New and Interesting Perspectives for the Management Accountant in a World of Data

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Abstract

This paper aims to answer two specific research questions: how might business analytics influence the management accounting community and accountants and how can the community benefit from the growing interest in business analytics? The paper surveys the existing literature on business analytics and management accounting, which is still in its infancy. The intention is not to offer a comprehensive review, but to stimulate discussion and future possibilities. The paper identifies a number of studies from both academic journals but also reports from professional consultancies and accounting organisations concerning future opportunities and implications for management accounting in combination with business analytics. It was found that both academic articles but also accounting organisations together with large consultant companies suggest changes for the practical management accountant. It also shows that topics such as, a holistic view, fact-based decisions, predictions/forecasting, visualization, and specific analytics skills for the accountant are the most important areas mentioned. Finally, the paper demonstrates that there are different ambition levels for the management accountant, depending on if s/he wants to be on a descriptive, on a predictive, or on a prescriptive level. The true value of the paper, therefore, lies in making management accountants more aware of the need to adjust for today’s challenges of business analytics/big data environment and, thereby, starting a debate on the possible adjustments for the management accountant’s skills for the future.

Keywords: Management accounting, management accountant, business analytics, big data, decision making, quantitative skills.

1 Introduction

For many years, the basic problem for management accounting has been that – in spite of a huge number of researcher, paper, articles, conferences, and journals - not much impact on society and on practice have been documented (Birnberg, 2009; Hopwood, 2007; Kaplan, 2011; Moser, 2012; Zimmerman, 2001)². There may be many reasons for this unfortunate fact. Without going into too much speculation – one main factor - may actual be the research community itself and the people within it when selecting topics and methodology and doing the research (see, e.g. Kaplan, 1998 – for the way Kaplan drives his research). The problem is also shown for different countries and their traditions, (e.g. the Nordic countries vs. Germany or US) or between Europe and US (see, e.g. the discussion in European Accounting Review 2001/2 about the differences between the tradition in Europe and the US tradition). A big frustration has been – and is still of big concern - that few research findings and results have never been used in the practical world (Kaplan, 1998; Kasanen et al., 1993; Merchant, 2012; Otley, 2001; Rautiainen et al., 2017).

The term ‘business analytics’ (BA) is being used within the information technology industry to refer to the use of computing to gain insight from data. The data may be obtained from a company’s internal accounts and sources such as its enterprise resource planning application, from data warehouses, from a third party data provider, or from public sources. Companies seek to leverage the digitized data from transaction systems and automated business processes to support what is normally called ‘fact-based’ decision making.

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²One exception is Robert S. Kaplan former professor at Harvard Business School now Emeritus professor of Leadership Development at Harvard Business School, and known as the creator of ABC (Activity-based Costing) and co-creator of the Balanced Scorecard, together with David P. Norton. Both concepts have had a tremendous effect - not only on theory development - but also on practical companies’ controlling ideas world-wide (see, e.g. Johnson and Kaplan, 1998; Kaplan, 1998; Kaplan and Anderson, 2007; Kaplan and Atkinson, 2014).
Therefore, the concept of business analytics is a category of computing rather than a specific method, application or product (Lustig et al., 2010). In many ways, the goal of business analytics is to make better business decisions that have impact rather than simply to automate standardized processes.

The movement toward the increased use of ‘analytics’ (i.e. the use of data) in business and organizations therefore represents an interesting new venue from which management accounting and the management accountant can benefit a lot.

A citation from the CIMA Conference in London 2017 (Big Data and Business Analytics) also states: ‘Analytics will play a vital role in the future of finance, so CFOs, finance managers, management accountants and other finance professionals will benefit’.

To shed light on the link between business analytics and management accounting, and challenges for the management accountant (MA), the purpose of this paper is to review some target related literature discussing this intersection. More specific, the paper seeks to answer two specific research questions: what does the targeted literature say about this interconnection and how can the MA adjust to these new environments?

To answer these two questions the paper first analyses the driving forces and elements in business analytics and combine these elements with classical areas within management accounting. Based on the findings a need for increasing the focus between business analytics for decision making is strong. Finally, the paper discusses the demand for management accountants’ analytical skills which is expected to soar in the future. The main conclusion is that if the management accountant want to excel to the highest decision level in the business analytics environment (i.e. the prescriptive level) the accountant must increase – not only their IT, mathematical and statistical skills – but also specific soft skills such as intuition, creativity, and communication specific originate from the analytics idea.

The paper is structured as follows. Section 2 synthesizes a number of the relevant articles from reviewed journals and reports from consultant companies on business analytics and management accounting. Section 3 discusses the implications of the business analytics synthesises for the management accountant and section 4 finishes the paper with a conclusion, and limitations.

2 Literature driving the business analytics³

The background information synthesis is that ‘analytics’ will have a decisive impact on management accounting and the MA. The concept of business analytics originated in an HBR article by Davenport in 2006 entitled ‘Competing on Analytics’. Since then, Davenport has written a number of books and a large number of articles. Looking into the definition of ‘business analytics’ this is defined as: ‘the use of data, information technology, statistical analysis, quantitative methods, and mathematical or computer-based models to help managers gain improved insight about their operations, and make better, fact-based decisions’ (Davenport and Harris, 2007, p. 7).

They continue by saying ‘that analytics are a subset of what has come to be called ‘business intelligence’: a set of technologies and processes that use data to understand and analyse business performance. Normally analytics have three (or four stages) going from Descriptive Analytics (what happened now, for example by looking at a standard report) -> Diagnostic Analytics (why did it happen, for example by drilling-down in the report and by using data mining to find interesting correlations) -> Predictive Analytics (what could happen, for example for our existing customers if there is a decline in demand?) -> Prescriptive Analytics (How can we address the best outcome taking into account uncertainty and other external factors?).

In prescriptive analytics, the decision maker must think about what the best response or action will be given the limited resources of the company. Prescriptive analytics uses optimization to identify the best – and most likely – alternatives in order to minimize or maximize some objective for example, costs or net profit. This means the use of experimental design and optimization to identify the best possible alternative given different scenarios, criteria, and objectives (e.g., by using optimization, integer optimization, heuristics, non-linear or non-smooth optimization tools).

³It is important to realize that several concepts within the ‘analytics movement’, for example business analytics, business intelligence, or data mining, may have different definition and different meaning for different people (e.g. data scientists vs. ordinary users). Finding a single unique definition may almost be impossible, also because the concepts have developed over time.
In order to compare and being able to say something about different ideas from the analytics literature on management accounting one can examine the driving forces or factors behind the analytics movement from primary and secondary sources and synthesize the literature by analysing important differences and similarities (Denyer and Tranfield, 2008; Hemingway, 2009). Primary literature search is based on reviewed articles from academic journals, whereas secondary literature is literature such as research reports and white papers from consultant companies or other documents not normally subject to editorial control and peer review. This classification is used below in order to give a more complete view of possible influences on management accounting and the MA.

