inflow what comes from the customers and outflow what goes to the constructions. At the project level."

In the second group (i.e. non-accounting initiated projects), the most extreme was case E (mail services) where the project was introduced by the Development Manager for (very) short term production planning purposes. The Development Manager worked previously as a controller at the local level, but in 2003 he moved to company HQs and began to work as a Development Manager and had implementation of ERP system (SAP) as his main duty.

"When I started to work in the ERP project we started to think about the forecasting problematics. Traditionally, our production has been fixed…Really the problem in that is that…what we have tried to achieve, is that since our production costs amount to a billion euros per year, we have tried to cut this by reducing overtime. Overtime wage costs are bad costs."

Their main objective was to get support for demand planning in order to optimize human resource needs for mail delivering. In this company, the operational forecasting system has no links to budgeting/rolling forecasting or any other financial systems at all.

Also in cases A (coffee products) and B (bakery products) the idea of the new forecasting system came from demand and/or sales planning departments. In case A the original initiator was the demand planning department, but in 2008 the accounting department informed that they also needed a new system for sales forecasting. Nevertheless, the co-operation between demand planning and accounting department was not intimate during the projects. According to the Demand Planning Manager in case A:

”In practice they were almost two different projects. Meaning we had a controller…the one who was the controller in accounting department, he kind of took care of the sales budget part of it. And we did our thing according to our own timetables, a bit of a different project, and this is a good point that perhaps the two projects could have been more integrated. Let’s say we had bugs that resulted because of communication failure, something they did in budgeting that affected us…so at a certain level sales forecasting and sales budgeting are separate…[…]… sales is forecasted at the product level but budgets are prepared only at the brand level.”

Similarly, according to the Controller in case A:

”In any case the time period is different, our budgeting is annual, and our level of detail is much more aggregate… Of course we have had discussion on whether these two processes should be integrated.”

Hence, despite the fact that at least some co-operation between demand planning and accounting department took place during the acquisition phase, the co-operation did not work anymore at the implementation phase. The main reason behind the project was the willingness to replace the existing taylormade demand/sales planning Excel-model by a more standard application.

In case B (bakery products) the idea originated from the sales department and the main target was to improve reliability of delivery but quite soon after the project started the responsibility of the project moved to Logistics Department. According to the Manager, Business Development and Logistics:

”Well, when we began all this, our forecasting team was part of our customer service centre, that is, under the sales department. And when we actually started the project, they were transferred to the logistics department. And one could think that after the project is finished, we are back to the sales organization”

But once again, the same manager emphasizes that there is no integration between operative forecasting and budgeting:

“It can be said that our accounting is not really involved in forecasting.”

The Development Director of case B confirms this by saying:

“Honestly, the departments have no interaction in this matter… and I say that they should have.”

To sum up, it seems that in the above described cases where accounting function has been the sole or another main initiator of the PA-project, the sales numbers of operative forecasting and rolling

forecasting are tightly coupled. The common characteristic for these companies is also that they conduct rolling forecasting, not traditional annual budgeting. Contrary to these companies, in the companies where the accounting department was not the original initiator of the forecasting project, there seems to be no actual integration between forecasting and budgeting or any other systems in accounting department. Additionally, it appears clear that as suggested by Taipaleenmäki and Ikäheimo (2013) in management and financial accounting context, information technology (PA tools) can have a major role as a facilitator, catalyst, motivator, and also an enabler for the convergence of sales numbers in forecasting and budgeting/rolling forecasting.

4.2 Influence of accounting ownership and forecasting horizon on integration of sales numbers

One key phenomenon that was found in the data related to the *ownership* of the forecasting process. For instance, if the person who is ultimately responsible for the forecasting and budgeting/rolling forecasting processes is the same, it is more likely that the two set sets of numbers are more aligned. Accounting ownership of the forecasting process often means updating the budgeted/rolling forecasted figures more frequently on the basis of forecasts, and establishing comparisons between the two sets of figures. In Case F (defense industry) this was the case, as the person responsible for both forecasts and rolling forecasts commented:

”*All the time we are following two things, first what is the forecast compared to our targets, continuously updated every month. Comparison to targets and comparison to the latest estimate. Then we compare to the project budget, meaning the figures that were calculated in the contract stage. But this is not done every month.*” (Vice President, Business Controlling)

In Case C (publication paper), sales forecast and the rolling forecasting was coordinated by the controlling function that had implemented and extensive business intelligence solutions.

