Exploring the Future Shape of Business Intelligence: Mapping Dynamic Capabilities of Information Systems to Business Intelligence Agility

Full Paper

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Abstract

A major challenge in today's turbulent environments is to make appropriate decisions to sustainably steer an organization. Business intelligence (BI) systems are often used as a basis for decision making. But achieving agility in BI and cope with dynamic environments is no trivial endeavor as the classical, data-warehouse (DWH)-based BI is primarily used to retrospectively reflect an organization's performance. Using an exploratory approach, this paper investigates how current trends affect the concept of BI and thus their ability to support adequate decision making. The key focus is to understand dynamic capabilities in the field of information systems (IS) and how they are connected to BI agility. We therefore map dynamic capabilities from the IS literature to agility dimensions of BI. Additionally, we propose a structural model that focusses on DWH-based BI and analyze how current BI-related trends and environmental turbulence affect the way that BI is shaped in the future.

Keywords

Business Intelligence, Agility, Dynamic Capabilities, Information Systems.

Introduction and Motivation: The Need for Speed

When it comes to establishing sustainable corporate advantage and mere survival, turbulent market environments are key challenges of today's organizations. On the one hand, an organization needs to keep up a distinguishable long-term strategy to position itself in the market. On the other hand, it needs to react quickly to changing circumstances in order to be successful. Managers and decision makers must be able to react and adjust the organization's strategy and its execution (Gandossy 2003; Wensley and van Stijn 2007). Hence, minimizing the risk of decision making by limiting uncertainties and being prepared for multiple scenarios are among the top priorities. If an organization is able to adjust to environmental turbulence and enable adequate and timely decision support, we assume that this is a critical factor to accomplish sustainable competitive advantage (SCA). Decision making, as well as the execution of business processes, is usually supported by information systems (IS). In particular, business intelligence (BI) as a distinct class of dispositive IS is used as an instrument to understand and gain insights from internal and external information. Primarily used to reflect operational performance (reporting-centric), organizations tend to use BI more and more to actively shape the future. A common example is to integrate social media data to measure and manage market perception of a company's decisions. But to support the long-term strategy and reflect the historical performance of an organization and simultaneously adapt and react timely to changing circumstances is not trivial. The tasks of reporting and consolidation typically have rigid requirements in terms of robustness, reliability and non-volatility (Inmon 1996). This challenge has even grown as the amount of data to be incorporated in management decisions has amplified during the last years. Accordingly, the importance and potential of data-related

problem solving has developed (Chen et al. 2012; Redman 2008, The Economist 2010a, 2010b, 2010c). We consider BI a critical resource to improve decision support as many strategic and operational decisions are based on BI (Marjanovic 2007). In our opinion, BI can remarkably enhance decision support, which then ultimately results in SCA. We therefore hypothesize and achieve our overall research model as depicted in Figure 1:

H1: A high level of viable BI is associated with a high level of viable decision support.

