EDITED BY
MARKO KOHTAMÄKI

# REAL-TIME STRATEGY AND BUSINESS INTELLIGENCE

## Digitizing Practices and Systems

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Editor

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palgrave
macmillan

*Editor*
Marko Kohtamäki
University of Vaasa
Vassa, Finland

ISBN 978-3-319-54845-6 ISBN 978-3-319-54846-3 (eBook)
DOI 10.1007/978-3-319-54846-3

Library of Congress Control Number: 2017936901



Printed on acid-free paper

This Palgrave Macmillan imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

# Acknowledgements

This book is a product of the DIMECC S4Fleet research project. Financial support from the Finnish Funding Agency for Technology and Innovation (Tekes), the DIMECC, and from companies involved in this project is gratefully acknowledged.

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# About the Editor

**Marko Kohtamäki** is a Professor of strategy and a Director of the "Networked Value Systems" (NeVS) research program at the University of Vaasa. Previously, he worked as a Head of Department of Management as well. Prof. Kohtamäki also works as a visiting professor in the Luleå University of Technology and takes special interest in industrial service business or servitization, strategic practices, and business intelligence or management information systems in technology companies. He has published in several distinguished international journals, such as Strategic Management Journal, Industrial Marketing Management, Technovation, Journal of Business Research, and Strategic Entrepreneurship Journal. Kohtamäki has served as a project director in large-scale research projects, such as "Future Industrial services" and "Solutions for Fleet Management."

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# Introduction: Real-Time Strategy and Business Intelligence

Marko Kohtamäki

## Approach and Underlying Concepts

This book draws on the interplay between strategy and business intelligence, taking a holistic 360° perspective on the management of firms. It develops the concept of real-time strategic management to highlight the opportunities provided by digitization and to improve the management of firms for added organizational agility. One of the book's key goals is to illustrate how digitization is changing the strategic management landscape, aiming to generate new thinking to bridge strategy and management information systems to develop the concept of real-time strategic management. Together with globalization and opening markets, digitization is increasing the pace of environmental and organizational change, reducing obstacles to firm growth and competition. Business environments not only vary between industries, markets, and strategic groups, but also over time,

M. Kohtamäki (✉)
University of Vaasa, Vaasa, Finland
e-mail: mtko@uwasa.fi


M. Kohtamäki (ed.), *Real-time Strategy and Business Intelligence*,
DOI 10.1007/978-3-319-54846-3_1

regarding hostility of competition, dynamism of change, and complexity of technologies and other resources. Changes, which relate to environmental hostility, dynamism, and complexity, set a new and increasing demand for company strategies, capabilities, practices, processes, IT systems, resources, and competencies. As the search for competitive advantage is constant, innovative management practices are required from top to middle management at different organizational levels. Organizations need capacity to adapt to the changes in the environment, strategic agility enabled by business intelligence, and related innovative strategic practices. Chapter "Strategic Agility— Integrating Business Intelligence with Strategy" provides a model to help determine the relations and fit between business environment (e.g. stabile vs. dynamic), company strategy (e.g. differentiation vs. low cost) (Porter 1980), and value system organization (e.g. markets vs. hierarchies) (Williamson 1985), reflecting the classic contingency theory (Lawrence and Lorsch 1967).

With regard to the concept of real-time strategic management, this book uses a compilation of underlying concepts, such as strategic agility, practices, business intelligence, and the knowledge process. These underlying concepts integrate the ideas in different chapters to provide a coherent approach toward real-time strategic management. One of the central concepts selected for this book is strategic agility. We suggest the concept of strategic agility reflects a company's capacity to renew its strategy, business model, and operations (Doz and Kosonen 2010; Weber and Tarba 2014). Strategic agility describes a strategic orientation through which a company constantly senses, seizes, and reconfigures resources for rapid adaptation (Teece et al. 2016), or strategic learning (Sirén and Kohtamäki 2016). For strategic agility, companies require sufficient capacity to absorb knowledge, analyze and conduct strategic decisions, set targets, measure, follow-up, and reward behaviors that support strategy implementation (Kaplan and Norton 2000; Rabetino et al. 2017). Thus, in this book, real-time strategic management is considered a key enabler of strategic agility. In an agile organization, strategic practices take place throughout the organization. Strategy is not only something undertaken by top management, but strategic activities also emerge from different organizational functions—strategy is what the organization does (Mintzberg and Lampel 1999). Sometimes, it is

difficult even for companies themselves to comprehend the strategies they utilize, and strategic cognitions may vary, even within firms or top-management teams (Gavetti and Levinthal 2000). Hence, the cognitive perspective (strategic decision making) is particularly relevant when trying to understand decision making and strategy implementation.

