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Exploring the Value of Business Analytics Solutions for SMEs

Robert Goebel
IBM Germany, rgoebel@ibm.de.com

Alistair Norman
University of Leeds, an@lubs.leeds.ac.uk

Stan Karanasios
University of Leeds, S.Karanasios@lubs.leeds.ac.uk

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Robert Goebel, IBM, Germany, rgoebel@de.ibm.com

Alistair Norman, AIMTech Research Centre , a.w.t.norman@lubs.leeds.ac.uk

Stan Karanasios, AIMTech Research Centre, s.karanasios@leeds.ac.uk

Abstract

There is an increasing recognition of the need for organisations to make effective use of the information which is available to them, that sources of information have expanded hugely and that analytics offers organisations the possibility of insights which could not otherwise be obtained. Sophisticated analytics, however, have been seen as the preserve of large organisations but is this is, potentially, changing. In this paper we have explored the potential value of business analytics solutions in the specific case of smaller organisations and we have highlighted how such organisations may start to drive value from such analytic tools.

Keywords: Business intelligence, business analytics, SME analytics capability

Introduction

How do small to medium-sized enterprises (SMEs), as the backbone for growth and success of any economy (Doherty et al. 2013), utilise information technology (IT) potential to drive their strategic development? A BCG study from 2010 concluded *"SMEs have historically been the hidden engine of many national economies, but they have not necessarily operated on the 'bleeding edge' of technology"* (Kalapesi et al. 2010, p. 24). In addition to the importance of SMEs to an economy, the OECD stated that information technology "is having a fundamental impact on the way economies work and on the global allocation of resources, contributing to productivity growth by expanding market, increasing business efficiency and reinforcing competitive pressure" (OECD 2008, p. 5). The question arises; which are important technologies to apply? Three headlines from Harvard Business Review "*Analytics 3.0*" (Davenport 2009); "*Big Data: The Management Revolution*" (McAfee & Brynjolfsson 2012); *"Data Scientist: The Sexiest Job of the 21st Century"* (Davenport & Patil 2012) show the emphasis HBR as a management and business magazine places on BA. BA refers to IT technologies that enable analysing of ever more data, and creating new and valuable insights that have not been possible before. But for SMEs these often "mystical" seeming analytics use cases that fill business journals and advertising are more of "a concept that continues to strike fear and anxiety into the hearts of many SMEs" (Symes 2014). But what does lead to the conception among SMEs that analytics tools *"are too expensive and unnecessary"* (Symes 2014)? What are the barriers for SMEs to use them and how can their value be ensured in an SME environment?

Background and research question

In the last twenty years we have seen several eras of BA. What started with enterprise resource planning systems, complicated and hard to implement, has led to easily deliverable and deployable solutions that can analyse diverse data extremely fast. The benefits and value which these solutions can create are unquestionable.

In order to take advantage of the value BA can bring to an organisation, it is necessary to have funds to build the systems, human resources to deploy and use them and enough data to analyse. Therefore, cloud computing created totally new possibilities that can decrease the cost of system integration and deployment. Big data technologies enable companies to enrich their internal data with external data. Consequently, these advances helped *"to level the playing field, giving SMEs access to larger markets through cost-effective […] tools once available only to large companies"* (Kalapesi et al. 2010).

This study addresses the question, "How can SMEs maximise value from BA Solutions?". The main objective of this study is to analyse the value that BA can provide for medium sized enterprises. Therefore we have identified barriers and facilitators for BA adoption through a series of interview with C-Level managers of medium-sized businesses. This paper is based on work undertaken by the lead author as a Masters dissertation.

Literature Review

The literature review focuses on the evolution of BA, as well as BA from a technological and managerial point of view. It explores how information systems and information technology in general, and BA tools specifically, create value in organisations. Because of the contemporary nature of the theme, the review covers industry as well as academic literature.

Evolution from BA 1.0 to 3.0

While the term BI was already popular in the 1990's in business and IT communities (Chen et al. 2012), the term BA was introduced by Davenport (2006) who used it to illustrate the analytical key component of BI. Recently the term big data has been introduced to illustrate the demands and advantages that huge datasets can add. In 2009 Davenport introduced the term "Analytics 3.0" to describe a new era where "*not just information firms and online companies […] can create products and services from analyses of data*" (Davenport 2009, p. 67). Chen et al. (2012) used the same numbering from BA 1.0 to 3.0 to describe its evolution. Figure 1 below describes the general characteristics of the three different evolutional steps of BA.

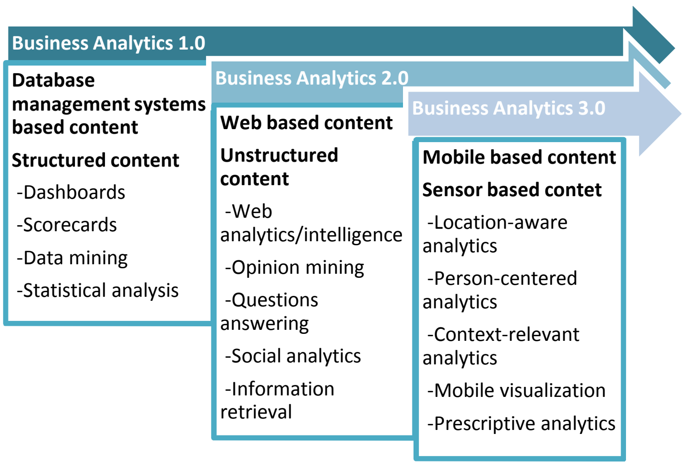

Figure 1: BA Evolution and Characteristics

Source: adapted from Chen et al. 2012

Business Analytics 1.0

With roots in database management, BA is initially based on data collection, extraction and analysis technologies (Chaudhuri et al. 2011; Turban et al. 2008). The current industry standard in BA tools can be considered as BA 1.0, in which the majority of data is structured, collected by companies themselves and stored in database management systems (Chen et al. 2009). Davenport (2009, p. 66) described the era of BA 1.0 as "*a time of real progress in gaining an objective, deep understanding of important business phenomena and giving managers the fact based comprehension to go beyond intuition when making decisions*". In Gartner's current Hype Cycle (Schlegel 2013), BA 1.0 technologies are displayed far on the right in the "*plateau of productivity area*", which means that "*benefits of the technology are demonstrated and accepted*" (Schlegel 2013, p. 63).

Business Analytics 2.0

In the early 2000s, the rise of the internet began to offer new data collection and analytics opportunities (Chen et al. 2012), which led to the new era of BA 2.0. The fundamental difference to the BA 1.0 era is that data is not only sourced within an organisations' internal data sources, but also externally, coming from different types of web content (Davenport 2012). Besides the web search engines (Google, Yahoo) and e-commerce businesses (Amazon, eBay), user-generated content on social platforms and user specific data from cookies have boosted analytics of web-based unstructured content (Doan et al. 2011; Chen et al. 2012; O'Reilly 2005). This enabled organisations to understand the web as a conversational tool between businesses and customers, consequently changing their marketing approach towards user specific communication (Lusch et al. 2010). In order to be able to use this valuable data, innovative technologies had to be created, which were quite different to those needed for BA 1.0. To account for the different technologies needed to deal with large datasets, Gartner also introduced a dedicated "Hype Cycle for Big Data" in 2013 (Schlegel 2013; Heudecker 2013).

Business Analytics 3.0

During the BA 2.0 era companies used analytics to support customer-facing products, services and features by analysing customer specific data (Davenport 2012). These pioneer companies were primarily online and information technology businesses; the BA 3.0 era meant that other large organisations in different industries started to follow suit by collecting highly varied data. Davenport (2012, p. 67) notes that "*if your company makes things, moves things, consumes things, or works with customers, you have increasing amounts of data on those activities*". This data can consequently be used in new ways; increasing production capacity, decreasing product or material failure, increasing information transparency and crucially to include analysed data into every business decision made. Two trends driving BA 3.0 are mobility and "*the internet of things*" (Chen et al. 2012).

In 2011, Mobile BI was introduced as a core capability into Gartner's "Hype Cycle for BI and Analytics Systems" (Bitterer, 2011), predicting that it has the potential to revolutionise the BI market. In Figure 2, the current Gartner "Hype Cycle for Business Intelligence and Analytics" (Schlegel 2013) is overlayed with a categorisation of the technologies into the BA eras.

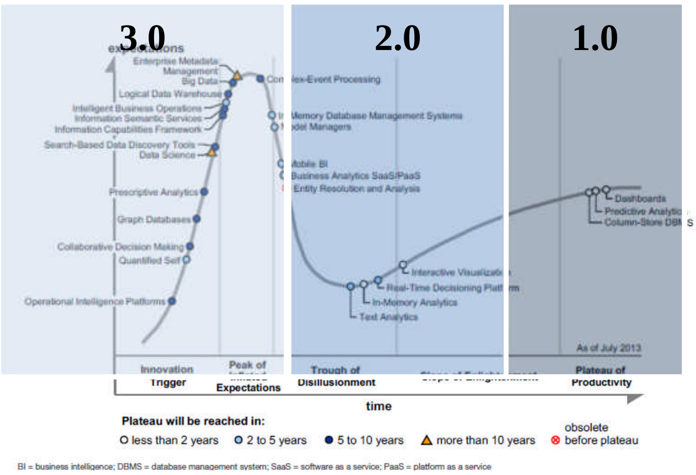

Figure 2: Hype Cycle for BI and Analytics incl. BA era

Source: Schlegel (2013)

Categorisation of Business Analytics

The basis of this categorization is adapted from Banerjee et al. (2013) and Chen et al. (2012), while the description of each category is based on additional publications and analyst reports (Sallam et al. 2014; Schlegel 2013; Davenport 2009; Kumar et al. 2013; Sinha et al. 2012; Sahay & Ranjan 2008).