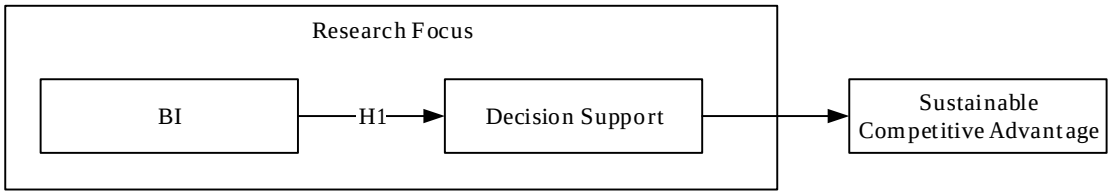

Figure 1. BI Impact to Decision Support and SCA

In this exploratory research paper, we want to explore what affects viable and timely decision support from a BI perspective. Hence, we concentrate on the left-hand side of the model presented in Figure 1. It should be noted that we do not explicitly address the discussion about agile process or management methods like Scrum (Schwaber 1997), Extreme Programming (XP) (Beck 2000)) or BI-adapted versions (Collier 2011; Hughes 2008). These principles deliver without a doubt high value in theory and practice, but concentrate on the process of how a BI system is created. Instead, we plan to investigate how BI itself behaves more agile. Thus, we aim to shed light on the contribution of BI to enhanced decision support. As many BI implementations fail (Olszak 2014), we hope to gain valuable insight into factors that affect BI and drive its success by using an exploratory approach. To achieve a common theoretical background, we build upon current BI literature and the value of agility in a BI context. Next, we analyze the attributes of dynamic IS capabilities and map these characteristics to BI agility characteristics. This aims towards our first research goal – the understanding of dynamic capabilities in the field of BI. In addition, we develop a structural model over the course of this paper as our second intended contribution to identify factors that impact BI. In the last section, we draft the impact of our research to theory and practice and give an outlook to future research opportunities.

Current Trends in Business Intelligence

BI can be defined as "a broad category of applications, technologies, and processes for gathering, storing, accessing, and analyzing data to help business users make better decisions" (Watson 2009). It is an umbrella term for systems and processes that turn raw data into useful information (Chen and Siau 2012; Wixom and Watson 2010). BI systems support decision makers through business analyses on the basis of internal and external data (Abbasi and Chen 2008; Chung et al. 2005; Watson and Wixom 2007). BI has been introduced to measure corporate performance based on IS data as well as to support problem and opportunity identification, decision-making and alignment of operations with the corporate strategy (March and Hevner 2007). Most multidimensional BI systems utilize the data warehouse (DWH) approach to systematically extract, harmonize and provide data to reflect the organization's single point of truth (Kimball and Ross 2002; Rifaie et al. 2008; Watson and Wixom 2007). A DWH is built to fulfill fundamental requirements (Inmon 1996), i.e. integration, subject-orientation, time-variance and non-volatility.

BI became popular in the 1990s and evolved over time. The data-centric approach of data management and data warehousing can be considered as BI 1.0. A characteristic of this stage is mostly structured data that is collected from different source systems. Typical capabilities, amongst others, are reporting, dashboards or ad-hoc queries (Chen et al. 2012). With the rise of the Internet and Web in the early 2000s, new possibilities for acquiring and processing information from these sources emerged. They focus on semi-structured or unstructured data from the Web, Internet or social media. Keywords for this BI 2.0, for instance, are text mining, web intelligence and analytics or social network analysis (Chen et al. 2012). As the number of mobile devices such as smart phones or tablets is strongly increasing, a new stage of BI, BI 3.0, arises in the 2010s. Briefly summarized, it deals with mobile analytics and sensor-based content

(Chen et al. 2012) that enables the consumer to pull information on demand; this trend that is also summarized by the term "self-service BI".

Within this logical evolution of BI, the term big data gained a lot of attention in academia and industry during the past few years. This phenomenon is characterized by the processing of very high data volume, complex data variety and/or the velocity of data generation (Beyer and Laney 2012; Laney 2001; Russom 2011). The rising integration of external data sources such as social media and the resulting increase in unstructured data has become and more important in many organizations. When looking at success stories in the context of big data, the combination of all or several of the "3V's" seems to add value in the application of big data analytics (Funke and Olbrich 2015). This trend towards big data is accompanied by technological advancements, e.g. cloud computing, mobile applications or in-memory databases (IMDB).

Cloud computing, also named on-demand computing, software as a service, internet as platform or infrastructure as a service, describes the phenomenon that data, applications as well as hardware and systems software are swept from local PCs and servers to a "cloud". A cloud is the data center software and hardware. This means that these components are shifted geographically to unseen computers. This transfers software as well as infrastructure and its maintenance to cloud computing providers. Cloud computing has the potential to change the IT industry significantly. It enables cloud users to eliminate up-front investments and pay only for resources used by flexible scaling alternatives. (Armbrust et al. 2010; Hayes 2008).