This book adopts a practice perspective on digitization, management information systems, and business intelligence. Digitization has opened both the external and internal environments of organizations to constantly having to reconfigure processes surrounding information and knowledge resources. Accordingly, new observations, interpretations, and applications have been enabled faster than ever before. Thus, on the one hand, digitization enables more effective management than before, if an organization can utilize the opportunities provided. On the other hand, a more open environment makes organizations more vulnerable to the surrounding world and subsequent security threats, against which any organization must guard itself (Iansiti and Lakhani 2014). This book considers management information systems as enablers of real-time strategic management. Collecting, storing, analyzing, and implementing knowledge are easier than in the past because of the digitization, increasing knowledge-processing power and storage capacity. Furthermore, the connectedness of organizations, people, and things allows increasing amounts of data to be utilized for strategic decision making (Porter and Heppelmann 2015), whether human or artificial. Various chapters in this book analyze and describe how digitization takes different forms in a variety of functions that facilitate strategic agility, financial decision making, competitive intelligence, customer relationship management, human resource management, supplier intelligence, and decision making. In addition, we provide a conceptual overview of business intelligence and related literatures.

The existing strategic management literature has approached strategy from a variety of contents and process perspectives (Ketchen et al. 1996). The former has focused on content-level questions; for instance, what types of strategies companies have utilized. The latter has concentrated on the process view of strategy, what types of processes are utilized to generate strategy content (Hutzschenreuter and Kleindienst 2006). While acknowledging some of the important works conducted by the process

view, some chapters utilize the practice perspective (Jarzabkowski 2008; Vaara and Whittington 2012; Whittington 1996) as an approach focusing on the micro-levels of strategy work. The strategy-as-practice view focuses on the practices that companies actually utilize, such as managerial agency, and words and actions that come to constitute company strategy. For instance, the "Strategic Agility—Integrating Business Intelligence with Strategy" chapter considers practices in strategic agility, while the decision making in Chap. "Making Sense of Strategic Decision Making" combines the practice view with organizational identity (Nag et al. 2007) and sensemaking (Daft and Weick 1984). Chapters on customer relationship management (CRM and Customer Intelligence), human resource management (HR Intelligence), and supply chain management (Supply Chain Intelligence) each present various practices from their functional perspectives. The emerging strategy-as-practice perspective has brought the concept of practice to theorizing on strategy work, with an emphasis on the micro-practices utilized by top and middle management (Balogun and Johnson 2004; Mantere 2008; Rouleau 2005). The practice perspective sees strategic practice not only as something that occurs in board meetings, but also in different organizational levels including practices, such as sales meetings, department meetings, or social media. Thus, strategy is more than merely an issue of top management, strategy is found in the words and actions of any organizational member. Hence, the practice perspective on strategy adopted here blurs the boundaries between strategic analysis, choice, and implementation, and between top and middle management, which suggests that strategic practices are relevant when understood properly at the micro-level. Thus, the practice perspective provides a conceptual basis for analysis and discussion of the interplay between strategy and management information systems. As one of its ambitious goals, this book intends to further develop strategy theory to better grasp the enabling effect of information systems. To that end, this book set out to provide some integration between theorizing on strategy work and management information systems (Whittington 2014).

Several chapters in this book highlight the role of middle management. Middle management is seen as having a key role in shaping and implementing agile strategies. Accordingly, the practices that facilitate middle-management participation in strategy work are seen as central

for an agile organization. In alignment with practice theory, we consider that companies and managers (or other actors) utilize a variety of micro-level social practices, which can be related either to the words or actions of different actors. We consider that often, words translate into actions (Seidl and Whittington 2014), and accordingly, organizational discourse has a significant role in the organization's development. Social practices both reflect and shape organizational identity and the organization's character. Thus, social practices reach beyond their limited short-term performance outcomes (Jarzabkowski et al. 2007).