Types of Analytics

Different types of analytics distinguish what is being done with the data analysed, ranging from simple descriptive statistics to logical reasoning and action-taking about data. Depending on the outcome of analytics, Sallam et al. (2014) defined them as descriptive, diagnostic, predictive or prescriptive (Table 4).

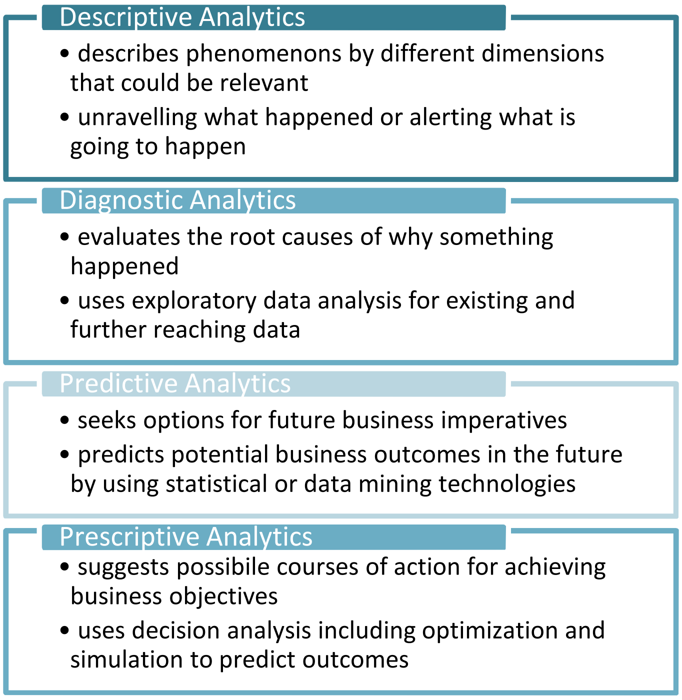

Table 1: Types of analytics

Source: adapted from Banerjee et al. (2013)

From descriptive to prescriptive analytics, there is a progression in terms of business value and sophistication (Figure 3). Banerjee et al. (2013, p. 1) state that "*in today's market much of this analysis is predictive in nature, although elements of descriptive analysis are not uncommon*". Nevertheless, the core analytical activities in many organisations are based in the lower left square of figure 3 (Banerjee et al. 2013). The analytical activities in the upper-right square can be described as 'advanced analytics'.

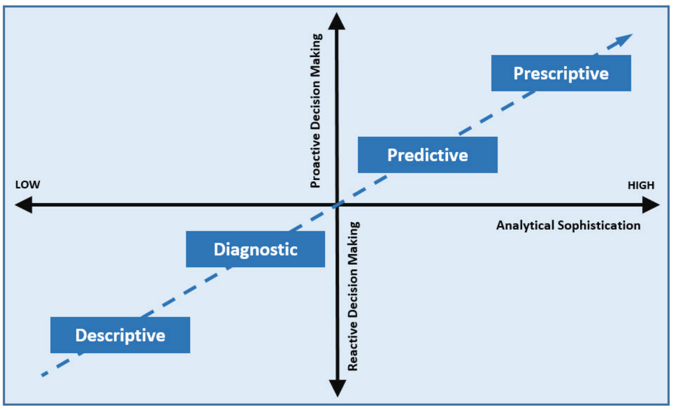

Figure 3: Analytics in Decision making

Source: adapted from Banerjee et al. (2013)

Technical Areas of BA

Apart from the previous categorisation, Chen et al. (2012) defined five critical technical areas of BA; (big) data analytics, text analytics, mobile analytics, network analytics and web analytics. Each of these can contribute to each of the BA eras (1.0-3.0) as well as to each of the categories defined in the previous section.

(Big) Data Analytics

The term (big) data analytics refers to technologies based on data mining and statistical analysis (Chen et al. 2013). Such technologies of relational RDBMS (relational database management systems), data warehousing, ETL (Extract-Transform-Load), OLAP (online analytic processing) and BPM (business performance management) are now mature techniques that form the basis for data analytics (Chaudhuri et al. 2011). The emergence of the "internet of things" in the BA 3.0 era introduced process mining (van der Aalst 2012). In order to take advantage of large amounts of unstructured data, the development of new storage options was necessary to enable ad-hoc extraction, parsing, processing and indexing, from a database (Chen et al. 2013). The solution has been the MapReduce platform, which enabled large scale, massively parallel data access (Patterson 2008) or Hadoop (Chen et al. 2013, p. 1175).

Text Analytics

The roots of text analytics are in information retrieval and computational linguistics (Chen et al. 2013), which enable the use of unstructured textual data in organisations, the web and social media. Information retrieval technologies have become the basis for modern search engines, digital libraries and enterprise search systems (Salton 1989). The bases for computational linguistics are statistical natural language processing (NLP) techniques (Manning & Schütze 1999).

With the BA 2.0 era, the need to leverage big data analytics has led to the development of new text analytics techniques, including information extraction, topic models, question answering and opinion mining (Chen et al. 2013).

Web Analytics

Web analytics have become increasingly important with the maturity and increasing popularity of web services and web 2.0 systems (O'Reilly 2005). While web analytics is generally based on the techniques of big data analytics and text analytics, it encompasses unique analytical challenges (Chen et al. 2013). Web services, based on

XML and internet protocols (HTTP, SMTP), and application programming interfaces (APIs) enable a rich stream of new data sources for web analytics.

Another major development facilitator is cloud computing, enabling companies to use applications, software and hardware delivered as services over the internet (Chen et al. 2013).

Network Analytics

In network analytics the aim is to identify network properties and relationships, especially in different social networks. Its background lies in bibliometric analysis, where citation and authorship networks have been analysed to understand scientific impact and knowledge diffusion (Chen et al. 2013). Today, link mining and community detection are important techniques of network analytics. (Chen et al. 2013).

Value Facilitators of IS/IT Systems

To examine what previous research has revealed on how IT, and BA systems specifically, create value for organisation we focus on two key models (Borek et al. 2011; Wixom et al. 2011), complemented with previous research and studies.

IS/IT Systems Value

In order to create a framework, which increases the value of BA, it is essential to understand how BA creates business value. Therefore, information has to be understood as a resource and IT as the primary technology used to manage information (Eaton et al. 1988). Research into IS/IT systems and their value for organisations shows (Borek et al. 2011) BA should be understood as a technique to increase the value of IS/IT tools, by collecting, managing and analysing more data, and creating insights that were not possible before.

Understanding how IS/IT systems are influencing organisational performance has been an enduring research focus (Melville et al. 2004). Borek et al. (2011) (Table 2) reviewed existing concepts and interrelated them in order to explain the components that build business value out of IS/IT systems.

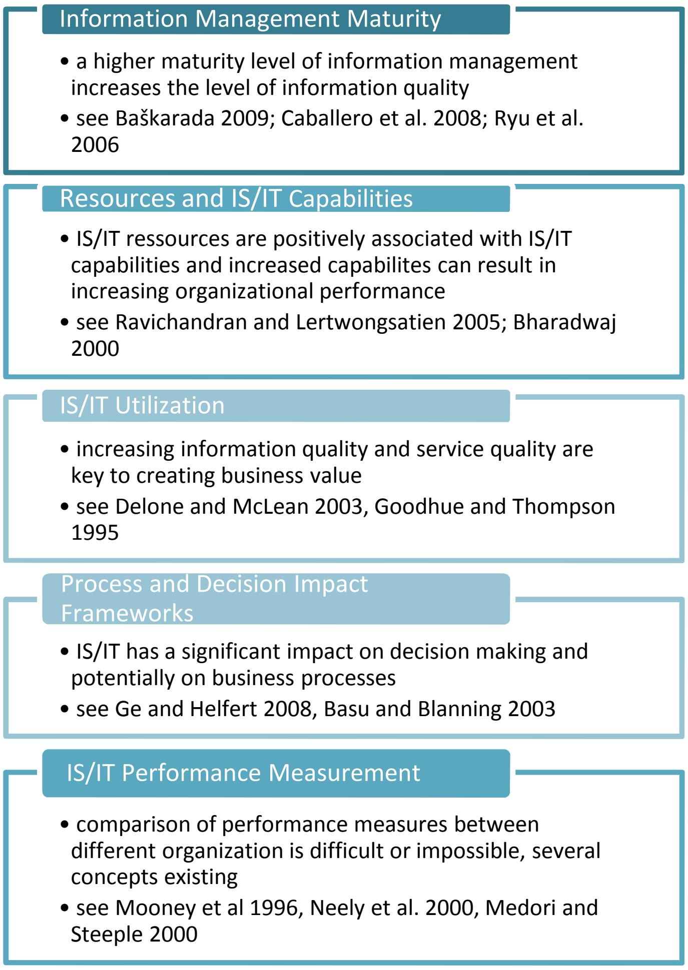

Table 2: IS/IT business value concepts   Source: Borek et al (2011)

On the basis of this Borek et al. (2011 p. 363) derived four key relationships describing the value creation of IS/IT systems:

1. IS/IT resources and complementary organisational resources influence IS/IT capabilities.
2. IS/IT capabilities have an impact on IS/IT utilisation.
3. IS/IT utilisation affects business processes and decision making.
4. These effects are visible in the short-term in the form of financials and other performance measures; in the long-term on competitive advantage.