2.1 Primary or reviewed accounting literature

A search of large scientific databases (ABI Inform, EBSCO, and Science Direct) for key words such as business analytics and management accounting/accountants was done. This gave a large number of hits, but only few relevant reviewed articles. However, this search produced a number of articles concerning different IT/ERP systems and management accounting which is not the basic topic here.

Kaplan was one of the first to mention a new environment for management accounting. In an interview with Paul Sharman in Strategic Finance, March 2008, Kaplan also pointed to the importance of BA by saying:

Management accounting analytics is no longer constrained by limited or complex access to companies’ databases. But to excel at analytics, management accountants will require extensive training in modelling, multivariate statistics, and econometrics.

Nästase and Stoica (2010) explore and discuss the relationship between the analytical capabilities in the planning, sourcing, making, and delivering areas of business performance using business analytics and business process orientation as moderators. The article lists a number of relevant areas within management accounting in which BA is being used or can be used, and it discusses a number of concepts (BI, data mining, and data analysis) and their assumptions. The message is that because the world is changing and becoming increasingly instrumented, interconnected, and intelligent, new ways of using and presenting data hold the potential to supply actionable insights for decision makers at all levels of the organization such that performance can be optimized.

Schläfke et al. (2013) were among the first to discuss business analytics in a performance management system framework and to address the need for management accountants to develop a performance management analytics approach. They suggest a multilayer performance management framework that could help managers decide on the kind of analytics they should use when they want to test and map the causality-based couplings of context factors, inputs, processes, outputs, and outcomes in order to highlight their value creation. As pointed out by Schläfke et al. (2013) this will require new data analysis skills.

Cokins (2013) discusses seven trends in management accounting, where predictive accounting and business analytics embedded in ERP methods are two of them. He suggests that instead of focusing on historical cost or descriptive costs, researchers must now focus on predictive costs to close the gap between what management accountants report and what managers want in order to make relevant decisions. He also finds that business analytics is needed because this is the only sustainable long-term competitive advantage as the traditional generic strategies such as being the lowest-cost supplier are vulnerable to agile competitors who can quickly match a supplier’s price or invade his customer base. In the end more relevant skills are needed if management accountants are to be able to fulfil their jobs.

Bhimani and Willcocks (2014) discuss the dilemmas and possibilities of digitisation, software and processing power and the accompanying data explosion for enterprises and their finance function. The authors develop a model for understanding data, information and knowledge relationships for companies and point to both the potential of the complexities of Big Data in relation to the finance function generally and to management accounting information provision specifically. ‘Big Data’ and data analysis techniques enable executives to act on structured and unstructured information but such action must recognise that the traditionally presumed sequential and linear links among corporate strategy, firm structure and information systems design are no longer in play. The authors also point to fact that, cost structure are affected by developments in how data, information and knowledge can be utilised. Finally, the authors
conclude that the possibilities for the digitally enabled business creating a range of ‘information literacy’ challenges as well as new possibilities for accounting information providers.

Warren et al., (2015) discuss the importance of Big Data (the 4V’s of Big Data – volume, velocity, variety, veracity) on management and financial accounting basically from video, audio, and textual information made available via Big Data. Specifically, in managerial accounting, the authors posit that Big Data will contribute to the development and evolution of effective management control systems and budgeting processes. For example, for the BSC Big Data can identify new behaviours that influence respective goal outcomes. For instance, web use while at work may be tied to learning and growth goals, internal emails may correlate with the effectiveness of internal business processes as well as customer service quality, and customer service quality may be related to vocalic cues mined from customer service calls, or the tone of emails and phone conversations made on company equipment could be indicators of employee morale or the number of emails sent by managers could be a proxy for productivity. The authors also mention the use of Big Data, including additional streams of data outside ERP systems (e.g., climate, satellite, census, labour, and macroeconomic data) could be used to enhance the beyond budgeting practices.

Brands and Holtzblatt (2015) discuss and analyse how management accountants can position themselves so as to play a key role in the implementation and application of business analytics in their organizations as they move beyond traditional, transaction based accounting to analytics. This trend will transform the way management accountants’ analyse and interpret data for their companies in the future, not only in relation to financial accounting (e.g., accounts receivable, and payment monitoring) but specifically in relation to the visualization of data. The authors end with a roadmap for BA and the following statement:

‘Management Accountants have a difficult task ahead of them. If they fail to leverage the opportunities provided by the digital information revolution, they could jeopardize their organization’s operating performance and competitive advantage. Put simply, management accountants and other financial professionals must identify how they can use and analyse data’ (p.10).

Quartrtrone (2016) discusses the fascination with the digital revolution into the historical and cultural contexts that have intertwined with the evolution of management accounting as a practice involved in the production of knowledge for decision-making. Quartrtrone argues that while the effects of the digital revolution on management accounting and decision-making are still unclear, these effects will not deliver the dream of perfect information and rational decision-making as one may be lead to believe by the growth of data-driven organizations and societies. Quartrtrone is also very sceptical of Big Data and analytics, or as he says:

If I had to bet on what big data will do for decision-making, I would say that it will make people take wrong decisions much more quickly than before, with even less room for the exercise of wisdom beyond the increasing compliance that affects various realms of decision-making, from finance to risk management.

Finally, Arnaboldi et al. (2017) discuss an agenda for researching the relationship between technology-enabled networks – such as social media and Big Data and the accounting function. Specifically, they identify new performance indicators based on social media and Big Data. An important point made by the authors is that accounting practitioners tend not to see Big Data as a resource. However, there is a significant interest in new indicators based on user/customer engagement, which encompasses communication, marketing, customer care and even innovation (e.g. the balanced scorecard). This use goes beyond social media data, as it is elaborated and triangulated with other data, often stimulating the exploration of further external sources. The authors also mention this element as a promising research path, leveraging on the accounting tradition of visualisation. The authors also point to the interest in indicators originated in practitioner literature, mostly outside accounting journals that address this issue.

2.2 Secondary literature research findings

To explore new research ideas or changes, academic literature may be scarce and in such cases secondary or the ‘grey’ literature may be included (Hemingway, 2009). In the following an outline is provided of the publications and reports issued by mainstream accounting organizations and large consulting companies on the influence of business analytics/Big Data on management accounting.
2.2.1 Accounting organizations

Because the influence and importance from professional accounting organizations seems to have increased over the years, it is important to include their ideas, topics, and research areas to see how these organizations envision the future for management accounting and accountants. Focus is on a few relevant reports from the American organization IMA (Institute of Management Accountants), the UK organization CIMA (Chartered Institute of Management Accountants), ACCA (Association of Chartered Certified Accountants), and CGMA (Chartered Global Management Accountant).

The synthesis can be formulated as: what does empirical research conducted by these accounting organizations and consulting companies from 2013 and forward envision and suggest for the future as regards the interrelation between BA, big data, management accounting, and the management accountants?