Finally, several chapters take the process view on knowledge acquisition, assimilation, transformation, and exploitation (Zahra and George 2002). The authors of the various chapters—while adopting different perspectives on real-time strategic management in different functions—cover the issue of knowledge processing (Crossan and Berdrow 2003), knowledge absorption (Patel et al. 2015; Zahra and George 2002), or dynamic capabilities (Zollo and Winter 2002). Thus, the chapter authors provide a variety of perspectives on knowledge processing in business intelligence. For business intelligence and real-time strategic management, information needs to be collected, stored, assimilated, analyzed, and implemented. The available conceptualizations are numerous.

The chapters consider a variety of functions and their transition toward real-time management. They also shed light on practices related to company-level strategic agility, business intelligence in general, financial management, customer relationship management, human resource management, supplier management, competitive intelligence, strategic decisions, and project-based solutions delivery. Each chapter is written from a managerial perspective, also providing theoretical insights and a future orientation.

## Introduction to the Chapters

After this short introduction to the whole book, the "Strategic Agility—Integrating Business Intelligence with Strategy" chapter delves deeper into strategy and business intelligence, and the conceptual mixture of strategic practices, business intelligence, and strategic agility. As well as providing

a comprehensive framework for the book, it highlights some of the main theoretical grounds for real-time strategic management. The "Strategic Agility—Integrating Business Intelligence with Strategy" chapter goes into more detail about theoretical concepts, measurement, and practices, and it provides deeper insight into the concepts utilized in our framework on real-time strategic management, as well as integrating the idea of strategic learning. Finally, the chapter also aims to align strategic practices and business intelligence technologies.

The "Business Intelligence—Capturing an Elusive Concept" chapter introduces the conceptual frames for business intelligence. It aims to generate the conceptual architecture in order to map the landscape of business intelligence and management information systems and to consider the prior research on business intelligence. The "Business Intelligence—Capturing an Elusive Concept" chapter adds to the first by scrutinizing the information system side of business intelligence. It also illuminates the conceptual and theoretical separation between the literature on strategy and business intelligence. From the literature perspective, the chapter explicates the gap between strategy and business intelligence research.

The "How Management Control Systems Can Facilitate a Firm's Strategic Renewal and Creation of Financial Intelligence" chapter focuses on the financial management of a company from the perspective of strategic accounting and management accounting or control systems. The literature on management accounting systems provides important insights into the control perspective relating to the management of an agile organization. The management control perspective provides important insights into key practices related to strategy implementation, target setting, and measurement and into following up on strategic activities. This chapter also combines the idea of dynamic capabilities with management control systems. These practices have a central role in real-time strategic management, as is also established in the second chapter.

The "Competitive Intelligence—A Strategic Process for External Environment Foreknowledge" chapter introduces the concept of competitive intelligence, focusing on the firm's practices intended to increase decision makers' understanding of the competitive landscape. Incorporating competitive intelligence as part of a company's real-time

management system is at the heart of strategic thinking emerging from industrial economics. This chapter provides interesting insights by identifying best practices for competitive intelligence. It also highlights the disparity between the competitive intelligence perspective and real-world application of theoretical concepts.

The "Human Resource Intelligence—Enhancing the Quality of Decision Making and Improving Business Performance" chapter concentrates on the role of human resource management in business performance. It highlights a variety of high-performance works practices and the role of information systems in human resource management. The chapter also makes a valuable contribution to the HRM literature by listing a variety of practices that can add value to the development of real-time human resource management. In addition, the chapter demonstrates a variety of metrics for human resource management.

The "Business Intelligence Within the Customer Relationship Management Sphere" chapter introduces customer relationship management (CRM), with a variety of practices utilized in the B2B context. The developed framework addresses how to collect, analyze, and implement customer knowledge to facilitate strategic and operational decision making. This chapter provides a managerial framework for customer relationship management, which highlights the role of real-time practices and also illustrates an exhaustive list of key metrics for CRM.

The "Making Sense of Strategic Decision Making" chapter focuses on the cognitive side of strategic decision making, providing insights into strategic cognition, cognitive models, sensemaking processes, and a variety of cognitive biases that influence strategic decision making. Thus, the eighth chapter provides a valuable perspective on the cognitive dimension of real-time strategic decision making and guidance on how to avoid cognitive traps.

The "Project Management Intelligence—Mastering the Delivery of Life Cycle Solutions" chapter focuses on the role of business intelligence in project-based solutions delivery, concentrating on the delivery of complex projects and the role of business intelligence in measuring and managing projects. The chapter provides a valuable model for the project delivery process, providing guidance on how to apply business intelligence to improve delivery if complex solutions projects.