To illustrate these relationships in the broader context of the existing research concepts, Borek et al. (2011) created an “information related framework”.

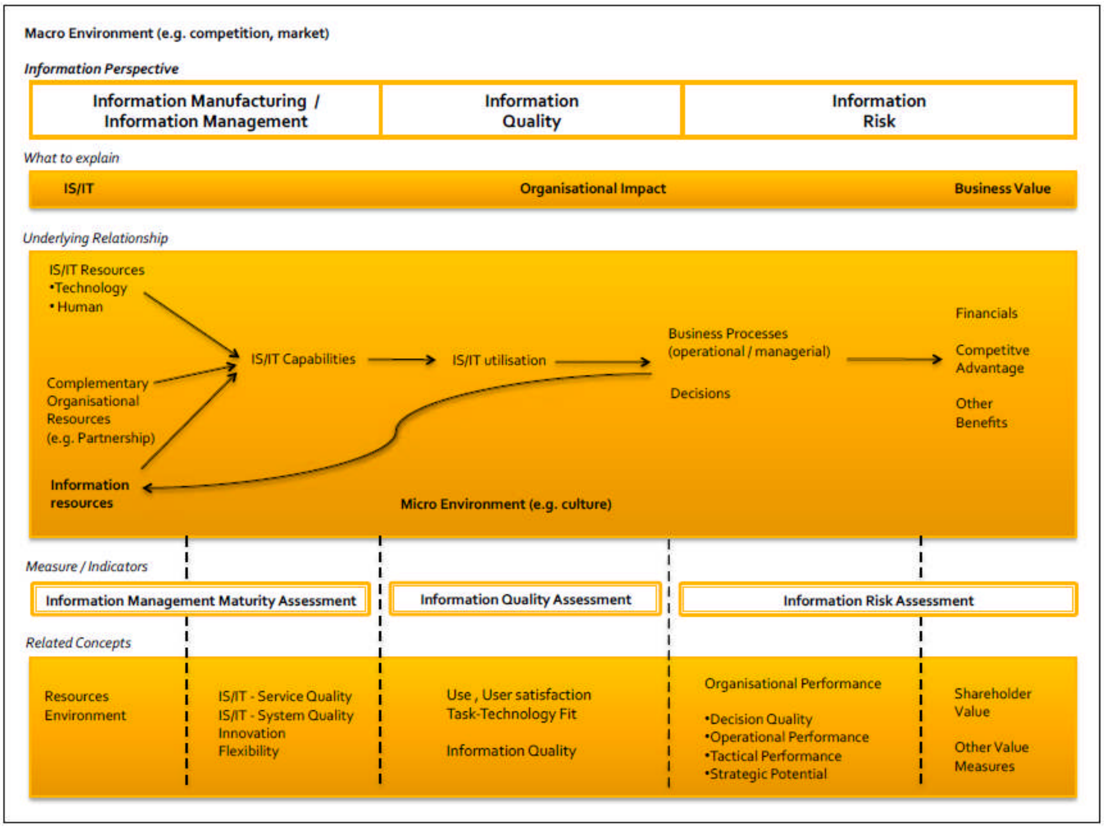

Figure 4: Framework for IS/IT business value Source: Borek et al. (2011)

The framework highlights that IS/IT and organisational resources are the basis for gaining value out of information resources. Its emphasis is that the inputs and outputs of IS/IT systems are always information and can consequently be compared to a manufacturing process (Ballou et al. 1998). This explains the significance the model has to the value of BA in organisations; enhancing IS/IT capabilities and utilisation ultimately leads to value creation, hence the potential of BA to increase business value (Borek et al. 2011).

Business Analytics Value

Given the many publications highlighting the potential of BA (Davenport 2009; Davenport et al. 2012; McAfee & Brynjolfsson 2012; Jourdan et al. 2008), potential value is clear. Nevertheless, research has struggled to define a general way of estimating the value or ROI of BA tools in organisations, making a case-by-case investigation necessary. Specific case studies do exist, mainly of big multinational organisations like Continental Airlines, which was estimated to have achieved an ROI of 1000% (Watson et al. 2006).

Apart from the possibility of a framework for measuring value and ROI several studies have examined how organisations can increase the value of BA (Wixom et al. 2013; White & Rowe 2012; Lock 2014; Deng & Chi 2012). These have a distinct focus on the user who is gaining, and working with, the analytical insights. Nevertheless, driven by the rapid development of cloud offerings, recent studies also focus on the delivery model of the BA solution.

To explore how BA tools are delivering business value, Wixom et al. (2011) defined the "Enterprise Business Analytics Capabilities Model".

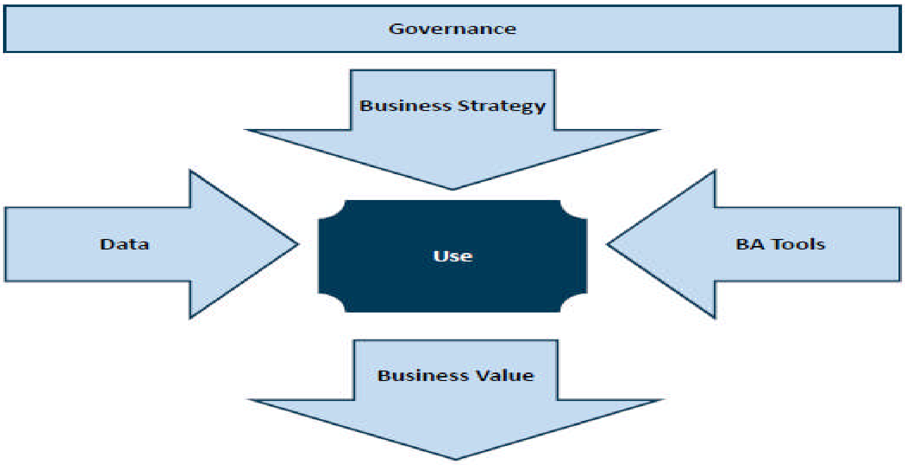

Figure 5: Enterprise BA Capabilities Model

Source: Wixom et al. (2011)

As the model shows, besides BA tools and sufficient data to analyse, it is important to have an aligned business strategy, incorporating the use and measurement of these tools (Wixom et al. 2011)., The model emphasises that ensuring the final use of the analytical insight is key to creating business value. Building on this, Wixom et al. (2013) defined two main themes which facilitate use. These themes are "speed to insight" and "pervasive use" and Wixom et al. (2013) also identified three facilitating practices for each.

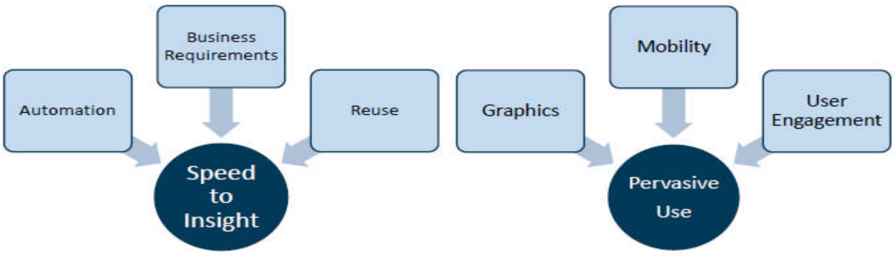

Figure 6: Drivers of Speed to Insight and Pervasive Use

Source: Wixom et al. (2013)

Speed to Insight

To increase speed to insight, the first driver is to automate the incorporation of new data sources into an organisation's data infrastructure. By defining standards for this process, the quality of data can be ensured, enabling faster usage (Wixom et al. 2013). White & Rowe's (2012) study suggests "that best-in-class" companies enable parallel processing for data integration and user access during re-indexing. Furthermore, leaders are using data integration techniques like data virtualization or replication to ensure quality and increase speed of data integration (White & Rowe 2012).

Definition of business requirements is the second driver. Lock (2014) found that 70% of best-in-class companies have clearly defined and frequently measured KPIs for their analytical capabilities. Measuring the right things from the right perspective is essential to drive speed to insight. In order to do so, Wixom et al. (2013) suggest that collaboration between business users and development teams helps to identify business requirements faster. Lock (2014, p. 9) explains that *"when you combine IT know-how with business expertise in a collaborative and iterative way, you create a much more effective decision environment"*.