Because we are interested in the field evidence on the subject, only targeted empirical studies are used. The search has come up with the papers listed in table 1.
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<tr>
<th>Organization</th>
<th>Title</th>
<th>Research assumptions</th>
<th>Statements related to Management Accountants</th>
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<tr>
<td>CGMA (2013)</td>
<td>FROM INSIGHT TO IMPACT Unlocking opportunities in big data</td>
<td>The report is based on a survey of 2,093 CFOs and other finance professionals, working in a broad range of business sectors across more than 80 countries. It also makes use of a program of interviews with senior finance executives.</td>
<td>MA should focus on all types of data (unstructured but also on the potentials of structured data), on new analytics techniques and tools on daily metrics and on finding patterns and correlations. Concepts such as BI, data mining, predictive analytics, communication and presentation skills are important for MA.</td>
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<td>IMA &amp; ACCA (2013)</td>
<td>Big data: its power and perils</td>
<td>Based on literature on big data together with three roundtable meetings with leading accountancy and finance professionals (in total 36) to consider the future implications of big data for the profession, supplemented by a series of expert interviews with big data practitioners.</td>
<td>MA must focus on new skills and new ways of thinking and on using big data and analytics for performance and decisions (in real time) to identify new options and using different datasets for risk forecasting. New skills and new ways of using data are important. Only this can retain their influence. They also need to know about statistical modelling, data mining, advanced predictive analytics, and risk forecasting techniques.</td>
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<tr>
<td>CGMA &amp; Oracle (2015)</td>
<td>The Digital Finance Imperative: Measure and Manage What Matters Next</td>
<td>The survey is based on 744 respondents in 34 countries, EMEA (Europe, Middle East and Africa), USA and Canada, BRIC countries (Brazil, Russia, India and China), UK, APAC (Asia-Pacific) countries, and Latin America, excluding Brazil supplemented by interviews with senior finance and management professionals across the globe.</td>
<td>The digital age has redefined the role of the CFOs – specifically related to intangible assets and data-driven decision making. They will be asked to define and implement new, digitally-enabled business models. MA must be able to develop new KPIs (e.g. for customers) to track the progress based on causal relationships and correlations also within supply-chains, sales and customer areas. The role of the CFOs has broadened regarding specific IT and data management. MA must work together with data scientists to improve performance.</td>
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<tr>
<td>CGMA (2016)</td>
<td>JOINING THE DOTS - DECISION MAKING FOR A NEW ERA</td>
<td>The report is based on a survey conducted on 300 C-level executives (C stands for Chief) in large organizations from 16 countries around the world. The survey was supplemented by in-depth interviews for deeper insight with nine CFOs in big companies.</td>
<td>Relevant decision making for ‘Integrated Thinkers’ is based on integrated and holistic thinking (the business model as a frame), i.e., cutting through silos to find the relevant information across the organization to see the big picture. VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) and defining short, medium, and long terms time dimensions makes this difficult. Real-time decision making is very important for forward looking and predictions. Sixty five percent of Integrated Thinkers perform better than their industry peers. Therefore, the conclusion is to invest in increased skills for the decision maker.</td>
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Table 1: Publications from accounting organizations.
Due to space and because of the repeated points made in many of the reports, only the most relevant points and findings from the latest CGMA (2016) report will be discussed below.

To be certain that the decision we take will eventually have the highest impact is rarely possible. We therefore need to make each decision based on the best possible information and shape it by the best possible judgment. This is the main topic in this report. Senior leaders around the globe are often struggling to make the right decisions. The large majority find themselves battling against bureaucratic decision making processes, siloed and short-term thinking, facing lack of trust and collaboration inside the organization and difficulties with translating ever expanding volumes of information into relevant knowledge. The solution lies in a holistic view:

The solutions to many of the decision-making challenges we have identified can be achieved through more integrated thinking—cutting through silos to connect the relevant people and information from across the organisation. Joining the dots in this way enables leaders to see the big picture. It means that all of the relevant insight is available when making decisions. It enables the analysis of how the business is performing in its market and why, drawing on the business model as a powerful frame of reference. And it means encouraging behaviours that build a foundation of trust upon which information is shared and influence secured (p. 4).

The report uses the word ‘VUCA’ world - characterized by Volatility, Uncertainty, Complexity, and Ambiguity. It is becoming harder and harder to get it right. As discontinuity becomes the norm and the most established business models are challenged, organizations need to make good strategic decisions quickly and then deliver on their choices. In this VUCA world CFOs are important:

Organisations need a powerful framework led by the CFO and their management accounting functions to help leaders take the best possible decisions and in so doing to implement practical solutions that address the challenges of decision making today—this will prevent the decision-making gap from growing further. All the relevant information needs to be brought together, organised on the basis of a shared understanding of the business model, focusing on key performance indicators, in order that resources can be best allocated and risk managed to maximise cash generation (p. 5).

The solution lies in what the report calls ‘integrated thinkers’:

While many are struggling to make headway in their decision-making capability, there is a group of organisations at the other end of the spectrum. These companies are using high-calibre decision making to drive performance and bottom-line results, as well as making their organisation an attractive and stimulating environment for talented people. We call these organisations ‘Integrated Thinkers’ and they are characterised by strong implementation of the Global Management Accounting Principles® that provide a foundation for effective decision making and the creation of value in large organisations. These principles are: Influence, Relevance, Analysis and Trust (p. 8).

Integrated thinkers – or 25% of the respondents - enjoy a decision making advantage and are more effective in the key factors that affect decision making.

Asking respondents how their organizations have performed over the past two years, compared to other organizations in their industry, 65% of integrated thinkers cited a better performance compared to their industry peers. About 55% of the executive teams see a need to improve active collaboration with fellow executives:

Clearly the days of the ‘imperial’ CEO are over. No one person has all the information necessary to make decisions. You need the people with the right experiences at the table who bring that knowledge, whether it be their business units or their functions (Mark Weinberger, Global Chairman and CEO of EY, p. 18).

Another important topic for management accountants is how to define different time perspectives for decisions. Defining short, medium and long term objectives in companies seems to pose a real challenge:

Yet, in our survey, almost half (48%) of respondents say they are struggling to balance their short, medium and long-term objectives as they make key decisions about their organisations’ futures (p. 20).

This is also supported by problems related to different metrics in that 34% of the respondents report that they find it challenging to select the right combination of metrics to measure business performance over different time frames. However, 68% of the integrated thinkers say that they are highly effective in their understanding of how their business model needs to adapt over time in response to market trends. This ‘time dimension’ must be included in models and decisions:
The sophistication of information and its availability for real-time decision-making is in a different place from where it was a few years ago, says Mr. Henry of Royal Dutch Shell. Tapping into these information sources to react in tougher times is critical, and can be a major opportunity to create or protect value. At Yahoo, Mr. Goldman adds: Modelling can be very dynamic in today’s world—the information is constantly changing in a climate or environment that is more volatile than in the past (p. 23).

However, 80% point to at least one occasion during the last three years where their organization has made a strategic decision and subsequently discovered that it was based on flawed information, and although 37% of organizations say that Big Data has helped them to make better decisions, a worrying 32% say that it has actually made things worse.

The time dimension is specifically important in connection to forward looking and prediction. But ‘only’ 66% of the respondents say that their management information systems contain the right amount of forward-looking and predictive data.