In 2011 the number of mobile devices (smartphones or tables) surpassed the number of laptops and desktop PCs (The Economist 2011). The vision "information at your fingertips" articulated in 1994 by Microsoft founder Bill Gates is omnipresent in day to day life. In contrast, the availability of required information with minimal response times is still an exception in organizational or business environments. But, the need for mobile access to BI applications goes along with the growing usage of mobile devices in business organizations (Airinei and Homocianu 2010).

Another technological advancement extensively promoted by software vendors in the past few years are IMDBs. Although data can be cached in the main memory of a DRDB system, it needs to be processed and stored in several layers and the primary storage location remains a magnetic hard disk. Instead, an IMDB keeps its data permanently in main memory of the underlying hardware. Main memory is directly accessible by the CPU(s) and the access is orders of magnitudes faster (Garcia-Molina and Salem 1992). Due to recent price reductions for main memory and the usage of dedicated compression techniques it is now possible to even hold the entire data of large-size companies in-memory (Plattner and Zeier 2011). IMDB-based BI infrastructures use column-oriented data storage to optimally support online analytical processing (OLAP) applications like BI. Column-oriented storage also allows for better suited compression techniques and gains huge performance impacts – up to factor 1000 with praxis data (Plattner 2009).

In order to manage these evolutions, organizational structures like BI competence centers (BICC) have been introduced. Such trends will sustainably affect BI and impact the future shape of BI. We therefore hypothesize and summarize the above observations with the term "trends" in Figure 2:

H2: A high level of viable trends is associated with a high-level of viable BI.

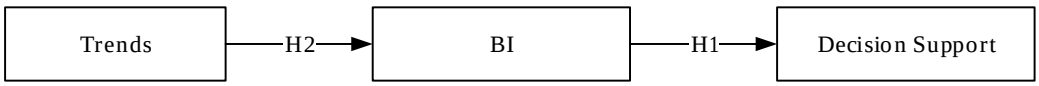

Figure 2. Trends impact BI and indirectly Decision Support

BI and big data analytics offer enormous potential to contribute to corporate success as many organizations and market researchers believe that "data is the oil of 21st century". Recently, a worldwide survey of more than 2000 CIOs identified BI as the number one technology priority (Gartner 2013). Therefore, many organizations have launched BI initiatives with the intention to implement or improve BI (Wixom and Watson 2010). There is evidence, however, that a significant number of organizations have failed to realize the expected benefits of BI (Chenoweth et al. 2006; Hwang and Hongjiang 2005; Joshi and Curtis 1999; Shin 2003) and that BI implementation projects are expensive, time-consuming and risky undertakings (Gartner 2009; Wixom and Watson 2001). About 60 to 70% of BI application failures are results of technology, organizational, cultural or infrastructure issues (Olszak 2014). In short, it seems

that the underlying assumptions of BI that aim towards robustness and reliability contradict the requirements of today's dynamic environments. Hence, the question remains how a by design rather static BI system can behave more agile to achieve better organizational performance.

An Agility Framework for BI

The idea of organizational agility has been established in practice and discussed in literature for decades. It originated from the field of manufacturing (Pankaj et al. 2009; van Oosterhout et al. 2007) and has also been used for several years in different management areas. Nevertheless, the definition of agility is ambivalent in scientific literature and industry (McCoy and Plummer 2006; van Oosterhout et al. 2007). Researchers have provided a wide range of definitions (cf. appendix in Pankaj et al. 2009) - often with deficiencies in the academic approach to arrive at these definitions (Pankaj et al. 2009). In contrast, Conboy and Fitzgerald (Conboy and Fitzgerald 2004b) conducted a cross-discipline literature review to derive a holistic definition of agility. In particular, they investigated the underlying concepts of agility, i.e. flexibility and leanness (Conboy 2009; Sharifi and Zhang 1999; Towill and Christopher 2002). They define agility as "the continual readiness of an entity to rapidly or inherently, proactively or reactively, embrace change, through high quality, simplistic, economical components and relationships with its environment" (Conboy and Fitzgerald 2004a). This definition is in line with the definition of Pankaj et al. (2009) who stated that agility must respect the abilities to sense a change, diagnose a change as well as select and execute a response to a change in an adequate time frame.