With reuse, Wixom et al. (2013) suggests that companies should use predefined best practices of experienced organisations, including data services, design catalogues and parameterised reporting.

Pervasive Use

As drivers for pervasive use, Wixom et al. (2013) defined graphics, mobility and user engagement. These aim to increase the number of people using BA tools and consequently increase its value. Therefore, graphics, dashboards and interactive visualisations help to attract users and are generally part of the key capabilities of BA platforms (Schlegel et al. 2013). Mobility, as one of the distinguishing technologies of the BA 3.0 era (Chen et al. 2013) and another key BA platform capability defined by Gartner (Schlegel et al. 2013), is another possibility to engage more users with BA systems. Portability, ease of access, increased productivity, instant decision making and more frequent analyses are key benefits of enabling BA tools on mobile devices (Wixom et al. 2013).

Further studies (Lock 2014; White & Rowe 2012) found that user engagement is also essential for driving pervasive use, and companies which enable self-service analytics are most successful in creating value out of BA tools (White & Rowe 2012). Additionally, Wixom et al. (2013) highlighted self-service approaches as a way of promoting user engagement and also suggested gamification (incentives for use) and collaboration techniques.

While all these approaches try to increase user satisfaction, Deng & Chi (2012) used a field study to identify use problems of BI systems, which in turn lower user satisfaction and hinder efficient and extensive use; they found that the user's lack of knowledge was, in 55% of the cases, the root cause for use problems (Deng & Chi 2012). As a consequence of that, gradually increasing system knowledge of users and constantly upholding their satisfaction with the system are essential for value creation of BA systems.

Software as a Service as Key Enabler

Cost of deployment continues to be the key limiting factor for many organisations, as *"designing, building, installing and running a data warehouse for data analytics has traditionally been too costly to undertake on a consistent and profitable basis"* (Thompson 2009, p. 50). Nevertheless, recent technological developments (Thompson 2009) have contributed to outsourcing the cost intensive integration of advanced data warehouses and delivery of analytical applications. This is software as a service (SaaS) which Gartner (ND) defines as:

"Software that is owned, delivered and managed remotely by one or more providers. The provider delivers software […] that is consumed in a one-to-many model by all contracted customers at any time on a pay-for-use basis or as a subscription based on use metrics."

This stands to benefit SMEs, as it eliminates a high initial investment, and reduces ongoing resources needed, enabling SMEs to keep pace with technological progress (Thompson 2009). While SaaS only delivers the application used for analytical tasks, Business Process as a Service (BPaaS) goes further by delivering complete automated business processes as a service via a cloud environment. Practically, the difference for analytical tools would mean that BPaaS would deliver complete analytical insight while SaaS would enable the user to analyse data and extract the important insights themselves. As with general IT outsourcing, this should enable companies to focus on their core competencies and reduce cost of IT services (Seddon et al. 2007). This marks an important point; as soon as BA counts as one of the core competencies of an organisation, it should not be outsourced, in order to maintain competitive advantage (Quinn 1999).

Lock (2014) explored the advantages of analytics tools delivered over SaaS and identified that companies using cloud BA tools make them more widespread in their organisations, supporting pervasiveness of use. This also concluded that the use of cloud BA tools increases self-sufficiency for users and as well as easier mobile integration. Thus, for SMEs, using SaaS to integrate BA tools into their business is an important driver to facilitate their adoption, and maximise their value.

SME Characteristics

The definition of SMEs employed follows the European Union definition of companies with fewer than 250 employees, 50 million Euro turnover or 43 million Euro balance sheet (European Commission., 2015). Unlike big MNCs, SMEs have a scarcity of resources including finance, skills or equipment (McLaughlin 2014a), and face challenges in adopting new technologies (Burgess et al., 2009; Poon & Swatman, 1999), while facing the same global competitive environment. The significance of SMEs ability to remain competitive in today’s economy (Rosenberg 2012) and contribute to development is apparent if we consider that “*the number of SMEs dwarf, by an extremely large percentage, the number of large firms in developed and developing economies*”(Pett and Wolff 2012, p. 48). Therefore, SMEs are challenged to build and maintain customer relationships and loyalty (PWC 2013), to execute effective budget management, manage change (McLaughlin 2014b) and to acquire the right talent and capabilities (PWC 2013, McLaughlin 2014b). McLaughlin (2012, p. 4) argues that “*for those organisations that are determined to succeed in this hypercompetitive and dynamic market, the need to better sense and respond to market forces becomes a survival imperative*”.

Considering the advances in IT, effectively utilising IT capabilities can help SMEs to overcome such challenges and help them overcome traditional market barriers and create new opportunities (Karanasios & Burgess, 2008 ;Doherty et al. 2013) "*to gain a dominant position against well-known and established organisations*" (McLaughlin 2012, p. 1).

SMEs also have advantages compared to large companies, including, better ability to adapt to change due to their size and flexibility (Samitas & Kenourgios, 2005) (Gunasekaran 2011) as well as innovativeness and resilience facing fierce competition (Salavou et al. 2004). Nevertheless, larger firms can market products more cheaply (Gunasekaran 2011) and have the budget and ability to build deeper IT capabilities and acquire more talent (Doherty et al. 2013). Consequently, SMEs are more dependent on improved co-operation among themselves, which can be supported through IT (Doherty et al. 2013).

Although IT can help overcome the challenges SMEs face in terms of IT, SMEs are recognised as being inherently different (Street and Meister 2004) from bigger companies and, thus, face different IT business challenges. Doherty et al. (2013) highlighted the key IT business challenges of SMEs and reported the top challenges as (1) improving business processes; (2) improving information/knowledge management; (3) delivery of IT services and solutions; (4) improving IT planning; (5) risk, data protection, compliance; (6) IT cost and budget management; (7) improving IT business management; (8) selecting, resourcing and managing IT; (9) managing tensions between innovation and operations; (10) improving alignment between business and IT units. The identified challenges show that improving business processes, and information/knowledge management are critical. Among the top 10 identified IT business challenges, many are related to internal day-to-day management and operational issues, which highlights the perceived importance of IT for SMEs. In addition, the concept of information as a resource for IS/IT systems (Borek et al. 2011) highlighted that BA has the potential to support SMEs in most of the identified key IT business challenges.

Research methodology

Research Philosophy

The study employed an interpretive approach, using activity theory as a conceptual framework. The interpretive approach "*adopt[s] the position that our knowledge of reality is a social construction by human actors*" (Walsham, 1995, p. 376). In contrast to positivist approaches, where the researcher assumes that collected "objective" data can be tested towards prior theoretic hypotheses made, the interpretive approach accepts that no "value-free" data can be collected as the researcher always includes their preconceptions (Walsham, 1995). It has been argued that interpretivism is best suited to studying IS in organisational contexts (Orlikowski & Baroudi, 1991).

To structure our study we adopted activity theory as our conceptual framework. Activity theory is a conceptual framework for inquiry into human activity consisting of a set of basic principles which can help explain certain phenomenon (Karanasios, 2014; Karanasios & Allen, 2013; Karanasios & Allen, 2014), in particular issues concerning mediation (Allen et al., 2013; Kuutti, 1991). The activity theoretic perspective argues that the human mind can only be understood in the context of its interactions with the world, which are socially and culturally determined (Engeström 1999). Interactions between an individual and the objects of its environment take place in a system (an activity system), which is mediated by cultural tools, defined by rules and norms around it and influenced by others actors involved as well as their defined roles and responsibilities (Engestrom, 1987). Engeström (1987) built on Leont'ev's notion of activity and developed a model of activity, the activity system, as illustrated in Figure 7. Referred to as the root model of human activity, the activity system posits that a subject (an individual, or group) acts upon an object (such as a person or thing) and does so using mental (skills, language etc.) and physical tools (IT etc.). The activity takes places against a backdrop of cultural historical rules and norms which influence the activity, a community which is connected to the activity and a division of labour which contributes to the outcome of the activity. In our study the object-oriented activity is taken as the prime unit of analysis (Engeström, 2001), as understood through the perspective of the SME manager.