Chapter "Supply Chain Intelligence" concentrates on measurement of the supply chain, providing an integral model and a view on supply chain metrics. The chapter aims to increase understanding of the role and practices of supply chain measurement, producing a broad overall framework for supply chain intelligence.

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## Author Biography

**Marko Kohtamäki** is a Professor of Strategy, and a Director of the "Networked Value Systems" (NeVS) research program at the University of Vaasa. Previously, he worked as a Head of Department of Management as well. Professor Kohtamäki also operates as a Visiting Professor in the Luleå University of Technology and takes special interest in industrial service business or servitization, strategic practices, and business intelligence or management information systems in technology companies. He has published in several distinguished international journals, such as Strategic Management Journal, Industrial Marketing Management, Technovation, Journal of Business Research, and Strategic Entrepreneurship Journal. Kohtamäki has served as a Project Director in large-scale research projects, such as "Future Industrial services" and "Solutions for Fleet Management."

# Strategic Agility—Integrating Business Intelligence with Strategy

Marko Kohtamäki and Donald Farmer

## Introduction

In search of knowledge to improve competitive advantage, and as a result of the low cost of storage and the rapidly growing use of data-rich applications, firms are collecting and storing more information than ever. In many cases, the usefulness of this stored data is unclear, but typically business strategists hope to acquire knowledge to improve competitive advantage in rapidly changing competitive landscapes. Thus, the question of the development, utilization, and implementation of the knowledge acquired has become particularly relevant. As a former director of Nokia said succinctly: "Five to ten years ago, you would set your vision and strategy and then start following it. That does not work anymore.

M. Kohtamäki (✉)
University of Vaasa, Vaasa, Finland
e-mail: mtko@uwasa.fi

D. Farmer
TreeHive Strategy, Woodinville, Washington, USA
e-mail: donald.farmer@treehivestrategy.com



M. Kohtamäki (ed.), *Real-time Strategy and Business Intelligence*,
DOI 10.1007/978-3-319-54846-3_2

Now you have to be alert every day, week, and month to renew your strategy" (Doz and Kosonen 2008a, b: 95). Even Nokia, despite probably recognizing the urgent need for change, ended up being trapped by its past capabilities, and as a result failed to renew its mobile phone business line. As such, the Nokia case exemplifies how in rapidly changing business environments where companies have to adapt effectively, the capacity to collect data, assimilate knowledge, and implement strategic decisions should be a central concern, at least that is the doctrine of strategic agility, also known as fast strategy. Perhaps Jon Kapan, VP of US sales and operations at Google, provides a good example when emphasizing the importance of agility to modern companies in 2015, stating that "We have to be agile. As you think about the businesses that we are in and how the company has changed over the last 10 or 15 years, it's totally different today than when we started. So we have to have leaders, we have to have employees, and we have to have technology that is all very agile for where the industry is going" (McKinsey & Company 2015: 1). A different issue is whether companies have the dynamic capabilities required to effectively renew and reconfigure their resource base (Eisenhardt and Martin 2000; Teece 2007).

Organizational flexibility is said to facilitate organizational independence, innovation, competitive advantage (De Leeuw and Volberda 1996), and company performance. Instead of simply selecting where to focus, companies need to decide which games to play to ensure the organization keeps learning and transforming to avoid being trapped by its past success (Sirén et al. 2012). A central concern of a technology company should be its capabilities, and it should be addressing which to expand upon to avoid the arrogance that can be an unwelcome by-product of continuous success. As Brown and Eisenhardt (1997: 2) state:

> In these industries, the ability to change continuously is a critical factor in the success of firms. In addition, what is also becoming apparent is that this continuous change is often played out through product innovation as firms change and ultimately even transform through continuously altering their product.

In this work, strategy is defined as a shared mindset and organizational actions to achieve competitive advantage (Agarwal and Helfat 2009).

Accordingly, when manifested in the actions of organizational members, strategy provides the necessary guidelines on where and how transformation in the company is happening. This form of strategy is seen as one evolving over time as the company adapts to its competitive landscape.