”*Product management and controlling team are involved in this process. Well, they are preparing the so-called RF, meaning rolling forecast on the basis of the information we have collected, and then there are the vision-related things that we may talk about, what we might add to that. In order to get a realistic forecast.*” (Sales support manager)

However, looking at companies not integrating their forecasting and budget/forecasting figures, one distinctive feature that arose from our data set was the short forecasting horizon of certain

companies. For instance, in Case A (coffee producer) it was thought that forecasting non-financial sales volume was thought to be more informative for decision making than financial numbers, much due to the price fluctuations in raw material. Their Business Controller commented on this:

"*In our business it is really the volume of coffee sold that is much more informative than what was the sales in euros. Because the fluctuation in the market price of raw coffee beans is so strong, for example the last year has seen quite a rise in prices, and since we are able to get price increases, our sales will increase, but at the same time the volume of our operations may have actually remained the same or even gone down*"

According to the interviewee, if the forecasting horizon was short enough, it was not worth the effort to transform forecasted sales kilograms to euros and compare them against the budget. Even if this was done, it would be difficult to reconcile the sales figures and the company would, however, end up with multiple sets of numbers. In Case B (bakery products), the short-term sales forecast was expressed in monetary terms, but the result was, rather expectedly, two sets of numbers, one forecasted and the other budgeted. This was especially case with the forecast periods farther up in the future. The Development Director seemed to view this as a problematic issue:

"*But if we go to the income statement side and planning the topmost row of it, what we do is we look that the figures are in line, but we have no formal mechanism for using the same number. There is no way to attach these to figures together. Well… But I have thought about it for a long time now that the sales figures should be the same. It has a couple of practical problems like if you forecast many periods to the future, the figures get blurred, because demand is only estimated at the product level.*"

In this company it was evident that the sales forecasting needs of operations[xi] function differed from those of accounting. In addition to using sales forecasts on a longer run for planning the development of suppliers and plant/equipment, the short – term purpose of sales forecasting is predominantly related to the production planning.

The different interests of accounting and operations functions are clear in our empirical material. In the cases, where the operations had initiated the BI-project for sales forecasting (three case companies; short interval forecasters), forecasting focus was on short interval forecasts. The Demand Planning Manager in Case A (bakery products) commented:

"This was mostly a project for production and the supply chain. Partly this may have been because accounting department did not feel that they would have had any kind of clear role in it …[…]… In

any case our payback is based on day-to-day forecasts. However, in one of our project we did a weekly forecast model, which might have been more interesting to accountants"

According to the interviewee, in the bakery business it was essential to be able to forecast the demand as accurately as possible, because stocking up the fresh bakery products is inherently problematic.

Another short term forecaster, Case E (mail services) used forecasts of the required delivery volumes ultimately for planning their human resource needs for mail delivering. The Development Manager emphasized the need for very short interval in their forecasts:

"A good day-to-day forecast helps us in it [next day's human resource planning]. It is specifically the fact that it is daily. We would not be satisfied with a weekly forecast. We have to have a daily forecast in each operational unit. So we wouldn't be satisfied with a daily forecast either, if it was nationwide. It would be of no use at the grass-roots level. Meaning the 500 places where the work is done. That's why we have this requirement, day- level forecast in each operational unit"

Hence, in practice they forecasted the volumes for mail deliveries in all their 500 business units for the next day. The forecasts helped them to recruit the right amount of personnel for their business units and efficiently utilize the potential for flex-hours stipulated in the employment contracts with their letter-carriers. In this case managing the deliveries by keeping stock was not possible either. In these companies the sales forecasts were updated every day and they were not coupled with the other sales forecasting activities in the company.

In the other companies (longer interval forecasters) the need for such a short interval forecasting was not necessary, because the companies were able to stock up their products and on the other hand time lag between the forecast and delivery time enabled them to better prepare for the coming deliveries. The Case H (construction) has 18 months as its forecast horizon and a month as a forecast interval; the forecasts are updated every month. The Senior Vice President of Development commented the level and form of their forecasts:

"Our system has project level information which includes forecasted sales units, sales euros and cash flows. And it's at the monthly level. And on the basis of this the system calculates our key facts, income statement and the balance sheet".

Hence, as also in the other longer interval forecasters, the sales forecasting was linked to the profit forecasting. The forecasts include both units and monetary values. Additionally, sales forecasting and rolling forecasting appear to be closely coupled with each other.