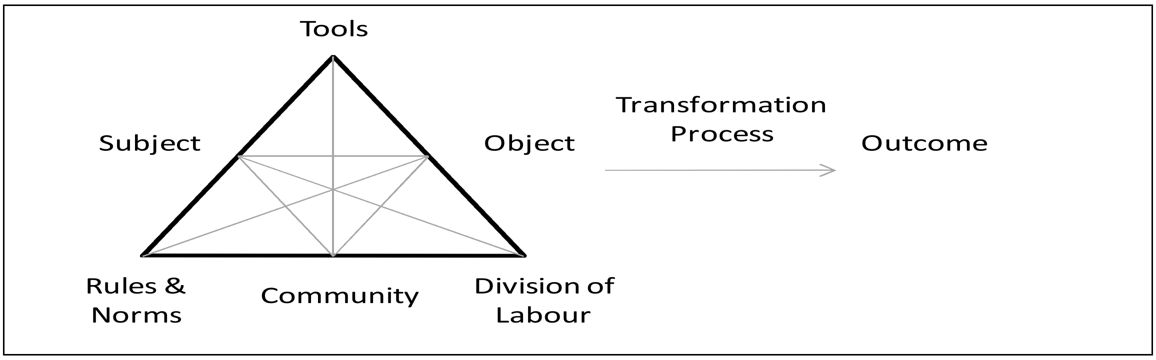

Figure 7: Engeström's (1987 p. 78) activity system

Data collection

Selection of the study subjects

In order to illuminate the research question the study targeted CEOs and Chief Manager Officers (CMO) of SMEs, as it was expected that they would provide an overarching understanding of how BI creates value. The study took place in Germany. A sample of 50 SMEs were contacted, interviewees were identified initially through existing contacts and then through the snowball sampling technique. Such an approach was necessary because it was necessary to engage the CEO/CMO, which is not possible through publicly available email addresses and telephone numbers. In total ten SMEs agreed to participate in the study. While the sample size is small, it is sufficient for exploratory study; it also merits mentioning that most qualitative SME studies rely on small samples and there is a general difficulty in obtaining access to senior managers in SMEs. Eight interviews were conducted face-to-face, however, because of logistical issues two were completed via telephone. Table 3 summarises the SME details.

Pseudonym	No. of employees	Location	Business area
SME1	56	Dresden	Sales agency for telecommunication products
SME2	81	Dresden	Marketing agency focused on marketing logistics services
SME3	12	Freital	Installation of heating systems and sanitary installations

SME4	5	Berlin	Estate agents
SME5	61	Idstein	Marketing agency
SME6	15	Sieghartskirchen (AT)	Farmer supplies and trading of crops
SME7	105	Frankfurt	Digital marketing agency
SME8	23	Frankfurt	Door and window supplier
SME9	50	Neu-Isenburg	IT service provider
SME10	124	Frankfurt	Manufacturer of carbon parts

Table 3: SME profiles

Instrument preparation and analysis

Kaptelinin et al.'s (1999) 'activity checklist' was adopted to structure the data collection. While the checklist's main focus is on design and evaluation of IS, Kaptelinin et al, (1999) suggest it can be used in other contexts where technology is the focus. In particular we focus on four key aspects: (i) *Means and ends*: the technology and how it affords or constrains the attainment of users' goals and the ability of technology to resolve or aggravate contradctions; (ii) *Social and physical aspects of the environment*: intergration of technology with the extant tools, resources, and environment rules and norms; (iii) *Learning, cognition and articulation*: transforming internal and exteranl components of the activty and supporting their transformations by the target technology; and, (iv) *Developmental*: developmental transoformation of the actiivity as a whole.

In addition to these four areas, we adapted Kaptelinin et al.'s sample interview questions, with Wixom et al.'s (2011) and Borek et al.'s (2011) components of BA capabilities and organisational value. In particular the themes of the questions focused on how the tools were being used, the value perception of the current tools, and the obstacles to using BA systems.

After each interview, the results were analysed and translated into codes, enabling the analysis to inform following interviews. The interviews were undertaken and scripted in German and later translated to English for data analysis; quotations are translated from German into English.

Results and Analysis

The analysis will give an overview of the results and explain how key value facilitators and further patterns have been deduced.

Interview Analysis

Altogether, analysis of the interviews drawing on the themes identified in the question set, which in turn drew on Activity Theory to frame the data collection and guide question set development, resulted in a total of 50 codes, which have the following frequency distribution.

Frequency of code in interviews	Number of codes
More than 7 times	11
5 to 7 times	8
2 to 4 times	21
once	10

Table 4: Code frequency

Table 4 shows that the interviews yielded 19 codes, which can be valued as well grounded (frequency at least five), 21 which are relatively grounded (frequency of two to four) and 10 which are not sufficiently grounded. Table 5 shows the 11 most grounded codes together with total occurrences.

Code	Total frequency
Collaborative sharing of data creates value	11
Increase in speed/efficiency creates value	10
Outsource (non-core competency) analytics tasks increases value	10
Advanced Analytics increase value	10
Costs discourage from improving systems	9
Excel most used for analytical tasks	9
Critical Mass needed	9
SaaS substantiates value	9
System integration increases value	8
Current tools not delivering potential analytical value	8
Increasing tool functionality step by step maximises value	8

Table 5: Well-grounded codes including frequency

What is directly apparent is the prominence of codes describing how value could be increased or created out of tools (7 out of 11 codes), including the four most grounded codes. Also, the list includes the codes *'costs discourage from improving systems'* and '*critical mass needed'*('critical mass' referred to users, not data)., which are particularly important to understand the high frequency of the code '*current tools not delivering potential analytical value'*. The high occurrence of '*advanced analytics creates value'* in the interviews supports this assumption.

Another important point made throughout the interviews, is that analytics delivered as a service (SaaS), is perceived as a valuable option to SMEs. In addition to that, the code '*maximised value would ease investment decision'* forms another influential trigger for SMEs to improve their analytical capabilities. KPIs for analytical tools have been mentioned five times, but they were strategically defined only once.

Throughout the analysis process, it was important to establish higher codes of order, to extract patterns out of the qualitative analysis. One prominent group has been the '*value facilitators'* including 17 codes, of which eight were well grounded with an occurrence above four. Apart from that, *'value preventers'* is another higher code of order, including five codes of which four are well grounded. As four codes were about SaaS and its value and benefits to SMEs, these form a specific higher code. Finally, two important groups include codes that show the barriers for SMEs to increase analytical capabilities and codes which could help overcoming these barriers. Altogether, 28 out of 50 codes could be placed in a higher code of order.

Comparing the interview results with previous studies and research, the influence of SaaS to SMEs was highlighted by White (2013) who found that organizations using SaaS get analytics into the hands of more employees and reach ROI 40% faster. This statement is complemented by a similar study by Lock (2014, p. 2), who wrote that "analytics in the cloud generally touts three areas of benefit: ubiquity, agility and user satisfaction". Another interesting correlation is that Lock (2014) also highlighted the importance of strategically well-aligned KPIs for organisations, showing another potential area of value improvement for SMEs.

Network View of Results

The following figure focuses on the current value preventers, explaining their background by creating a network view that logically connects different codes out of the analysis.

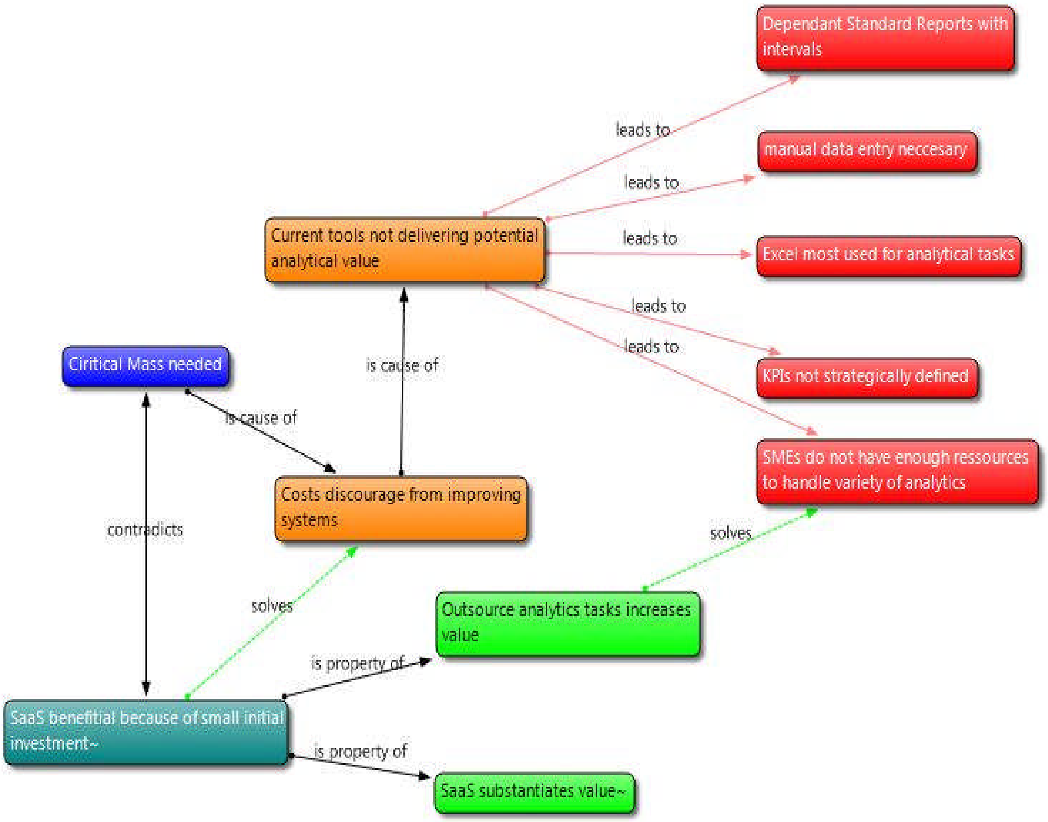

Figure 8: Network view value preventers

All interviewees cited the lack of a 'critical mass' as one of the main reasons to have not adopted better analytical tools. Most of them also connected that statement with the costs of improving their systems. The combination of these led to the assessments that nearly all SMEs perceived their tools as not delivering the potential value that could have been reached through analytical tools. As above, SaaS contradicts the statement that a critical mass is needed, since pay per-use or user models are common (Weinhardt et al. 2009) and a smaller initial investment is required. Consequently, SaaS offers a way of eliminating the value preventers by overcoming the two root causes, critical mass and costs. The second network view looks at the same root causes, using the value facilitators to offer another way of overcoming them.