The concept of adaptation is hardly new. For decades, studies have described the concepts of an adaptive strategy, a flexible organization, an organic organization, agility, organizational learning, absorptive capability, and strategic learning. However, these concepts were mostly developed before large-scale digitization, the internet, and the internet of things, and therefore do not cover the opportunities presented by digitization, and nor did they foresee the enabling role (and the complications) of information technology. For instance, neither the strategy process nor the strategy-as-practice literature has yet fully addressed the influence of information systems on strategy work (Whittington 2014). The same can be said of the research relating to management information systems and decision support systems (DSS), which mostly neglects the existing strategy research. Research on DSSs tends to have a rather technological emphasis and to neglect the parts of organizational life—the products, services, and order-delivery processes—where the strategy is manifested. As Clark et al. (2007: 580) state:

> There have been calls for a new theory of management decision support that focuses on a broader context than does the traditional DSS to include business processes, organizational members, technology, infrastructure, and organizational outcomes from using the systems.

The fact that the existing research on strategy and business intelligence, despite some emerging exceptions, does not provide the frameworks, practices, or tools necessary for real-time strategic decision making has given rise to a call for the development of a new theory.

Accordingly, this chapter and this book as a whole concentrate on developing a framework of real-time strategy to guide top and middle management. Combining the research streams on dynamic capabilities and agile strategy, business intelligence, strategy processes, and strategy-as-practice, the current chapter intends to create new ideas of near-real-time strategic management, which are here described as agile strategy. As information systems "increase an organization's agility or

its capabilities 'to sense and respond to predictable and unpredictable events' (Baskerville et al. 2005, p. 3)" (Hovorka and Larsen 2006: 162), and as the existing literature does not provide frameworks capable of integrating the business intelligence (BI) and strategic agility literature to the required extent, theory and framework development is needed. As such, digitization, the internet of things, and big data analytics provide an excellent opportunity to develop a theory of strategic agility to facilitate strategic renewal in technology firms.

## Theoretical Grounds

Building on the grounds of emergent strategy and business intelligence, the present work intends to develop the concept of real-time strategy by building on strategy-as-practice, organizational renewal, and management information systems literature. Strategy work is approached from the strategy-as-practice, planning, and emergence perspectives as well as that of fast strategy. Aligned with the classic Minzbergian idea, we consider that "strategy formation walks on two feet, one deliberate, the other emergent" (Mintzberg and Waters 1985: 271). As such, we see strategy as what managers and companies do, rather than what companies have (Whittington 2006; Jarzabkowski 2008; Vaara and Whittington 2012). Hence, our definition and understanding of strategy build on the strategy-as-practice approach. Moreover, we want to emphasize the idea of strategy as simple rules and concur with Eisenhardt and Sull (2001) in thinking that strategy should ultimately be simplified into a few guidelines that have a steering effect on organizational practice.

Secondly, we approach this topic of real-time strategy from the perspective of organizational renewal, which includes dynamic capabilities, absorptive capacity, and agile strategy. These perspectives view strategy as a process of organizational renewal that can be divided into knowledge absorption and resource reconfiguration. In addition, agile strategy is a perspective that has emerged in the strategy literature suggesting that companies should be agile and adaptive to changes in the business environment. Hence, strategic decision making is approached as

emergent strategic learning, where a modern corporation continuously invents and reinvents its strategy, while selecting targets, measures, processes, and resources. In addition, a noticeable and increasingly significant element of change in the business environment is the greater data literacy of younger employees and the development by software vendors of user experiences focused on a self-service approach to data analysis. We consider the impact of these developments on strategic planning and point to the dynamics of self-service in strategy-as-practice as a direction for future research.

Thirdly, this paper builds on knowledge management, which we define here through management information systems, DSSs, and business intelligence. While we acknowledge the role of BI technologies in the knowledge management process, the main focus here is on the interplay between strategic practices and BI technologies. Figure 1 synthesizes the theoretical concepts utilized in this article.