All in all, it appeared that if the predictive analytics enabled forecasting processes were owned by accountants, numbers would be the same. A special case seems to relate to predictive analytics having a markedly short forecasting horizon. In such cases, integration of numbers seems to be difficult to achieve.

5. Discussion and conclusions

This study sheds light on sales forecasting in companies that have adopted predictive analytics (PA; a part of business intelligence) tools on top of their ERP systems. The study was motivated by the fact that we know little how these new technologies influence forward-looking procedures, even though the technologies have recently become quite common in companies. Specifically, in spite of the significant role that PA adoption potentially has for the conversion between diverse forecasting procedures, our knowledge about their relationship with management accounting practices is still in its infancy. Traditionally, budgets/rolling forecasts have been the central future oriented management accounting tools that companies have used. Consequently, the core research problem of this paper is "*How predictive analytics tools affect the integration of sales numbers in budgets/rolling forecasts and operational forecasts.*" In order to answer this question, we addressed aspects potentially affecting the integration, such as the role of the initiator of a PA project, location of responsibility for forecasting procedures, and forecasting horizon. With regard to data gathering, we interviewed accountants and other personnel responsible for the forecasting process in eight companies that have recently adopted predictive analytics tools for sales forecasting (a field study).

In line with Taipaleenmäki and Ikäheimo (2013), our empirical material suggests that introduction of PA tools can enhance potential for the convergence of budgeted/rolling forecasted sales figures with operational sales forecasts. In other words, they may facilitate "one set of numbers". Nevertheless, it is worth to realize that even though a new PA-tool appears to have a capacity to play a major role as a facilitator, catalyst, motivator, and also an enabler for the convergence, it is

not alone a sufficient condition for the convergence (cf. Lukka, 2014). Namely, in our case companies a successful integration of sales numbers in different systems was connected with a successful change project (cf. Lee et al., 2014).

It appears that in companies where accounting department has played a major role in initiation of the PA project and subsequently owns the forecasting process, the diverse forecasting figures have been integrated, whereas in other companies no coupling with forecasted and budget/rolling forecast figures could be noticed. This is in line with previous research that suggests how information systems may be employed to solidify existing accounting practices and how, in addition to their potential for accounting change, such systems also have the ability to prevent or contain change (Dechow and Mouritsen, 2005; Hyvönen et al., 2009).

Relating to divergence of numbers, previous literature has addressed the fact that sales forecasts can be viewed both as realistic estimates and challenging targets (Becker, 2014; Henttu-Aho and Järvinen, 2013) and that budgetary targets may be adjusted if they deviate significantly from forecasts Bourmistrov and Kaarbøe, 2013). The before mentioned studies have mainly addressed rolling forecasts with forecasting periods of three months or more into the future. However, our case data shows rather clearly how companies having markedly short forecasting periods (day/week) find the integration of numbers inherently challenging to achieve with or without PA tools. In such companies, the operations were primarily interested in very short-term non-monetary forecasts for production planning purposes, whereas accounting tends to focus on longer term, monetary forecasts for profit planning purposes. The short-term forecasters are simultaneously the same companies where accounting department has not played a major role in initiating the PA project, and do not own the forecasting process. Furthermore, these short-term forecasters use traditional annual budgeting, whereas all the longer term forecasters have adopted rolling forecasting.

The paper adds to the scarce accounting literature on the convergence of diverse accounting practices (Taipaleenmäki and Ikäheimo, 2013) by extending our analysis to the sales forecasting process and the adoption of predictive analytics tools. The central contribution of the paper is to explicate and unpack the aspects related to the enabling vs. hindering the convergence of various forecasting numbers. Simultaneously, we respond to Granlund's (2011) call to investigate the potential and realized changes that the development of IT may cause for accounting and control practice.

With regard to suggestions for further research, it would be fruitful to investigate whether our tentative suggestions based on limited number of companies would achieve statistical significance if tested with the larger number of companies by using a survey method, for example. Additionally, in this study we did not address the challenges of one set of numbers. Namely, it would be worth to study how companies manage the situation, when the same sales predictions are potentially simultaneously used as "realistic" short-term predictions for production planning and "ambitious" sales targets, for example.