One of the main conclusions made in the report is to invest in skills or else other will take over:

Demand is increasing for data scientists and finance executives with data expertise. Closer integration between data specialists and other functions can help to unlock new sources of information, delivering fresh insights about past outcomes as well as helping to predict the future environment. Related to this, only 27% of senior leaders in our survey rate themselves as being highly effective at interpreting new data sources and tools. Recognising the need for greater organisational support in this area, 40% say that data scientists should be given greater responsibility in the decision-making process (p. 27)

Thus the pivotal questions are in what direction these accounting organizations go and how will it affect the future role of the management accountants? Implicitly, most of the statements and citations build upon a number of assumptions as regards the qualifications and skills needed by the accountant in the future. In the next section, a number of the most prestigious consulting companies and their ideas in relation to Big Data and BA are discussed.

2.2.2 Consulting companies’ views on business analytics and management accounting

The consulting companies used here are all on Forbes’ list of the most prestigious consulting firms in the world⁴. Due to the extremely high number of research reports and recommendations produced by professional consultancies concerning analytics and Big Data, the research is limited to include only papers from 2013 and forward. Table 2 lists the selected companies together with the assumptions for their research and the important implications for management accounting and management accountants.

⁴There is a number of different ways to classify consulting companies, e.g. financial management companies, top consulting firms, management consulting industries, or IT-consulting companies. Here the choice is on Forbes 2015 list over ‘The Most Prestigious Consulting Firms In 2015’, based on Vault.com. Vault’s list comes from a survey of consultants who are asked to rank their peers and competitors. However, even though a consulting company is not rated as one of the most prestigious, it might be relevant for many other specific reasons related to BA (e.g. Ventana for using System Dynamics for BA, or Alteryx and Tableau for using Visual Management for BA).
Table 2: Publications from major consulting and accounting companies.

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<thead>
<tr>
<th>Consulting Companies</th>
<th>Title</th>
<th>Research assumptions</th>
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<tr>
<td>Gartner (2013)</td>
<td>The CFO's Six Technology Imperatives</td>
<td>The survey is based on 237 financial executives, with 55% of respondents from global or multinational companies and with 27 percent of the respondents from publicly traded firms, 62 percent were from private for-profit, and 11 percent were from not-for-profit organizations.</td>
<td>CFOs are deeply involved in deployment and implementation of BA, IT decisions and performance management based on BA. The CFOs prioritize BI and business applications more than the CIOs do. The study also shows that the CFOs are often more concerned about the deployment of newer technologies. Topics such as scorecards, budgeting and forecast and customer profitability are the most important areas, but also predictive modelling and statistical analysis are mentioned.</td>
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<tr>
<td>PWC (2013)</td>
<td>Closing the gap in performance management</td>
<td>The results are based on 893 global members of the Chartered Institute of Management Accountants with nearly three-quarters of the respondents based in the UK and with the rest distributed across the globe.</td>
<td>CFOs should be able to link KPIs to strategic objectives and define KPIs by using a mapping approach and to use more scientific methods for cost allocations including finding relevant and real cause and effect relationships. CFOs must also be able to improve the budgeting, planning and forecast areas including capacity and pricing. This will require knowledge of data management, BI and model scenarios with variance analysis.</td>
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<tr>
<td>MIT Sloan Management Review in collaboration with SAS Research Report (2014)</td>
<td>The Analytics Mandate</td>
<td>The results are based on a survey of 2,037 professional managers and executives and interviews with more than 30 executives from organizations located around the world.</td>
<td>Several factors are needed to build an analytics culture that works. To be in front, MA must be more dedicated to analytics and data-driven models and be able to add value through different disciplines (e.g. statistical, contextual, quantitative, predictive, cognitive, and other techniques) and thus be ‘analytics innovators’. Data is both internal and external data. Asking the right question becomes very important in an analytics culture. To fulfill their analytics mandate, companies need graduates with the right skills within analytics.</td>
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<tr>
<td>Accenture &amp; MIT (2015)</td>
<td>Winning with Analytics</td>
<td>Is based on data from a survey of 864 respondents from companies in nine countries and eight industries and covers the countries of Brazil, Canada, China, France, Germany, India, Japan, the United Kingdom, and the United States.</td>
<td>MA is involved in both ‘low performers’ and ‘high performers’ with focus on growth, profitability and performance. People with analytics talent are needed. High performers use more data sources and more advanced tools and techniques (and have a much higher outcome). If the MAs want to be part of this talent group, they have to be able to handle advanced tools and techniques (e.g. optimization and simulation).</td>
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<tr>
<td>KPMG and ACCA (2015)</td>
<td>Planning, Budgeting and Forecast - An eye on the future</td>
<td>The survey is based on over 900 finance professionals from more than 50 countries (from Senior Finance Managers to Internal Auditors, Treasury Analysts and Consultants).</td>
<td>Because MAs are normally deeply involved in PBF (planning, budgeting, and forecasts), it is important to be aware of how big data, risk measurement and different techniques can be used to improve performance. CFOs must deploy techniques such as rolling forecasting with moving targets (that reflect real-time changes in external factors) in combination with tools within predictive and prescriptive analytics if they should make empowered decisions.</td>
</tr>
<tr>
<td>MIT Sloan Management Review in collaboration with SAS Research Report (2016)</td>
<td>Beyond the Hype: The Hard Work Behind Analytics Success</td>
<td>A survey based on 2,192 respondents across the world, supported by interviews and case studies from a wide variety of industries and from organizations of all sizes.</td>
<td>As analytics also includes cognitive models and learning, the MA has to be part of the team that can make data sufficient (accurate, timely, complete, accessible, reliable, consistent, relevant, and detailed). However, data management tools have not been used sufficiently in analytics. Decision making is the most important topic in analytics which again assumes much attention on data and analytics skills with focus on prediction and prescription. Integrating the analytics strategy with the organizational strategy is important. Intuition has a critical role in developing analytics and in strategic decision making.</td>
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Due to space and because of the repeated points made in many of the reports, only the most relevant points and findings from the latest MITSloan Management Review in collaboration with SAS Research Report (2016) report will be discussed below.

Even though IT companies such as SAS-Institute, IBM, Oracle, and SAP also produce a large number of so-called ‘white papers’ including topics such as Big Data, business analytics, performance management, etc., these papers are often related to the technicality of their respective software product and therefore not included here\(^5\).

The purpose of the MITSloan Management Review in collaboration with SAS Research Report (2016) study is to understand the challenges and opportunities associated with the use of business analytics and Big Data. In the report, the term ‘analytics’ refers to the use of data and related business insights developed through applied analytical disciplines (for example, statistical, contextual, quantitative, predictive, cognitive, and other models) to drive fact-based planning, decisions, execution, management, measurement, and learning. The survey was conducted to take the temperature of BA in the present business environment. The findings also show that despite the hype, the reality is that many companies still struggle to figure out how to use analytics to take advantage of their data:

*It is hard work to understand what data a company has, to monitor the many processes necessary to make data sufficient (accurate, timely, complete, accessible, reliable, consistent, relevant, and detailed), and to improve managers’ ability to use data. This unsexy side of analytics is where companies need to excel in order to maximize the value of their analytics initiatives, but it is also where many such efforts stall (p. 3).*

There are several reasons for not gaining the edge of analytics; 37% say that they have just begun to apply analytics; 29% say that they do not use analytics to drive strategic decisions; 29% say that they are not sure how to apply the analytical insights to their business; and 28% say that analytics is not a priority for senior management.