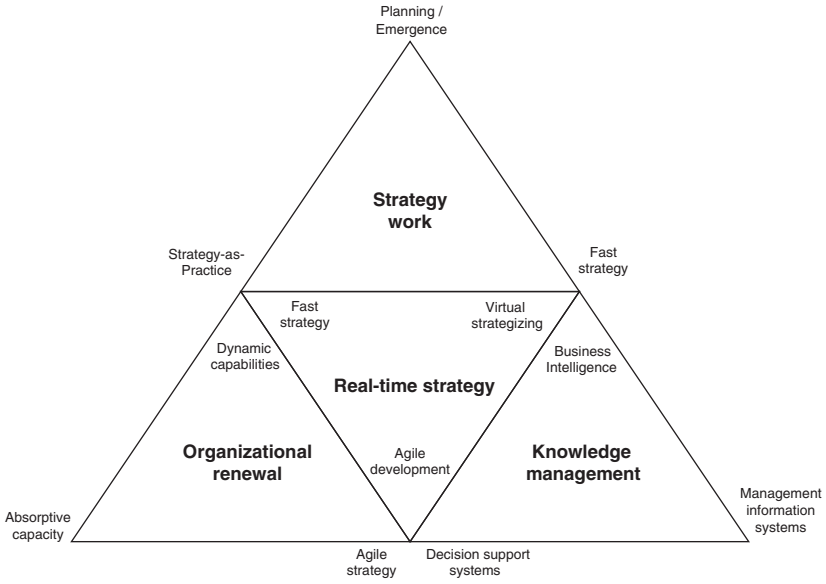


**Fig. 1** Real-time strategy building on established concepts

## Dynamic Capabilities

As a broader, umbrella concept, the strategy literature uses dynamic capabilities, which refers to a firm-level renewal enabled by the capacity to reconfigure processes, systems, and resources. More precisely, dynamic capabilities are often delineated as a "firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece et al. 1997: 516). Further, "dynamic capabilities can be disaggregated into sensing, seizing, and transformational activities" (Teece 2007: 1344). According to Winter (2003: 91), if a capability to change is to be interpreted as a dynamic capability, the capability for renewal and reconfiguration must be deeply embedded into organizational routines; thus, ad hoc problem solving would not constitute a dynamic capability. The literature that identifies the characteristics of companies with dynamic capabilities cites issues such as high relative share of R&D investments, and the number and significance of new patents (e.g., patent citations) over time. Other important characteristics highlighted include an ability to expand into new business, product, and service areas profitably, and a capacity to effectively develop new ecosystems and utilize partnerships and strategic networks. Given these characteristics, developing dynamic capability is no easy feat for a firm. Consider Google for instance, the firm maintains high levels of R&D investment to back its growth into new business areas, but still derives its biggest revenues and profits from advertising. Certainly, despite the challenges of making profits in new, far-reaching business areas, Google could be considered a company with the capability for renewal and reconfiguration, and as one of the most successful innovators around; Google also exemplifies a corporation with dynamic capabilities. Reflecting the main ideas of firm renewal, the dynamic capability literature concentrates on a firm's capacity to reconfigure resources when the market environment is changing. There has been less focus on a firm's ability to reconfigure when the resources available are themselves changing, as with the increasing data literacy and self-service capabilities described above.

The aspects central to the dynamic capability view include strategic renewal, organizational learning, absorptive capacity, and strategic learning. Examining the link between renewal and organizational learning,

Crossan et al. (1999: 522) stated: "Organizational learning can be conceived of as a principal means of achieving the strategic renewal of an enterprise." Learning has long been at the center of organizational renewal and change. Prior studies apply the constructs of absorptive capacity, organizational learning, and strategic learning almost interchangeably. Whereas absorptive capacity emphasizes the outside-in process, organizational learning concentrates on the learning process within the company, and strategic learning—building on Minzberg's (Mintzberg and Lampel 1999; Mintzberg and Waters 1985) work on strategic emergence—highlights the strategic role of learning (Kuwada 1998; Sirén et al. 2012). Learning can be seen as a central mechanism within strategic emergence, where strategy is formed in everyday actions, where strategy is what the organization does, and where strategy is developed through incremental and radical steps and is something lacking precise planning (Burgelman 1991; Kuwada 1998; Mintzberg and Lampel 1999). Alternatively, a path-dependent strategy based on incremental learning may also create organizational inertia (Burgelman 1991), as the existing and historically acquired competencies cherished by the organization can create a learning trap. In that case, incremental, exploitative development constrains effective adaptation to environmental changes, and the organization becomes trapped by its past success, history, and developed competencies, and processes, as highlighted by Andy Grove (Intel's then CEO) in Burgelman's (1991: 251) interview:

> Don't ask managers, "What is your strategy?" Look at what they do! Because people will pretend….The fact is that we had become a nonfactor in DRAMs, with 2–3% market share. The DRAM business just passed us by! Yet, in 1985, many people were still holding to the self-evident truth that Intel was a memory company. One of the toughest challenges is to make people see that these self-evident truths are no longer true.

This may resonate with Nokia following the corporation's experience of being trapped by its commitment to the Symbian operating system and the cheap-smartphone market. Table 1 highlights the definitions applied in prior studies.