To gain an understanding of agility in a BI context, we follow the framework suggested by Knabke and Olbrich (2013). As a result of a literature review they grouped similar constructs of agility as illustrated in Figure 3.

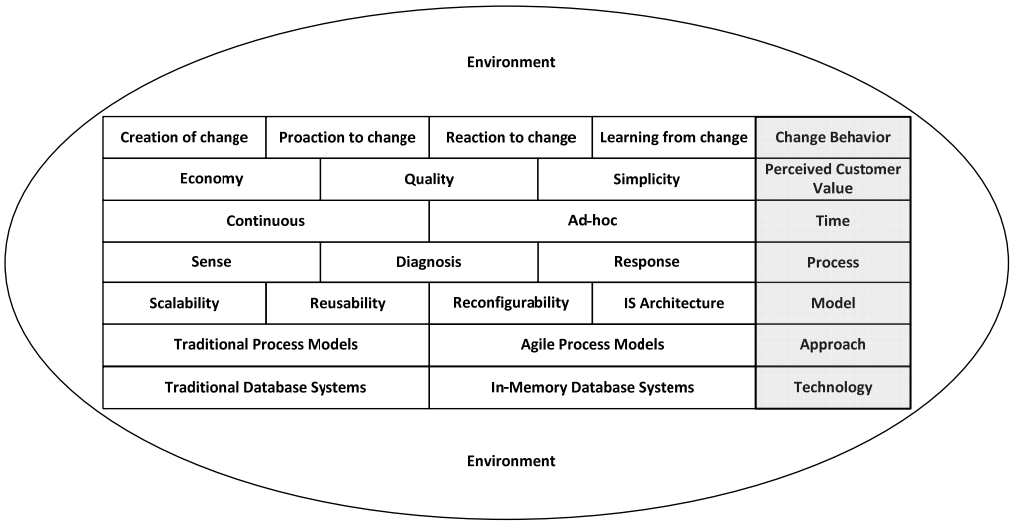

Figure 3. Framework for BI Agility

The agility dimensions framed by Knabke and Olbrich are briefly explained in the following:

Change Behavior A central construct of agility is the behavior with regard to change. Thus, a system can behave reactively, proactively, create or even learn from change.

Perceived Customer Value (PCV) This concept highlights the importance of quality, simplicity and economy as value for the customer of BI.

Time This dimension describes the ability of BI to adapt to changing environments over time. This can either happen in a continuous process or on an "ad-hoc" basis. The actual physical length of time is dependent on the context of the IS and may differ for strategic, tactical and operational IS.

Process An agile BI system should be able to sense, analyze and respond to a change. It should support methodologies and organizational structures to be able to quickly respond to changing requirements.

Model The model incorporates the architecture of BI, including its layers. Agile BI may even require a new architectural approach which is among others, reusable, reconfigurable and scalable.

Approach The approach describes the process method that is used in BI projects, e.g. traditional (waterfall) models or agile methods like Scrum.

Technology This dimension considers the underlying technology of BI. This may e.g. be a disk-resident database or an IMDB.

Environment The need for change often arises outside the IS. The environment of BI can be interpreted in multiple ways such as business processes, people, customers, clients, or formalities.

As the environment of an IS and an organization often triggers change, environmental turbulence is one main driver in our study. Decisions made and their resulting activities may be costly, time-consuming and irreversible in terms of resource usage (Pavlou and El Sawy 2006). Thus, continuous reconfiguration may be inefficient for decision support. We include environmental turbulence in our research model and achieve Figure 4 with additional hypotheses:

H3: The relationship between viable BI and adequate decision support is negatively moderated by environmental turbulence.