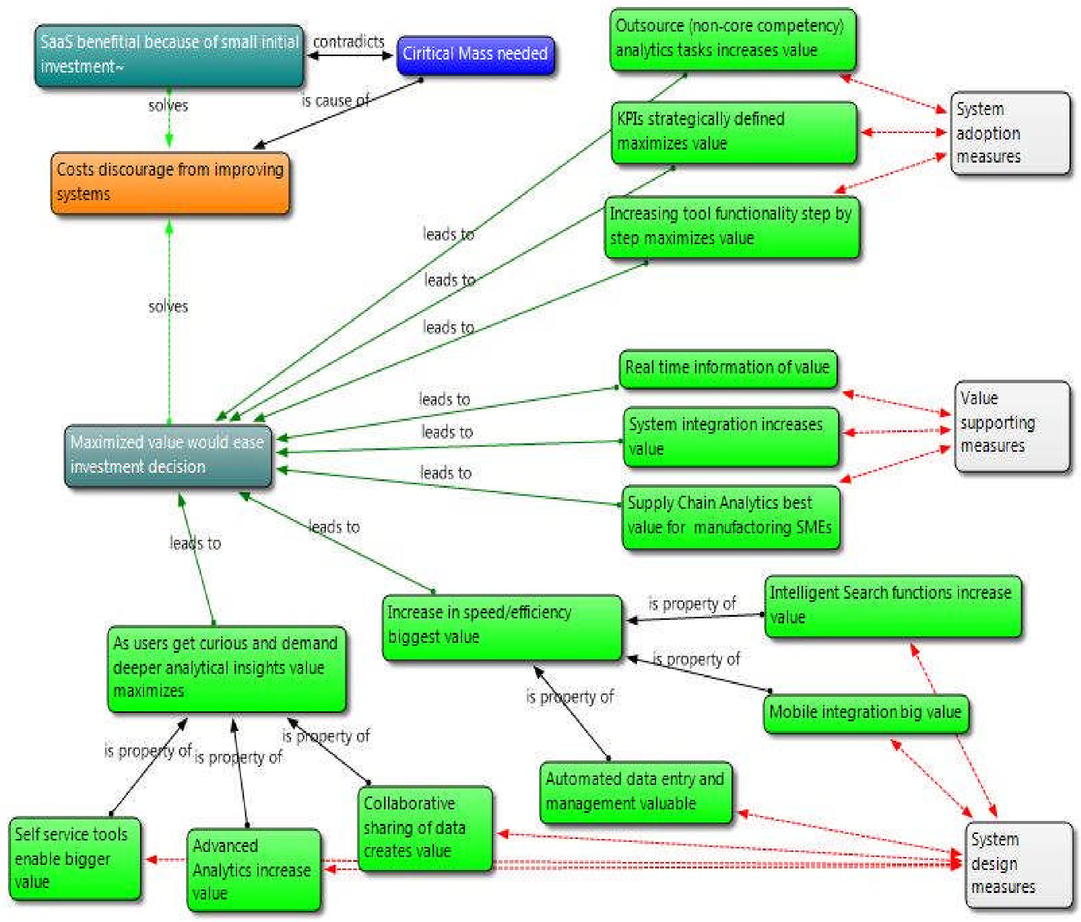

Figure 9: Network view value facilitators

Besides SaaS, *'maximizing value would ease investment decision'* is another confirmed implication out of the analysis, which could help overcoming the reluctance of SMEs to invest into analytical systems. Such measures can be broken down into different groups, which are 'system adoption measures', 'value supporting measures' and 'system design measures'. System adoption measures describe the most value delivering measures when adopting a system. The system design measures describe the most value creating features a system should deliver, hence increasing speed and efficiency in the organisation. Finally, value supporting measures display value increasing measures that can be selectively integrated into a system, depending on the type of organisation and its individual demands.

Consequently, the network views offer a causal explanation of what is necessary for SMEs to maximise analytical value and will be the basis for the framework in the conclusion.

Conclusion

SME Analytics Business Value Framework

In order to illustrate the process of value creation, the following framework (Figure 10) is based on the general principles of Borek et al's (2011) integrated framework for IS/IT business value from an information perspective. Its central parts are capabilities and utilisation, which in accordance with the business strategy should lead to a competitive advantage and consequently to value maximisation for the business.

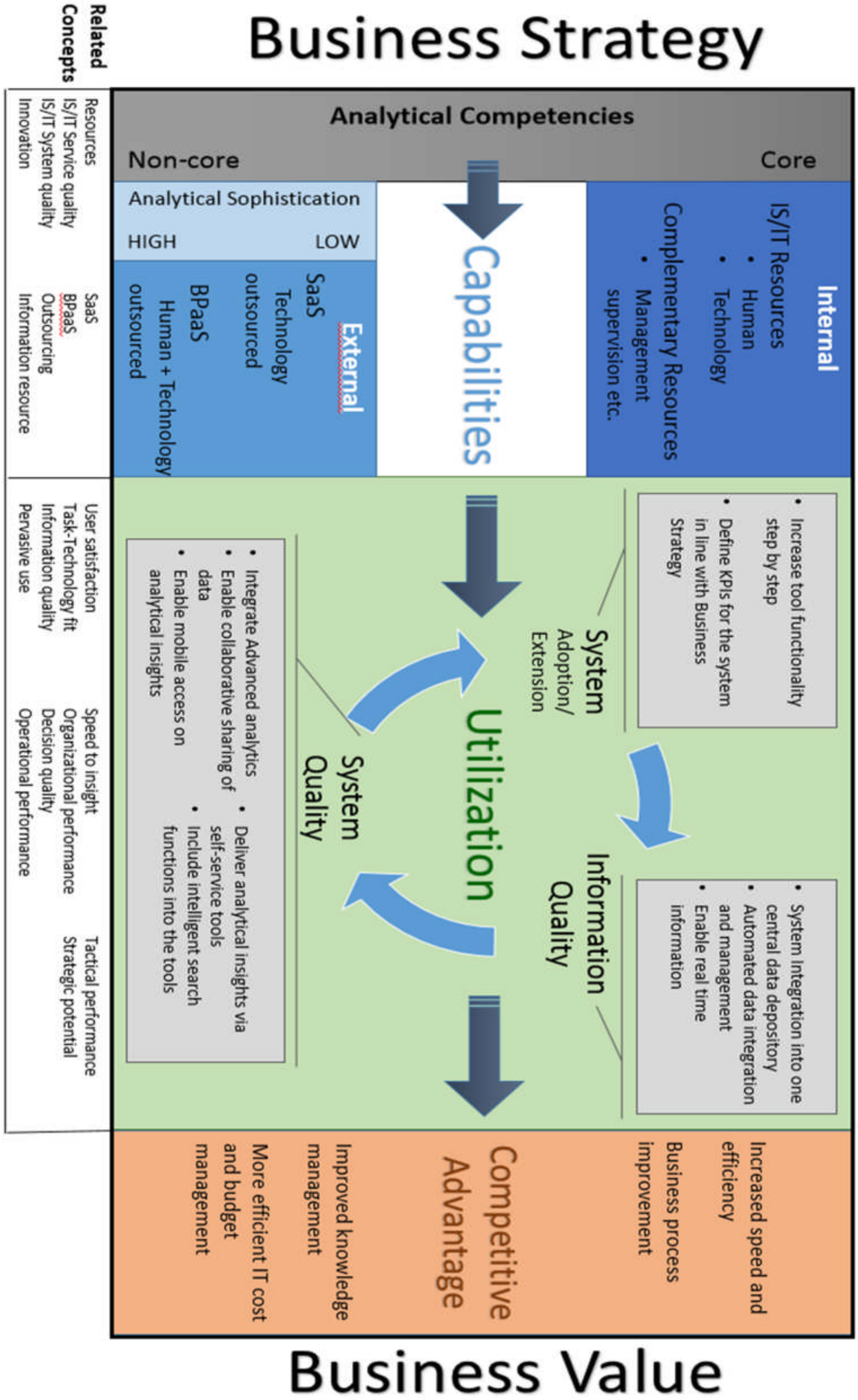

Figure 10: SME Analytics business value framework. Adapted from Borek (2011)

Borek et al. (2011) explained in his model, that one of the basic requirements for IS/IT systems to create value is the availability of sufficient resources. With the scarcity of resources SMEs face (McLaughlin 2014a), it is essential to offer them a way of starting to get involved into more analytical processes. Building the capabilities for analytical insights is the first part illustrated in the model, which suggest that analytical competencies of an SME should determine how to build these capabilities.