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Appendix 1. List of interviews

Persons interviewed	Date	Duration (min)
Business managers		
1. Demand Planning Manager 1. (Case A) &		
2. Supply Chain Planner (Case A)	12.4.2011	90
3. Manager, Business Development & Logistics (Case B)	3.5.2011	55
4. Business Area Controller (Case C)	23.5.2011	54
5. Business Controller (Case A)	21.6.2011	37
6. Development Director (Case B)	21.6.2011	70
7. Sales Support Manager (Case C)	12.9.2011	50
8. Development Director (Case D)	3.2.2012	52
9. CFO (Case D)	3.2.2012	59
10. Development Manager (Case E)	2.4.2012	75
11. SVP, Business Control & IT (Case C)	8.10.2012	60
12. Director (Case E)	9.12.2012	65
13. Vice President, Business Controlling (Case F)	22.2.2013	59
14. Manager, Corporate Performance Reporting (Case G)	11.3.2013	80
15. SVP, Development (Case H)	13.3.2013	85
16. Director, Supply Chain Management & Sales Planning (Case G)	3.4.2013	75
17. SVP, Finance (Case H)	16.5.2013	48
18. Demand Planning Manager 2. (Case A) &		
19. Supply Chain Development Manager (Case A)	25.6.2013	57
20. Key Account Manager (Case A)	5.8.2013	58

21. Controller (Case F)	19.8.2013	40

<u>Consultants</u>

1. Consultant (SAS Institute) &		
2. Business Advisor (SAS Institute)	19.10.2010	50
3. Technical Sales & Services Manager (IBM; Cognos)	26.10.2010	80
4. Senior Consultant (Via Group)	19.12.2012	70
5. Vice President, Online & Analytics (Solita)	11.12.2014	90
Total	24h 19 min	

All the interviews were face-to-face interviews and they were tape-recorded (except Business manager 14 and Consultant 5).

Appendix 2. An Interview structure

1. Why did you initiate the Predictive Analytics (PA) project (for sales/demand forecasting)?
2. Which were the main targets for the project?
3. To what extent have the targets been achieved?
4. Have you tried to evaluate the benefits of the project (ex-ante and ex-post)?
5. How controlling/accounting staff has been involved with the project?
6. How controlling/accounting staff sees the benefits of the project (ex-ante and. ex-post)?
7. How the forecasting was conducted before the implementation of a new PA tool?
8. What is the link between current sales/demand forecasting conducted with the aid of a new PA tool and sales budget/rolling forecasting?
9. How your ERP could have been utilized for sales/demand forecasting?
10. Which were the alternative solutions/tools evaluated to improve sales/demand forecasting?
11. How is your current sales/demand forecasted?
12. Which are the main drivers of the forecast?
13. What are the roles of different persons and functions in forecasting?
14. What are the main challenges with the forecasting?
15. What is the role of manual vs. automatized procedures in forecasting?
16. What was the role of cooperation partners in the PA project?
17. What kinds of development plans you have in order to improve your forecasting?

[i] Business Intelligence, BI, refers to two things. Firstly, the concept is used in to designate relevant information about a company and its business and market environment. Secondly, the concept is used to illustrate how corporations systematically organize the acquisition, analysis and use of relevant information, both internal and external. The management of such relevant information will optimally enable better decision making (Lönnqvist and Pirttimäki 2006, p. 1).

[ii] We have chosen to call these broadly accounting departments even though in many companies they can be called finance, financial, controlling, management accounting and financial accounting departments, for example.

[iii] IDC (2011) Extracting Value from Chaos.

[iv] Respondents from over 200 organizations participated in the annual study of the periodical Computer Economics Report (2011, Vol. 33, No. 66). The study addressed predictive analytics as part of business intelligence and the value added of these activities to the firms that had already implemented them.

[v] In 2013, representatives of 373 organizations, mostly IT-managers and business analysts, participated in this internet - based study (Halper, 2013).

[vi] The study is based on the interviews of 309 people in 2013, who were responsible for strategic planning and who had knowledge of predictive analytics. The interviewees were employed in organizations of more than 50 people. The study was carried out by independent UK consulting agency Loudhouse together with SAP.

[vii] We focus in our paper on sales related part of (operational) forecasting and budgeting/rolling forecasting.

[viii] Additionally, the profit plans are used for cash flow planning and resource allocation planning, for example.

[ix] See e.g. Lillis and Mundy's (2005) suggestion how to distinguish single case studies, multiple case studies, cross-sectional field studies, and surveys based on sample size, sampling logic, and preciseness/measurability of existing constructs, for example.

[x] A lot of consultations took place with the main actors in the field (representatives of PA software houses and consultants) to identify the organizations in question. These persons also helped us identify the most knowledgeable persons with regard to the PA projects in the case organizations. None of the contacted organizations or persons refused to be interviewed.

[xi] Production, purchasing and logistics, for example.