**Table 1** Concepts of organizational learning, absorptive capacity, and strategic learning as defined in the prior literature

| Authors | Concept | Definition | Dimensions |
|---|---|---|---|
| Crossan et al. (1999) | Organizational learning | The 4I framework of organizational learning contains four related (sub)processes—intuiting, interpreting, integrating, and institutionalizing—that occur over three levels: individual, group, and organization. The three learning levels define the structure through which organizational learning takes place. The processes form the glue that binds the structure together; they are, therefore, a key facet of the framework. (p. 524) | Intuiting<br>Interpreting<br>Integrating<br>Institutionalizing |
| Zahra and George (2002) | Absorptive capacity | ACAP as a set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability. (p. 186) | Knowledge acquisition<br>Knowledge assimilation<br>Knowledge transformation<br>Knowledge exploitation |
| Sirén et al. (2012) | Strategic learning | Defines strategic learning as an organization's dynamic capability, consisting of intraorganizational processes for the dissemination, interpretation, and implementation of strategic knowledge (p. 19) | Knowledge dissemination<br>Knowledge interpretation<br>Knowledge implementation |

The ideas in the present chapter draw on the concept of absorptive capacity, combining the content of absorptive capacity with knowledge management (or management information systems) and strategy-as-practice. For absorptive capacity, we utilize the model developed by

Zahra and George (2002) utilizing four phases of knowledge absorption: acquisition, assimilation, transformation, and exploitation. To benefit from *knowledge acquisition*, an organization needs to decide on the purpose for which the data are collected and choose the measures to be used to collect the data. Despite the amounts of data being collected, organizations are not always clear on what to do with all the information they acquire. The literature on absorptive capacity highlights the scope of such a knowledge search and portrays how an organization might refer to its strategy to define that scope. Without a clear strategy and measures, an organization can end up collecting data without purpose and consequently be unclear about what to do with it. For the purpose of business intelligence, we suggest a framework that could build on the dimensions and measurements of the framework presented in Fig. 3 (The business intelligence framework).

*Knowledge assimilation* concentrates on the interpretation, comprehension of, and learning available from the collected data. Hence, in this phase an organization gains an understanding of those observations made from the objects of study. Here, we include the data analytics, organizational interactions, and sensemaking that enable the organization to understand and attach the new data to the existing knowledge structures, thus providing material for decision making and enabling decisions to be made. The *knowledge transformation* phase focuses on turning knowledge into new decisions, activities, and investments. In this phase, knowledge is developed or transformed into concrete forms that can aid the implementation of product, service, or process development initiatives. In the final phase—*knowledge implementation*—knowledge is stored, and decisions are implemented. The implementation takes the form of the launch of new products, services, processes, and systems, and their utilization in the market. Studies highlight the importance of following up the achievement of strategic targets and rewarding staff for their achievements.

## Strategy Work

As the assumption of continuous company renewal strengthens, the borders between the strategic, the tactical, and the operative can be seen to

be diminishing somewhat. The literature concerning the process through which strategies are formulated is developing through three stages and schools: strategic planning, strategy processes, and strategy-as-practice. For the planning school (Andrews 1971; Ansoff 1965), strategy is very much forward looking, involving rigid planning processes, and is something implemented by strategic analysts and programmers. Strategic planning is seen as close to programming, being based on careful analysis, decision making, and implementation. The boundaries between analysis, decisions, and implementation are clearly defined and the rational, planned strategy is mainly thought of as an issue concerning the top management. Its critics accused the planning school of almost killing strategic planning as we know it (Mintzberg 1994; Taylor 1997), although this may have been an exaggeration at the time (Vaara and Whittington 2012). Since the 1970s, the strategy process school has moved the thinking on strategy formulation toward less bureaucratic forms. The strategy process literature brought an emphasis on strategic adaptation, staff participation, and to a lesser extent, strategy implementation, with quantitative analysis (Hutzschenreuter and Kleindienst 2006). The process school also highlighted the role of environmental changes and organizational adaptation. A sub-stream of literature considered strategy as contingent on the environment (Burgelman 1991) and had earlier suggested that the structure should follow the strategy (Chandler 1962). The environment-strategy-structure fit, therefore, requires a simplified model to express the basis of this interplay. Accordingly, illustrating potential components in the dimensions of the business environment, company strategy (e.g., Porter 1980), and value system organization (e.g., Williamson 1985), this chapter provides a contingency theoretical framework (Lawrence and Lorsch 1967) to consider the potential configurations of the environment-strategy-structure fit (see Fig. 2). While stopping short of offering a universally applicable explanation of how organizations should make decisions in certain circumstances, the framework does enable an organization to consider potential combinations of components, and it also illustrates how strategic agility facilitates the search for the optimal environment-strategy-structure configuration. The list of components utilized in Fig. 2 is not exhaustive by any means, but a collection of well-established concepts to frame and convey the main idea of the approach.