While SaaS and BPaaS enable SMEs to focus on their core competencies and reduce cost of IT (Seddon et al. 2007), the strategic importance of a decision to outsource knowledge capabilities has to be carefully considered (Quinn 1999). Therefore, the SME analytics framework encourages SMEs to first evaluate their own strategy and analytical competencies towards a decision to use SaaS and BPaaS for analytical tools. As in a general outsourcing strategy (Quinn 1999), the model suggests only considering SaaS or BPaaS if the analytical competencies are not part of the core competencies of the SME.

As soon as such a decision is taken, the sophistication of analytical tasks of the given SME should determine if SaaS or BPaaS is most valuable. The distinguishing factor for that is which resources are needed to turn the externally gained analytical capabilities into business value for the given SME. One interviewee, CEO of a marketing services company, provided an example of BPaaS being the most valuable choice: *"(…) today, many SMEs have only very small marketing teams which simply do not have the capacity and knowledge to analyse complicated analytical insights"*.

After the capabilities, the model focuses on their utilisation, and explains why and how system adoption, information quality and system quality relate to it. In order to increase utilisation to maximize business value (Borek et al. 2011), the technology functionality of the available capabilities needs to "*match task requirements and individual abilities*" (Goodhue 1995, p.1829). To make sure this is the case, the analysis and previous literature (Lock 2014, Wixom et al 2011) have shown that it is important to define desired KPIs, which support the organisations business strategy, at an early stage. Moreover, a careful system adoption has to be executed, which includes allowing users to gradually adapt to the system and to explore its value step by step. This is essential to build up user satisfaction from the beginning and increase trust in the system, which in turn leads to higher utilisation (Delone & McLean 1992; Wieder et al. 2012).

As DeLone & McLean (1992) explained, information quality and system quality are further elements that increase utilisation. In order to increase these elements in an SME environment, the analysis showed that automated data entry and management as well as real time information are effective. White & Rowe (2012), as well as this analysis, showed that system integration into a central data depository increases information quality.

As one interviewed CEO, experienced with analytical tool integration, explained: *"The values of analytics tools increases as the users understand their value and automatically come to ask for deeper insights"*. This highlights why information quality and system quality have to be ensured. Out of the analysis and previous research (White & Rowe 2012, Lock 2014, White & Rowe 2012, Wixom et al. 2011, Wieder et al. 2012) the framework suggests five features of a system that potentially maximise analytics value most for SMEs. Banerjee et al. (2013; see figure 3) as well as the analysis have pointed out that increasing the analytical sophistication to advanced increases information quality and enables proactive decision making.

Another system design measure identified is to enable mobile access for users of the analytical tools, as especially sales forces and services employees often need insights on the go. As most SMEs cannot afford to have in-house departments that design and deliver insights to employees, self-service analytics is another important system design concept. Apart from the influence of resources, self-service analytics have proven to be key to successful analytics (White & Rowe 2012).

In order to complete the continuous circle of ensuring high utilisation, further system extension is essential as the demand for valuable deeper insights grows. System extension in this case refers to increasing the data resources and the technology that analyses them. Therefore, it is essential to continuously ensure information quality and system quality, in order to keep user satisfaction high.

Finally, the framework highlights that analytics bear the potential to solve many of the key IT SME challenges identified by Doherty et al. (2013; chapter 2.4.). This underpins the validity and capability of the framework to favour SMEs in building competitive advantages.

Concluding Remarks

Returning to the statement that SMEs *"have not necessarily operated on the 'bleeding edge' of technology"* (Kapalesi et al 2010, p. 24) this study confirms this in terms of analytical tools. The study also highlights the potential that analytics have for SMEs. The data showed why SMEs did not engage further with analytics tools, even though they collectively perceived them to have massive potential value.

The SME analytics business value framework connects SMEs business challenges with the IS/IT business value concept. By integrating a continuous circle of system utilisation measures that ensure value focused system adoption, information quality, system design and system extension, the framework offers a way of step by step developing tools for valuable insights. Focusing on the most valuable system design measures eases SMEs ROI expectations by keeping system feature costs down.

The study suggests that analytics has the potential to help solve many of the SME-specific business challenges in today's world. It therefore recommends perceiving analytics as a possible source of building competitive advantages, which should not be omitted in SMEs strategy building.

References

Allen, D. K., Brown, A., Karanasios, S., & Norman, A. (2013). How should technology-mediated organizational change be explained? A comparison of the contributions of critical realism and activity theory. *MIS Quarterly, 37*(3), 835-854

Ballou, D., Wang, R., Pazer, H. and Tayi, G.K. (1998), "Modeling Information Manufacturing Systems to Determine Information Product Quality", Management Science, Vol. 44 No. 4, pp. 462–484.

Banerjee, A., Bandyopadhyay, T. and Acharya, P. (2014), "Data Analytics: Hyped Up Aspirations or True Potential?", Vikalpa: The Journal for Decision Makers, Vol. 38 No. 4, pp. 1–11.

Bitterer A (2011), Hype Cycle for Business Intelligence, Gartner, Stamford, CT.

Blei, D.M. (2012), "Probabilistic Topic Models", Communications of the ACM, Vol. 55 No. 4, pp. 77–84.

Blumberg, B., Cooper, D.R. and Schindler, P.S. (2011), Business research methods, 3. European ed., McGraw-Hill Education, London [u.a.].

Borek, A., Helfert, M., Ge, M. and Parlikad, A.K. (2011), "An Information Oriented Framework for Relating IS/IT Resources and Business Value", ICEIS, Vol. 4, pp. 358–367.

Burgess, S., Sellitto, C., & Karanasios, S. (2009). Effective Web Presence Solutions for Small Businesses: Strategies and Successful Implementation: IGI Global.

Chaudhuri, S., Dayal, U. and Narasayya, V. (2011), "An Overview of Business Intelligence Technology", Communications of the ACM, Vol. 54 No. 8, pp. 88–98.

Chen, H. (2009), "AI, E-Government, and Politics 2.0", IEEE Intelligent Systems, Vol. 26 No. 5, pp. 64–67.

Chen, H., Chiang, R.H.L. and Storey, V.C. (2012), "Business Intelligence and Analytics: from Big Data to Big Impact", MIS Quarterly, Vol. 36 No. 4, pp. 1165–1188.

Davenport, T.H. (2006), "Competing on Analytics", Harvard Business Review, Vol. 84 No. 1, pp. 98–107.

Davenport, T.H. (2009), "Analytics 3.0. In the new era, big data will power consumer products and services.", Harvard Business Review, Vol. 91 No. 12, pp. 64–72.

Davenport, T.H. and Patil, D. (2012), "Data Scientist: The Sexiest Job of the 21st Century", Harvard Business Review, Vol. 90 No. 10, pp. 70–76.

DeLone, W.H. and McLean, E.R. (2003), "The DeLone and McLean Model of Information Systems Success: A Ten-Year Update", Journal of Management Information Systems, Vol. 19 No. 4, pp. 9–30.

Deng, X. and Chi, L. (2012), "Understanding Postadoptive Behaviors in Information Systems Use: A Longitudinal Analysis of System Use Problems in the Business Intelligence Context", Journal of Management Information Systems, Vol. 29 No. 3, pp. 291–326.

Doan, A., Ramakrishnan, R. and Halevy, A.Y. (2011), "Crowd-sourcing Systems on the World-Wide Web", Communications of the ACM, Vol. 54 No. 4, pp. 86–96.

Doherty, E., Carcary, M., Downey, U. and McLaughlin, S. (2013), "Enhancing IT Capability Maturity – Development of an SME Framework to Maximize the Value Gained from IT. Executive Briefing", available at: https://ivi.nuim.ie/professional-publications (accessed 11 August 2014).

Engeström, Y. (1987). Learning by Expanding: An Activity-Theoretical Approach to Developmental Research. Helsinki: Orienta-Konsultit.

Engeström, Y. (2001). Expansive Learning at Work: Toward an Activity Theoretical Reconceptualization. Journal of Education and Work, *14*(1), 133-156.

European Commission. (2015). What is an SME? Retrieved January 9, 2015, from http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-definition/index_en.htm

Fuller, T. (2000). Will small become beautiful? Futures, 32(1), 79-89.

Goodhue, D.L. and Thompson, R.L. (1995), "Task-Technology Fit and Individual Performance", MIS Quarterly, Vol. 19 No. 2, pp. 213–236.

Gunasekaran, A., Rai, B.K. and Griffin, M. (2011), "Resilience and competitiveness of small and medium size enterprises: an empirical research", International Journal of Production Research, Vol. 49 No. 18, pp. 5489–5509.

Heudecker Nick (2013), Hype Cycle for Big Data, Gartner, Stamford, CT (accessed 30 May 2014).

Jourdan, Z., Rainer, R.K. and Marshall, T.E. (2008), "Business Intelligence: An Analysis of the Literature 1", Information Systems Management, Vol. 25 No. 2, pp. 121–131.