As pointed out in the survey one problem seems to be the use of data management tools because since 2012, companies have not improved their data management capabilities. Data management is fundamentally important to achieve effective analytics, yet it remains one of the biggest challenges for many organizations. However, most feel optimistic about analytics and its implementation over the next few years (about 80% strongly agree and agree in this statement).

A number of case studies included in the report also show that formal analytics strategies tend to focus on at least three basic areas of activity: skills development, data management, and cultural norms for using data in decision making. Some of the most mature analytics organizations (the paper mentions Bank of England, General Electric, Xiaomi), along with those that are striving to use analytics more widely, forge a strong connection between their organizational strategy and a formal strategy for analytics.

Finally the survey shows that decision making is probably the most important topic within BA:

*The main goal of a formal organizational strategy for data and analytics is typically to improve decision making with analytics in a wide realm of activities. These might include customer segmentation, pricing, identifying new markets, managing supply chain risk, fraud detection, creating efficiencies, and improving operational effectiveness (p. 10).*

Figure 1 shows the balance between analytics and intuitions when making different types of decisions for three groups of companies: analytical innovators, analytical practitioners, and analytical challenged.

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\(^5\)Also, a large number of case studies (or smaller videos or PowerPoint presentations) are used for these companies. A white paper is an authoritative report or guide that informs readers concisely about a complex issue and presents the issuing body’s philosophy on the matter. It is meant to help readers understand an issue, solve a problem, or make a decision. The original British term meaning a type of government-issued document has proliferated and has taken on a somewhat new meaning in business. In business, a white paper is closer to a form of marketing presentation, a tool meant to persuade customers and partners and promote a product or viewpoint (Wikipedia). White papers may also be considered as grey literature (Hemmingway, 2009).
It is evident that the Analytical Innovators perceive analytics as more important for all these types of different (classical management accounting) decisions. The paper interprets this fact as an analytics culture driven by senior mandates, more strategic focus in their application of analytics, high value on data and analytical skills, and advanced approaches that focus on prediction and prescription, meaning that executives are both proponents and users of analytics. However, analytics alone is not enough: The perceived dichotomy between analytics and intuition is false for two reasons: Intuition has a critical role in developing analytics; and blending analytics with intuition in decision making can produce more effective results than either alone, especially when making strategic decisions (p. 14).

In summary, even though the reports and the literature above include many different elements and statements and several topics (many topics such as cloud computing and partnerships), the tendencies seem to be clear. The decision makers agree that business analytics, data analytics, and supported techniques are increasingly important. Many decisions mentioned in this literature related to areas that are actually the main field of management accountants (compare, e.g. to Drury, 2004; Horngren, 2010; Seal et al., 2015) and this is actually the main reason why management accounting and management accountants have to take the analytics movement very seriously.

3 Implications for the management accountant

We proceed by first synthesizing the knowledge that we have gained on business analytics within the management accounting decision field and the reporting area. We then continue by suggesting revisions or a change in focus for the management accounting community. Surveys have shown that there are many different roles for the controller in the organizations (e.g. industrial controller, operational controller, corporate controller, strategic controller), who they report to, and what skills they have or need (IMA, 2016b). So – what have we learnt so fare? Below five statements give the highlights from the literature above.
Management accountants must focus on the holistic view in an analytics culture: MAs must focus on the whole business when identifying new issues and solutions because decisions must be made through integrated thinking - cutting through silos to connect the relevant people and information from across the organization. In an analytics culture, decision making norms, behaviours, values and outcomes are aligned to assure that analytical insights actually generate value, not merely promise the possibility. Within strategy, holistic models such as the balanced scorecards, the pyramid model, and different business models have been dominant (Berry et al., 2009; Ferreira and Otley, 2009; Flamholtz and Hua, 2003; Kaplan and Norton, 1996; Malmi and Granlund, 2009; Simons, 1995). An example is shown in Figure 2.

Figure 2: The principal relations between different KPIs

Birnberg (2009) and Bromwich and Scapens (2016) have suggested that the practical problems faced by management accountants be solved by transgressing the boundaries of management accounting and interacting with non-accountants by for example combining qualitative and quantitative methods. However, in the analytics perspective, the holistic view is related to making decisions and access to relevant data, meaning that the MAs must also be able to come up with new ideas and suggestions that create commercial insight and impact. The main idea is to treat the whole ‘patient’ rather than just the current complaint. This again assumes that the MAs are able to ask the right questions at the right time. However, as pointed out several times in the literature above, leadership competency is still important, but this now has to be executed in an ‘analytics’ setup, using data for storytelling and visualization to share the human impact of the numbers. MAs will face new challenges to overcome if they are to sustain their professional expertise and to cultivate dynamic qualities and become pro-active, approachable and people-oriented. However - as mentioned earlier – the MAs do not necessarily need to know the in-depth database structures, but they need to know how to extract relevant data, and they need to understand and explain what the outcomes of analytics are and how it can add value for the company.

Management accountants must focus on fact-based decisions that create value and impact: Using their understanding of the significance of data, the MAs must facilitate effective decision making, and be able to add value to the company. However, data must be transformed into experience and impact (Fig 3).

Figure 3: From data to decision
Ref. Emblemsvåg, (2005) and Bhimani and Willcoocks (2014)
There may be many types of relevant data; historic vs. real time data, internal vs. external real-time data, small vs. Big Data, structured vs. unstructured data, static vs. dynamic data financial vs. non-financial, tangible vs. and intangible. Companies often engaged management consultants or business data scientists to pour over copious amounts of historical, internal data to identify trends and develop models and algorithms to predict future trends and improve the company’s operations. However, the problem is that without current real-time data, the decision maker cannot effectively prescribe a course of action. Data-driven decisions also include intangible assets (e.g. customer satisfaction, employee engagement and retention). MAs must ensure sufficient causal relationship between the inputs variables and the output variables in their models, for example, for the BSC where Big Data can identify new behaviours that influence respective goal outcomes or where employees’ satisfaction may correlate with the effectiveness of internal business processes.