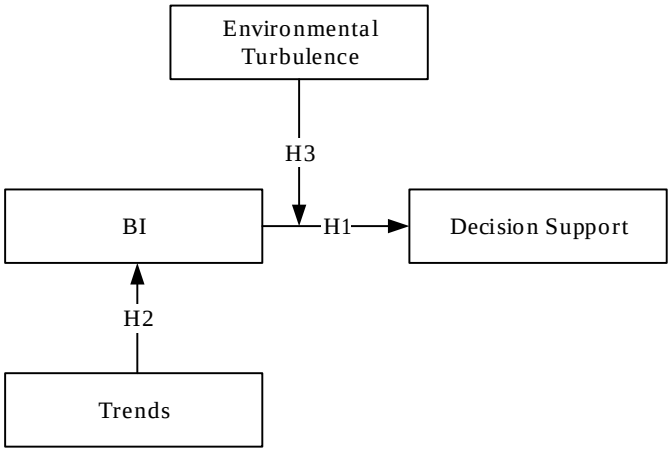

Figure 4. Impact of Trends and Environmental Turbulence on the Research Model

Summarizing, BI can be considered as a crucial resource of an organization, i.e. an available factor owned or controlled by the organization to offer products or services by using other assets of the organization (Drnevich and Croson 2013).

Resource-based View, Dynamic Capabilities and their application to BI Agility

The resource-based view (RBV) (Wernerfelt 1984) of an organization argues that it can achieve competitive advantage with the usage and configuration of its available tangible and intangible resources (Barney 1991; Wade and Hulland 2004; Wernerfelt 1984). It was utilized in IS research in the mid-1990s (Wade and Hulland 2004). According to Barney (1991), an organization's resource must have four attributes to provide competitive advantage. These attributes are valuable, rare, imperfectly imitable and non-substitutable (VRIN). Resources must exhibit all of these attributes to achieve a long-term competitive advantage (Wade and Hulland 2004). However, neither IT assets nor organizational resources are strategic in and of themselves, but the synergetic combination of non-VRIN resources can result in VRIN resources (Cosic et al. 2012; Nevo and Wade 2010). RBV has been criticized for only focusing on the resources themselves and not taking surrounding factors into account. The theory of dynamic capabilities (Eisenhardt and Martin 2000; Helfat and Peteraf 2003; Teece et al. 1997; Winter 2003) aims to overcome the gap between the RBV that focuses on core resources more useful in stable environments and dynamic business periphery. According to the theory of dynamic capabilities, existing competences are assembled to new capabilities according to changing business environments (Teece et al.

1997). The ability to build, integrate and reconfigure existing competencies into new capabilities (Pavlou and El Sawy 2006) can be referred to as "resource renewal" (Cosic et al. 2012). This interaction can lead to greater capabilities than the sum of its individuals (Nevo and Wade 2010). With dynamic resources, an organization can achieve and maintain SCA by adjusting its resource mix (Pavlou and El Sawy 2011; Wade and Hulland 2004). The concept of dynamic capabilities is especially useful for organizations that act in rapidly changing environments. IS capabilities, and thus BI as a subset of IS, are IT assets combined with other (tangible or intangible) resources such as people, routines and processes (Barney 1991; Cosic et al. 2012; Drnevich and Croson 2013). A flexible steering of an organization's resource mix influences the used assets and capabilities in return. Analytical agility may develop and integrate resources over time and contribute to a company's long-term competitiveness. Hence our assumption is that BI can contribute to improved decision support. However, BI resources are part of a complex system with correlations to other assets and capabilities of an organization. Therefore, we believe the perspective of dynamic resources to be the most adequate one considering our research approach. Furthermore, they may have a significant impact on an organization's performance (Sambamurthy et al. 2003).