Kalapesi, C, Willensdorf,S and Zwillenberg,P (2010) The connected kingdom: how the internet is transforming the UK economy. Boston Consulting Group.

Kaptelinin, V., Nardi, B.A. and Macaulay, C. (1999), "Methods & tools: The activity checklist: a tool for representing the "space" of context", interactions, Vol. 6 No. 4, pp. 27–39.

Karanasios, S., & Allen, D. (2013). ICT for development in the context of the closure of Chernobyl nuclear power plant: an activity theory perspective. *Information Systems Journal, 23*(4), 287-306. doi: 10.1111/isj.12011

Karanasios, S. (2014). Framing ICT4D research using activity theory: A match between the ICT4D field and theory? . *Information Technologies & International Development, 10*(2), 1-17.

Karanasios, S., & Allen, D. (2014). Mobile Technology in Mobile Work: Contradictions and Congruencies in Activity Systems. *European Journal of Information Systems, 23*(5), 529-542. doi: 10.1057/ejis.2014.20

Karanasios, S., & Burgess, S. (2008). Tourism and Internet adoption: a developing world perspective. *International Journal of Tourism Research, 10*(2), 169-182.

Kumar, V., Bhaskaran, V., Mirchandani, R. and Shah, M. (2013), “Creating a Measurable Social Media Marketing Strategy: Increasing the Value and ROI of Intangibles and Tangibles for Hokey Pokey”, Marketing Science, Vol. 32 No. 2, pp. 194–212.

Kuutti, K. (1991). The concept of activity as a basic unit of analysis for CSCW research. In L. Bannon, M. Robinson & K. Schmidt (Eds.), *Proceedings of the Second European Conference on Computer-Supported Cooperative Work ECSCW ’91* (pp. 249-264): Springer Netherlands.

Kuutti, K. (1991), “Activity Theory and its applications in information systems research and design”, in Nissen, H.-E., Klein, H. and Hirschheim, R. (Eds.), Information Systems Research Arena of the 90's, Elsevier, Amsterdam.

Lock, M. (2014), Cloud Analytics in 2014: Infusing the Workforce with Insight, Aberdeen Group, Boston, MA (accessed 16 June 2014).

Lusch, R.F., Liu, Y. and Chen, Y. (2010), “The Phase Transition of Markets and Organizations: The New Intelligence and Entrepreneurial Frontier”, IEEE Intelligent Systems, Vol. 25 No. 1, pp. 71–75.

Manning, C.D. and Schütze, H. (1999), Foundations of Statistical Natural Language Processing, The MIT Press, Cambridge, MA.

McAfee, A. and Brynjolfsson, E. (2012), “Big Data: The Management Revolution. (Cover Story)”, Harvard Business Review, Vol. 90 No. 10, pp. 60–68.

McLaughlin, S. (2014a), “Building Capability – An Imperative for SME Competitive Advantage. Executive Briefing”, available at: https://ivi.nuim.ie/professional-publications (accessed 11 August 2014).

McLaughlin, S. (2014b), “Driving SME Transformative Change: Leveraging the SME IT-CMF. Executive Briefing”, available at: https://ivi.nuim.ie/professional-publications (accessed 11 August 2014).

McLaughlin, S. (2012), “Positioning the IT-CMF: A Capability versus Process Perspective. Executive Briefing”, available at: https://ivi.nuim.ie/professional-publications (accessed 11 August 2014).

Melville, N., Kraemer, K. and Gurbaxani, V. (2004), “Review: Information Technology and Organizational Performance: An Integrative Model of IT Business Value”, Vol. 28 No. 2, pp. 283–322.

OECD (2008), “Broadband and the Economy”, OECD Digital Economy Papers; No. 146.

O'Reilly, T. (2005), “What Is Web 2.0. Design Patterns and Business Models for the Next Generation of Software”, available at: http://oreilly.com/web2/archive/what-is-web-20.html.

Orlikowski, W. and Baroudi, J. (1991), “Studying Information Technology in Organizations: Research Approaches and Assumptions”, Information Systems Research, Vol. 2 No. 1, pp. 1–8.

Patterson, D.A. (2008), “Technical Perspective: The Data Center Is The Computer. January 2008/Vol. 51, No 1”, Communications of the ACM, Vol. 51 No. 1, p. 105.

Pett, T.L., Wolff, J.A. and Perry, J.T. (2010), “Information technology competency in SMEs: an examination in the context of firm performance”, International Journal of Information Technology and Management, Vol. 9 No. 4, p. 404.

Poon, S., & Swatman, P. M. C. (1999). An exploratory study of small business Internet commerce issues. Information & Management, 35(1), 9-18.

PWC (2012), “Dealing with disruption: Adapting to survive and thrive, 16th Annual Global CEO Survey”, available at: http://www.pwc.com/gx/en/ceo-survey/2013/index.jhtml (accessed 10 July 2014).

Quinn, J.B. (1999), “Strategic Outsourcing: Leveraging Knowledge Capabilities”, MIT Sloan Management Review, Vol. 40 No. 4.

Rosenberg, J.M. (2012), “5 issues facing small businesses in 2013”, available at: http://www.nbcnews.com/business/economy/5-issues-facing-small-businesses-2013-f1C7660251 (accessed 5 July 2014).

Sahay, B.S. and Ranjan, J. (2008), “Real time business intelligence in supply chain analytics”, Information Management & Computer Security, Vol. 16 No. 1, pp. 28–48.

Salavou, H., Baltas, G. and Lioukas, S. (2004), “Organisational innovation in SMEs: The importance of strategic orientation and competitive structure”, European Journal of Marketing, Vol. 38 No. 9/10, pp. 1091–1112.

Sallam, R.L., Tapadinhas, J., Parenteau, J., Yuen, D. and Hostmann, B. (2014), Magic Quadrant for Business Intelligence and Analytics Platforms, Gartner, Stamford, CT (accessed 30 April 2014).

Samitas, A. G., & Kenourgios, D. F. (2005). Entrepreneurship, small and medium size business markets and European economic integration. *Journal of Policy Modeling, 27*, 363-374.

Schlegel Kurt (2013), Hype Cycle for Business Intelligence and Analytics, Gartner, Stamford, CT (accessed 29 April 2014).

Seddon, P.B., Cullen, S. and Willcocks, L.P. (2007), “Does Domberger's theory of 'The Contracting Organization' explain why organizations outsource IT and the levels of satisfaction achieved?”, European Journal of Information Systems, Vol. 16 No. 3, pp. 237–253.

Sinha, V., Subramanian, K.S., Bhattacharya, S. and Chaudhuri, K. (2012), “The contemporary framework of social media analytics as an emerging tool for behaviour informatics, HR analytics and business process” Journal of Contemporary Management Issues, Vol. 17 No. 2, pp. 65–84.

Street, C.T. and Meister, D.B. (2004), “Small Business Growth and Internal Transparency: The Role of Information Systems”, MIS Quarterly, Vol. 28 No. 3, pp. 473–506.

Symes, R. (2014), “Why SMEs need analytics: The rise of the quantified enterprise.”, available at: http://realbusiness.co.uk/article/25882-why-smes-need-analytics-the-rise-of-the-quantified-enterprise.

Thompson, J.K. (2009), “Business Intelligence in a SaaS Environment”, Business Intelligence Journal, Vol. 14 No. 4, pp. 50–55.

Turban, E., Sharda, R., Aronson, J.E. and King, D. (2008), Business Intelligence: A Managerial Approach, Pearson/Prentice-Hall, Boston.

Walsham, G. (1995), “The Emergence of Interpretivism in IS Research.”, Information Systems Research, Vol. 6 No. 4, pp. 376–394.

Watson, H.J., Wixom, B.H., Hoffer, J.A., Anderson-Lehman, R. and Reynolds, A.M. (2006), “Real-Time Business Intelligence: Best Practices at Continental Airlines”, Information Systems Management, Vol. 23 No. 1, pp. 7–18.

Weinhardt, C., Anandasivam, A., Blau, B. and Stößer, J. (2009), “Business Models in the Service World”, IT Pro - IEEE Computer Society, pp. 36–41.

White, D. (2013), “Software-as-as-Service Analytics: Scale Your Way to Faster ROI”, Aberdeen Group Studies.

White, D. and Rowe, N. (2012), “Go Big or Go Home? Maximizing the Value of Analytics and Big Data”, Aberdeen Group Studies.

Wieder, B., Ossimitz, M.-L. and Chamoni, P. (2012), “The Impact of Business Intelligence Tools on Performance:. A User Satisfaction Paradox?”, International Journal of Economic Sciences and Applied Research, Vol. 5 No. 3, pp. 7–32.

Wixom, B., Watson, H. and Werner, T. (2011), “Developing an enterprise business intelligence capability the Norfolk Southern journey”, MIS Quarterly, Vol. 10 No. 2, pp. 61–71.

Wixom, B.H., Yen, B. and Relich, M. (2013), “Maximizing Value from Business Analytics”, MIS Quarterly Executive, Vol. 12 No. 2, pp. 111–123.