![Diagram of a modulator and a mediator KPI](image)

**Figure 4: Example of a moderator and a mediator KPI**

In general terms, a moderator is a qualitative (e.g., race, class of employees or customers) or quantitative (e.g., level of internal reward or available income) variable that affects the direction and/or strength of the relation between an independent or predictor variable and a dependent or outcome variable. Specifically within a correlational analysis framework, a moderator is a ‘third’ variable that affects the zero-order correlation between two other variables. A moderator effect within a correlational framework may also be said to occur where the direction of the correlation changes (Baron and Kenny, 1986). The model in the left diagram in Figure 4 has four causal paths (a, b, c, and d) that feed into the outcome variable (O) of task performance: the impact of the noise intensity as predictors (Path a and b), the impact of controllability as a moderator (Path c), and the interaction or product of these two (Path d). The moderator hypothesis is supported if the interaction (Path d) is significant. There may also be significant main effects for the predictor and the moderator (Paths a, b and c), but these are not directly relevant conceptually to testing the moderator hypothesis. In general, a given variable may be said to function as a mediator to the extent that it accounts for the relation between the predictor and the outcome variable (Baron and Kenny, 1986). Mediators explain how for example an extra or hidden KPI may affect the outcome variable. The model in the right diagram of Figure 4 introduce a path diagram as a model that assumes a three-variable system such that there are two causal paths feeding into the outcome variable (O): the direct impact of the independent variable (Path c) and the impact of the mediator (Path b). There is also a path from the independent variable (P1) to the mediator (Path a) (ME1). A variable function as a mediator when it meets the following conditions: i) variations in levels of the independent variable significantly account for variations in the presumed mediator (i.e., Path c), ii) variations in the mediator significantly account for variations in the dependent variable (i.e., Path b), and, iii) when Paths a and b are controlled. A previously significant relation between the independent and dependent variables is no longer significant, with the strongest demonstration of mediation occurring when Path c is zero. In regard to the last condition we may envisage a continuum. When Path c is reduced to zero, we have strong evidence for a single, dominant mediator. If the residual Path c is not zero, this indicates the operation of multiple mediating factors.
Because many KPIs within performance measurement may have multiple causes, a more realistic goal may be to seek mediators that significantly decrease Path c rather than eliminating the relation between the independent and dependent variables altogether. From a theoretical perspective, a significant reduction demonstrates that a given mediator is indeed potent, albeit not both a necessary and a sufficient condition for an effect to occur. In general it becomes a complex and a coherent test to find out when such a model is a valid enough to be used for decisions. MAs must, also, be able to define different time perspectives for decisions, i.e. short-short, short, medium, long and long-long term objectives in companies, and to do so in the right combinations for key decisions and specifically for forecasts and predictions. Fact based decision is, however, only one of many different angels using different theories (see, e.g. Berry et al., 2009), even though that emphasis on solving real and relevant practical problems have been in front for several years now (e.g. by Groot and Selto, 2013; Johnson and Kaplan, 1987). This point has also been widely discussed in order to secure the impact on students and society (Ahrens and Chapman, 2007; Hopwood, 2002; Kaplan, 1998, 2011; Kasanen et al., 1993; Merchant, 2012). Birnberg (2009, p. 3) makes this very clear by saying: ‘At a time when practice is in need of assistance, our current focus has led to research that is primarily intended to enhance current models rather than assist in solving the problems of practice’. Experience has shown that making fact based decisions is hard work and assumes in fact a lot of talent and skills (Davenport and Harris, 2007; Silvestro, 2014). Not only statistics, but also measurement theory, will therefore be a key element and a prerequisite in order to make fact-based decisions (Micheli and Warwick, 2014). At the operational level this is often easier than at the strategic level (Fact based decisions; Tableau, 2012: ‘Decisions follow facts’). Strategic decision making tends to be very different and much more complicated: too many variables, too little structure, and too much uncertainty. Only certain directions are therefore often favored, from there different types of scenarios may be tested. Simchi-Levi (2014) mention two main types of research within the analytics approach. In problem-driven research, an academic or a decision maker identifies a problem and uses models and data to develop insights and possibly improvements for the company. In data-driven research, data from an organization are gathered before any specific model is developed; it is the academic’s or the decision maker’s careful analysis of the data that sheds light on possible opportunities to make improvements. MA, therefore, must be able to use more advanced model designs and thereby help drive productivity and profitability. And as pointed out in the literature above, an important assumption is that associations and relations are based on ‘real’ cause and effect relationships derived by ‘scientific methods’ (as mentioned in PWC, 2013) for example by using different statistics/econometric or multivariate techniques for selecting the best KPIs. When exploring the data, the MAs must be able to find patterns to determine whether something is directionally correct, which matters more than total accuracy.

- **Management accountants must focus on predictions and forecasts:** Besides, from being involved in traditional decision topics (e.g. improvements in cost and pricing), the MAs must be able to take forecasting and predictions into their decision areas. Both areas and techniques are mentioned several times in the analytics literature together with budgeting and planning as important ‘new’ topics for MAs. Forecast reports and dashboards are typically created using business intelligence tools. However, an alternative is that instead of trying to predict the future, organizations should try to strength to cope with uncertainty (see, e.g. Otley, 2012) for example by using scenario planning models (Schoemaker, 1995). The MAs must also be able to use advanced predictive analytics such as statistical modelling and data mining to predict risk events to assess emerging threats. Prediction and forecast have been specifically emphasised in a large part of the literature above, whereas the traditional budget has been tone down. Different types of planning and budgeting systems

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9If you brought 20 practicing scientists from different areas (sociologist, biologists, chemists or physicists) into a room and asked what real ‘causation’ was, they would all disagree. In this paper we think mostly of a ‘statistical’ association of two or more variables/KPIs to be related in a statistical/econometric context, if their values change so that as the value of one variable/KPI increases or decreases so does the value of the other variable/KPI (although it may be in the opposite direction).
and procedures have always been an important part of management accounting/control even though the topics, techniques and purposes have changed over the years (see, e.g., Libby and Lindsay, 2010; Østergren and Stensaker, 2011; Welsch et al., 1988). Some argue that the problems with traditional budgeting stem from the way budgets are used (Horngren et al., 2004) while others argue that budgeting processes are fundamentally flawed. Budgets have also become the subject of considerable criticism and debate with the purpose of promoting the idea of Beyond Budgeting (Bogsnes, 2009; Hope and Frazer, 2003). However, in the analytics environment, choosing and using the right KPIs as depending or independent variables presuppose that the data structure is aligned to the value drivers of the business and thus is able to facilitate effective decision making. The purpose of forecast is to be able to track the expected performance of the business (using probability statements) so that timely decisions can be taken to address shortfalls against target or to maximize an emerging opportunity (Makridakis et al., 1998). Prediction, on the other hand, is a statement or a plain hunch of future events based on present circumstances (Moridge and Player, 2013) such as using the present sales to predict how many customers will buy a new car and what the total profit will be (Davenport and Kim, 2013). Prediction is more related to predictive modelling, whereas forecast is more related to a specific object for example demand forecast for an activity or a specific object for specific customers (does not require analytics background). This is normally based on different time series techniques from econometrics. A simple use of forecast would be within the ABC concept – called Activities-based Budgeting (ABB) (see, e.g., Stevens, 2004) where the financial performance of an organization is driven by the sales forecast of products and services and where the consumption of these activities is linked to the sales forecast on the operational level. An example is shown below in Figure 5 (forecast errors by a time plot indicates if the forecasting could be improved – not shown here) together with an example for prediction analytics estimating net profit for the ABB-model.