In order to find out more about possible correlations, we analyzed publications in leading IS journals to get an understanding of dynamic capabilities in the field of IS and how they can be aligned. To identify relevant sources, we looked into the Association for Information Systems (AIS) senior scholars' basket of journals, known as the "basket of eight" (Members of the Senior Scholars Consortium 2011). We focused on these outlets because of their acknowledged quality and centrality in the IS discipline. Additionally, we included the Strategic Management Journal in our search as some groundbreaking publications of RBV and dynamic capabilities have been published in this outlet, e.g. Helfat and Peteraf 2003; Teece et al. 1997; Wernerfelt 1984; Winter 2003. All journals were assessed from their first issue to the most recent issue available in the respective electronic databases (up to January 2015). We used EBSCO as the database to conduct an advanced search for articles that contained the terms ("dynamic capabilities" or "dynamic capability" or "dynamic resource based view") and ("information system" or "information systems" or "business intelligence" or "business analytics" or "data warehouse" or "DWH") in the title or abstract. As we are especially interested in the overlap of dynamic capabilities and IS/BI, one of the expression in the first parentheses needs to occur with at least one expression in the second parentheses. This explains why not every accessed journal appears in the hit list below. Our search resulted in nine publications in these outlets. The summary of dynamic capabilities within an IS context is shown in Table 1.

Examples of Dynamic Capabilities	Authors and Year	Journal
Manufacturing capabilities (just-in-time manufacturing, customer & supplier participation programs) by resource planning systems, operations management systems, electronic data interchange applications	Banker et al. (2006)	MISQ
Reconfiguring resources through sensing the environment (by market orientation), learning (by absorptive capacity), coordinating activities (by coordination capability), integrating interaction patterns (by collective mind) IT leveraging competence through effective use of project and resource management systems, effective use of knowledge management systems, effective use of cooperative work systems	Pavlou and El Sawy (2006)	ISR
Organizational and managerial processes (by integration, learning, reconfiguration and transformation), paths (by path dependencies, technical opportunities), positions (by technological assets, complementary assets, financial assets, locational assets), products and services (by internal and external stakeholders)	Butler and Murphy (2008)	JIT
Improvisational (spontaneous) dynamic capabilities (by project and resource management systems and collaboration work systems), planned dynamic capabilities (by organizational memory systems)	El Sawy et al. (2010)	ISR
IT personnel expertise, IT infrastructure flexibility, IT management capability	Kim et al. (2011)	JAIS

Processes that learn, value-based governance, dynamic personal accountabilities/dynamic commitments, modular processes and services/modular design	Singh et al. (2011)	JAIS
Customer-based knowledge creation (by analytical ability and web-based customer infrastructure), operational process execution (by internal and external IS integration, inter-functional coordination and channel coordination), customer agility (by customer sensing capability, agility alignment and customer responding capability)	Roberts and Grover (2012)	JMIS
Collusion/coordination, governance, competence, flexibility	Drnevich and Croson (2013)	MISQ
Business objectives drive projects, multiple and dynamic prioritization criteria, dynamic balancing of risk and reward, cancel/reconfigure in-flight projects	Daniel et al. (2014)	JSIS

Table 1. Overview of Dynamic IS Capabilities

We grouped the above capability examples to a higher level to build a comprehensive dynamic capabilities framework. We identified six areas of dynamic capabilities that are relevant to BI. These are organization & governance, business processes, change management & change behavior, people & culture, technology & infrastructure and IS portfolio & IS architecture. Briefly summarized, organization & governance is the ability of an organization to manage its (BI-related) resources. Business processes comprise all activities that are related to the products and services offered by an organization. Change management & change behavior consider how an organization deals with change. People & culture are the individuals and the "personality" of an organization. Technology & infrastructure describe general IT assets (hardware and software) and their usage. IS portfolio & IS architecture summarize the IS applications and their architecture, e.g. data model or layered architecture. Table 2 maps these dynamic capability areas of IS to the BI agility dimensions outlined in Figure 3.

BI Agility Dimension / Dynamic IS Capabilities	Change Behavior	Perceived Customer Value	Time	Process	Model	Approach	Technology	Environ-ment
Organization & Governance	X	X				X		X
Business Processes		X						X
Change Management & Change Behavior	X	X	X	X				X
People & Culture	X	X						X
Technology & Infrastructure							X	
IS Portfolio & IS Architecture		X			X			