![Figure 5: Example of forecast for an activity and net profit for a predictive ABC model](image)

Doing such analysis normally also imply that the decision maker gets a lot of other relevant information that can be used for future planning periods (e.g. reducing Std. Dev. or improving Skewness). To supplement a traditional budgeting and planning process with forecasts and prediction modelling as prescribed in the BA environment requires in-depth knowledge of how the areas are linked together (see, e.g. Gribbin et al., 1996 and Harrison et al., 2007; Kostakis et al., 2011).

- **Management accountants must focus on interactive modelling and a visualized reporting process:** Many data-driven decisions and results are within the domain of the MA, and must, therefore, also be interpreted and communicated by the MA. The MA has a pivotal role to play in helping the business translate new data insights to company value by using different visualization techniques. Rather than just presenting financial data and KPIs, the role of the MAs in an analytics setup could for example be to identify the options available to decision makers by analysing different datasets. In addition, by not only using historical data, but also Big Data,
the MAs can help organizations foresee and avoid risks and thus protect performance. The main goal for data and analytics is to improve decision making in a wide realm of activities, for example, as regards customer segmentation, pricing, costs, identifying new markets, managing supply chain risk, or improving operational effectiveness. Recent studies in accounting have also explored how the visual aspects of reporting have a ‘powerful’ role in data communication (e.g., Bhimani et al., 2012; Quattrone et al., 2016). The verbal link between numbers and word is important. In the analytics view, both concepts have been emphasized several times. Ideas, effects and possibilities must be presented in an interesting, understandable and effective way. These ways of presenting information are often a mixture of hard core information combined with explanations, arguments, and new directions. Often such presentations can be used interactively, meaning that the presenter can show the full effect immediately when, for example, a change in a variable is completed. Visualizations help people understand their data through data storytelling (importance of understanding events from beginning to end) and to share the human impact of numbers (Davenport and Kim, 2013). To gain advanced insight, the MAs also need to use data blending tasks such as parsing XML data to find and analyse, for example, part failure trends or spatial analytics to find and analyse customer behaviour by store. Two examples of visual analytics are shown in Figure 6.

Figure 6: Two examples of building a data discovery tool using methods for data preparation (Visual Analytics)
To the left Visual Machine Capacity Tracking, to the right a Facebook Performance Visual.

The two graphs contain both hard core data (numbers, time series data) and qualitative information, but most importantly also the assumptions (e.g. data management structure) underlying this information (it can be checked by double clicking on a specific piece of information in the outcome). The visualization requires that the decision maker has enough technical skills to make diagnostic analyses on the basis of the explorations of the data. Again, the accountants’ core skills put them at an advantage: telling the story of Big Data requires the ability to analyse it and to separate the essential from the marginal information (Capgemini, 2013). Presentation also assume that the decision maker is able to make powerful experimentation based on the data to optimize the decision. The most effective data experiments augment managerial intuition and exploit unique data.

Management accountants must focus on explicit skills used for business analytics: Skills and education have been mentioned and discussed in several of the papers above, without, being specifically clear about it. For example, within IT, business intelligence, data mining, and data management are mentioned briefly and within statistics, correlation and multiple regression have been mentioned. Vocational skills have always been important for management accountants (communication, presentations, and explanations of view and outcomes to colleagues, clients, and superiors for decision making as mentioned above) (Horngren et al., 2004;
However, traditional soft and hard skills have been debated for years (Collier et al., 2007; Francis and Minchinton, 1999; Howieson, 2003). However, when we look at business analytics topics, these ‘traditional’ approaches and levels (for both hard and soft skills) will probably be inadequate. If the MAs want to be part of the future for ‘analytics’ and want to secure their jobs for the future, they need to shape their professional identity and to focus on the necessary skills (or what Bhimani and Willcocks (2016) call ‘business skills’ and ‘data and information skills’) to do so or they run the risk of other professional groups take over. Hiring the best people is increasingly been recognized as a key to an organization’s successful analytics deployment (Davenport et al., 2010) which also includes MAs. So which specific skills are important for the MAs in the business analytics environment? This can be seen in an IMA report (2016a) that shows that the accounting profession is dealing with a significant shortage of both technical and nontechnical skills required for data analytics initiatives and showed in Figure 7.

![Image](image.png)

**Figure 7: Technical skills and the talent gap for management accountants**

Ref. IMA report (2016).