Table 2. Mapping of Dynamic IS Capability Areas and Dimensions for BI Agility

The strong intersection of dynamic IS capabilities and dimensions for BI Agility highlights the recent development in decision support systems. During the 1990s and early 2000s, standard reporting was one of the most important topics for an organization's BI. Here, the focus was on broad standard reporting that was deeply grounded in the company's internal financial figures, either bound to regulatory requirements or corporate performance management paradigms. But requirements for BI evolved from a retrospective usage towards an ever more forward looking steering instrument (Olbrich et al. 2014). This evolution can be explained by a) the empowerment of the user that took the role of a knowledge worker and b) the increasing availability of (unstructured) data that may originate outside the organization's boundaries and can be made available for statistical analysis - a development usually summarized by the

term big data. On the user side, BI broadened from strategic to tactical and operational decision support using real-time data (Watson et al. 2006). This requires faster adoption of BI in turbulent environments, which turns agility into a critical factor. But BI is often based on the concept of DWH in many organizations. DWHs are built to fulfill fundamental requirements (Inmon 1996) that are especially important for BI 1.0. First, the **integration** of data from (diverse) sources ensures consistency and yields for a single point of truth. Second, BI elements are organized according to the subject areas of the organization (**subject-orientation**). Third, structures in a DWH usually contain a connection to time (**time-variance**) to show changes over time. Fourth, data in the DWH should never be altered (**non-volatility**).

Based on the evidence of high BI project failure (Chenoweth et al. 2006; Hwang and Hongjiang 2005; Joshi and Curtis 1999; Olszak 2014; Shin 2003), we assume that the fundamentals of DWH-based BI as operated currently contradict the requirements of today's agile environments. This indicates the importance of agile BI. As many organizations base their BI initiatives on a DWH, we use DWH-based BI following the principles of Inmon as a starting point in Figure 5. One key research question of our overall study is to identify how such BI can turn into dynamic BI capabilities and which factors (environmental turbulence and trends in Figure 5) support this evolution towards agile BI. BI is usually sourced from several systems and the information processing is done via several layers – to a great extend due to performance reasons. Some trends, e.g. IMDB, may be an enabler for more agile BI. IMDBs seem to positively impact BI (Plattner 2009; Plattner and Zeier 2011) and may simplify the underlying architecture of DWH-based BI systems (Knabke et al. 2014; Knabke and Olbrich 2011). Hence, the streamlined BI architecture enables a faster reaction to change facilitated by a technological trend, IMDB. We therefore expand our research model and include DWH-based BI as depicted in Figure 5. The term dynamic BI capabilities summarizes the achievements from Table 2.

According to Pavlou and El Sawy (2006), turbulent environments increase the possibility that new competencies can be reconfigured by using dynamic capabilities and enhance relative advantage. Turbulent environments comprises diverse phenomena. This may be frequently changing requirements for BI due to changing market situations. On the other hand it addresses organizational- or industry-specific topics. There are industries in which higher regulatory demands are applicable, e.g. finance or utilities. Such regulations seem to be a great obstacle for agile BI. This indicates that the impact depends on the type of organization and industry. Looking at the organizational perspective, many companies implement dedicated departments for BI, i.e. BICC (Zimmer et al. 2012). These cross-functional institutions determine roles, processes and agreements for the governance and effective usage of BI. In the light of this development, we hypothesize as depicted in Figure 5:

H2: The relationship between DWH-based BI and dynamic BI capabilities is positively moderated by BI-related trends.

H4a: The relationship between DWH-based BI and dynamic BI capabilities is positively moderated by environmental turbulence.

H4b: The relationship between DWH-based BI and dynamic BI capabilities is negatively moderated by environmental turbulence.

In a nutshell, BI and agile BI in particular can be considered as a dynamic resource of an organization, i.e. an available factor owned or controlled by the organization to offer products or services by using other assets of the organization (Drnevich and Croson 2013).