Also based on the literature review above, the MAs still need both hard and soft skills as it also shows in Figure 7. In general hard skills include IT skills (BI, database, data mining, and basic programming in for example, Python, R or SAS which are the three most popular languages in basic data science), but they also need a broad spectre of both general and more advanced quantitative skills within statistics and econometrics (from simple correlation and regression analysis to advance multiple and non-linear regression, different multivariable techniques such as discriminate analysis, canonical correlation and structural equation modelling (see e.g., Hair et al., 1998; Keller, 2012; Kmenta, 1986). Also dimensionality reduction techniques such as Principal Component Analysis, Factor Analysis, Principal Component Regression, Discriminant Analysis, Pattern Recognition, and Clustering will be relevant for selecting and mapping for example relevant KPIs for the BSC (see, e.g. Halper, 2014; Hastie et al., 2008; Procost and Fawcett, 2013). But the choice also depends on what analytical level the individual MA wants to be on. If the MA wants to stay on the basic descriptive level (i.e. gathering, organizing, and reporting history), then the skills proposed in the analytics literature are probably not necessary. But if the MA wants to move to the predictive or the prescriptive level, then new skills will be necessary. Or as said by Davenport and Kim (2013, p. 1) ‘everyone needs analytics skills’. Simulation and optimization on the prescriptive level will provide a powerful methodology for complex behaviours and decisions for the MA, but will also require relevant insight for building such models based on data as mentioned by Law and Kelton, (1991) and Simchi-Levi (2014). To construct such models in financial modelling is a complicated process and demands a lot of inside knowledge of the company, for example for activity-based costing, activity-based management, target costing, and life-cycle costing. Such models in a digitised environment would probably have to be redesigned (Bhimani and Willcoocks, 2014). As regards the IT-technical
skills, business intelligence is an important competence/requirement for MAs who are to transform raw data into meaningful and useful information for business analysis purposes, e.g. reporting, business performance management, and benchmarking (Accenture and MIT, 2015; MIT Sloan Management Review and SAS, 2016). BI was already discussed in a 2008 CIMA publication (Improving decision making in organizations – Unlocking business Intelligence) with focus on KPIs and performance management. BI metric-driven decisions can answer questions such as how many units did we sell last month, what was the total costs of order A for customer X last week, or what did our customers buy last year and how many ABC-capacity costs were used in department 1? Knowing that also means that the company can come up with new ideas and changes for the future (Chen et al., 2012; Desai et al., 2004; García, 2011). Today, BI is most effective when it combines external data derived from the market (e.g. by using different macro statistics metrics or different buying behaviour metrics) in which a company operates. This combination of different KPIs creates an ‘intelligence’ that cannot be derived by any single set of data, and it therefore, creates the biggest competitive advance. Data mining marks a very important progression from descriptive analytics to predictive and prescriptive analytics. Common data mining methods include cluster analyses, decision trees, different algorithms, association rule learning, regression analyses, sequence mining, anomaly detection, and online analytical processing (OLAP), but also more advanced tools such as interactive and boosted trees, machine learning, and independent components analyses (Nisbet et al., 2009). However, for the MAs who wants to work with decision making on the advanced analytics level, advanced IT and econometrics skills are a ‘must’ because the biggest competitive advantage that companies can realize for their customers is when math is applied in new ways to solve specific challenges or opportunities within their business (Lustig et al., 2010). As said by McAfee and Brynjolfsson (2012, p. 63); ‘Using big data enables managers to decide on the basis of evidence rather than intuition. For that reason it has the potential to revolutionize management’. Research from the Sloan School of Management also shows that companies that use ‘data-directed decision making’ achieve a 5-6% boost in productivity (Brynjolfsson et al., 2011). Even though the advanced techniques are in the hands of data science, management accountants should be familiar with the techniques. In big companies, the MAs will work together with other groups if they are to play a bigger role in driving commercial value out of data, for example, IT people, in helping capturing and extracting data from the company’s IT systems; with specialist data scientists and statisticians who need help to ask the right questions to be able to interpret cost accounting insights and patterns; and with other managers across the business to help ensure that data is gathered and interpreted properly to provide a holistic view of the business. In smaller companies the MAs will probably do many of these tasks by themselves or use consultants, but the important supposition for doing this is that the MAs understand the fundamental assumption for a decision no matter whether (s)he is part of the core analytics data team or not. For example could a decision maker come up with a lot of correlations when working with data, but these could be entirely random or what is called spurious correlations. If the MA does not understand what is really meaningful for the decision and is able to establish a holistic causal relationship between the relevant KPIs, it could develop into a disaster. Finally, in the analytics movement, the job market has also developed new categories of both statisticians and data scientists (e.g., those whose strength is within econometrics and those whose strength is within mathematics), but also in the case of data scientists (those who are strong in business analytics, e.g., estimating different KPIs, optimization, and decision sciences), Granville (2014). Many of these new specialists will be involved in tasks, and decisions traditionally performed by MAs (dashboards design, cost model design, metric mix selection and metric definitions, and planning). Therefore, new group of professionals are ready to take over. As already shown in other fields such as operations management and logistics (see, e.g. Liberatore and Luo, 2010) a future scenario for different types of management accounting/accountants analytics professionals will probably appear depending on the level (i.e. descriptive, predictive or prescriptive) on which the accountant wants to work. To be able to make decisions in the BA environment the MA must be able to
explain in detail what techniques are used, their assumptions, and what it means for the organization and the people involved. Or as LaValle et al. (2010, p. 1) express it:

Knowing what happened and why it happened is no longer adequate. Organizations need to know what is happening now, what is likely to happen next and what actions should be taken to get the optimal results.

These five syntheses tell us what the literature above has told us about the implications for management accounting/accountants in the analytics movement. It is evident from the discussion above that the analytics movement will have profound implications for the management accountant professionals and their practice in the future. Figure 8 represents the five spaces relevant for MA in a BA environment.

Figure 8: The figure depicts the five key implications for management accounting in Business Analytics

Even though these key implications are separated, they are all interrelated and depending on each other through different levels of IT-systems and software applications. This means that changes and decisions can be made or changed at a high speed, if necessary. The traditional sequences for a decision within management accounting normally goes from goal formulation, implementation, evaluation and feedback (see e.g., Drury 2004, p. 9 or Groot and Selto, 2013, p. 78ff). The time delays between these tasks will probably be reduced or disappear.

4 Conclusion, implications and limitations

No doubt that the finance and accounting function – including the management accounting people - will be deeply affected by the advent of the digital technologies. In the future, business analytics with its variety of techniques to handle large quantities of data will pervade most traditional accounting fields and decisions such as e.g., product mix, make-or-buy, profitability, outsourcing, planning and budgeting, assignment of costs, and pricing at the operational as well as at the strategic level. In business analytics, data will be an intangible asset on an equal footing with personnel, machinery and buildings. But whether you are talking about big or small data or conventional analytics, communication, intuition and creativity will also have important roles to play. One might even say that developing the right mix of intuition and data-driven analysis is the ultimate key to success within this movement. Neither an all-intuition nor an all-analytics approach will get you to the promised land.

Dynamic and stochastic performance, optimization, value creation, and fact based decisions, and reporting through visualization are examples of concepts and tools that the MA has to be acquainted with in order to be able to live up to the companies’ more advanced expectations in adding value to the company. MAs probably already have part
of these skills. But the important point now is that the level for these skills must be adjusted to what level the individual MA wants to be on; i.e. on a descriptive, on a diagnostic, on a predictive, or on a prescriptive level.

In BA environments simple test and modelling approaches will be replaced by more holistic, quantitative and in many ways complex models of different types and dimensions which will enable the decision maker to test even small changes for a single or a few input variables to see the effect for the final result for the company.

There are several limitations of this paper that need to be addressed. First, the literature and conclusions are primarily based on relatively few primary studies and on secondary empirical studies from professional consultancies. However, where the primary studies are mostly based on speculation and anecdotes – the empirical studies from the consultant companies – are confirmed through large empirical and global surveys. Using a different theoretical model may lead to different results and conclusions.

From the methodology point of view, more empirical studies are therefore needed in order to go deeper into some of the specific element in the new analytics environment for the decision field of the MA. One such element could be how data are transformed into knowledge and decisions. Another element could how Big Data influences the company’s strategy and, thereby, creates challenges to ‘established rules of strategy making’ (see, e.g. Bhimani, 2015).

Second, the impact of business intelligence, data mining, and Big Data technologies on management accounting and the MA is illustrated mainly using simple business and technology points of view meaning that the influence on the organisation – and how the structure of the organisation is designed – is not discussed here (e.g. contingency and cognitive factors). With business analytics, for example, it could be assumed that the management’s operational tasks will be minimized or that the management style will be more in line with ‘diagnostic control’ (Simons, 1995) and that the analysts will be a technocratic power group within the company.

A field of particular interest is what is now called ‘visualization research’ (see, e.g. Schneider et al., 2015). This denotes the process of representing data graphically and the interaction with these representations in order to gain insight into the data structure. Modern visualization research addresses the problem of converting data into compelling, revealing, and interactive graphics that suit users’ and decision makers’ needs. An example of the role of data visualization and analytics in management accounting and performance management can be seen in Kokina et al., (2017), using a sample of actual customer, order, and revenue data to map business problems with analytical techniques such as regression, decision trees, and clustering in order to prioritize activities and manage the growth the company has experienced to date.

Finally, all five key elements in Figure 8 are interesting and relevant subjects for future research. These key elements would secure that both subjects but also the methodology would be in front of what companies really need and therefore also a relevant road for researchers to make impact on both society, organizations, and secure that the management accounting students get relevant skills. Something that have been discussed for years now.
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