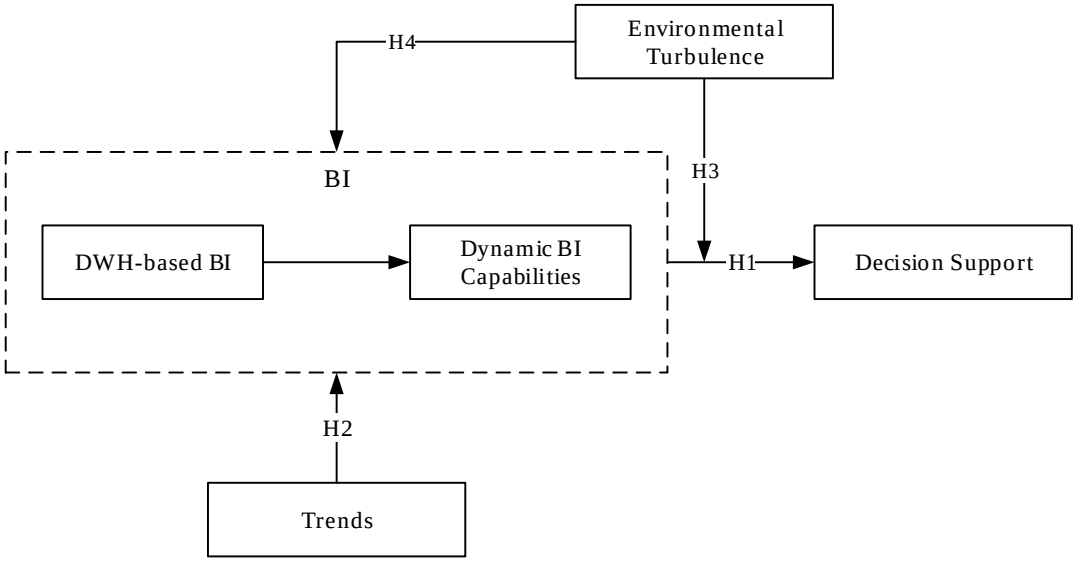

Figure 5. Research Model

Contribution and Future Research

The first objective of our research is to contribute to the understanding of dynamic capabilities in the field of BI and how they are connected to BI agility. We identified that current trends such as technological advancements or big data affect the way BI is done today. We draw the conclusion that BI needs to become more agile to cope with turbulent environments. As one contribution, we investigated the concepts of dynamic capabilities by conducting a structured literature review in major IS journals and mapped them to agility dimensions of BI identified by previous literature. This sheds light on how dynamic capabilities can be understood and used in BI research. As our second research goal and achievement, we developed a structural model that shows how more agile BI can yield to adequate decision support. Thereby we focused on DWH-based BI as the fundament of today's decision support and integrated current BI-related trends as well as environmental turbulence in our model. Technological and conceptual developments may facilitate the development of BI towards more agility and bridge the gap between BI and business analytics. For example, if users can integrate information from social media in their analysis that they require for decision making, they are willing to use BI more frequently. This adds value to daily work tasks, which makes BI more useful for them and results in timely, adequate and thus better decision support. With the information gained, they are able to steer their organization better, resulting in corporate advantage over compared to their competitors.

We followed an exploratory approach in this paper. To evaluate our research model, we conducted first qualitative tests. These were carried out by interviews during project implementations and confirmed our hypotheses. For instance, the users at a German sportswear designer and manufacturer highlighted a more agile BI system after implementing it on an IMDB. This was also achieved by consolidating system landscapes and creation appropriate organizational structures to cope with environmental turbulence. As we could not answer the second research question to our full satisfaction, we plan to put our model out for broad empirical testing. Therefore, a detailed questionnaire has been designed and was tested among 73 business intelligence consultants. We will collect the feedback of this first testing and send a revised version out to community of more than 5000 practitioners in the field of business intelligence. It is our intention to carve out in detail which trends need to be incorporated into the architecture of BI in order to continuously improve decision support. The empirical test will also address one of the shortcomings of this paper which could not the impact of organization and industry as part of environmental turbulence. The result of the empirical analysis will provide a recommended course of action for research and practice to achieve viable BI in terms of adequate and timely decision support. As the results of the empirical testing are still to be evaluated, our findings have to be considered preliminary in nature. Nevertheless, our hypotheses may serve as a starting point for future research in the field of BI.

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