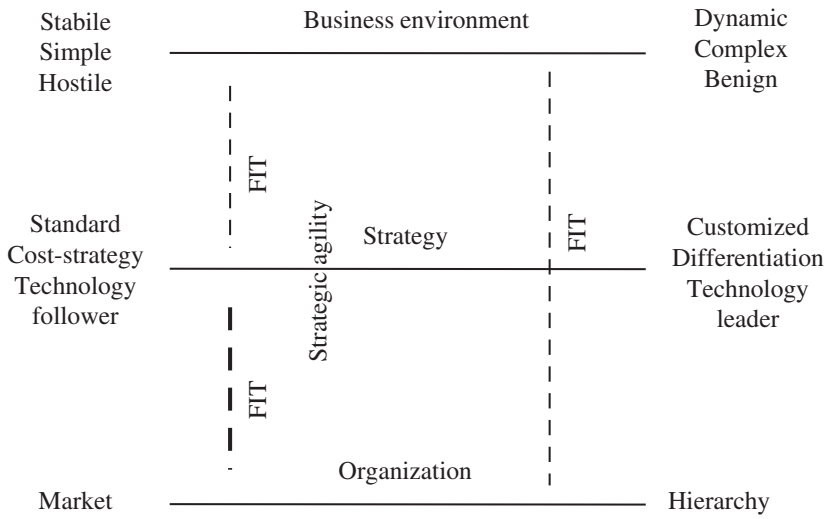


**Fig. 2** Environment-strategy-structure fit

Finally, extending and challenging the research in the strategy process tradition, strategy-as-practice, have concentrated on the micro-level practices of strategy, emphasizing the role of practitioners, practices, and praxis. Strategy-as-practice emphasizes the role of middle managers in strategy work, while also directing attention to the strategic work conducted by individual managers. These studies can be useful from the perspective of business intelligence and information systems in that they explore how managers and management teams use information systems in strategy work.

## The Concept of Strategic Agility

Prior research has utilized several different concepts that establish the ground of the discussion on company renewal (Agarwal and Helfat 2009; Volberda et al. 2001). Those concepts include agile strategy (Doz and Kosonen 2008a, b), fast strategy (Doz and Kosonen 2008a, b; Eisenhardt 1989), strategic flexibility (Evans 1991), strategic learning

**Table 2** Definitions of strategic agility and related concepts

| Author | Concept | Definition |
|---|---|---|
| Brueller et al. (2014) | Strategic agility | Strategic agility as the capacity of making knowledgeable, nimble, rapid strategic moves with a high level of precision |
| Fredericks (2005: 558) | Strategic flexibility | …is initiated in response to market opportunities and changing technologies (Sanchez 1995) that have a significant impact on firm performance |
| Fredericks (2005: 558) | Operational flexibility | …the ability of an organization to deal with short-term fluctuations in demand, labor and raw materials shortages, or equipment failure |
| Johnson et al. (2003) | Market-focused strategic flexibility | Market-focused strategic flexibility is a firm's dynamic resource-based capabilities derived from resource identification, acquisition, deployment, options identification, and recognition |
| Yuan et al. (2010: 301) | Strategic flexibility | …firm's capability to identify changes in the environment, to quickly commit resources to new courses of action in response to changes, and to act promptly when it is time to halt or reverse such resource commitments |
| De Leeuw and Volberda (1996: 134) | Flexible organization | Flexible organization asks for a willingness to shift, flex and change, and at the same time for an unconditional commitment, concern, and loyalty to the organization |

(Sirén et al. 2012), absorptive capacity (Cohen and Levinthal 1990; Zahra and George 2002), and organizational learning (March 1991). These concepts have been applied in a variety of contexts, such as at the firm (Sambamurthy et al. 2003), relationship (Huikkola et al. 2013), or supply chain level (Hoek et al. 2001). Table 2 provides a series of definitions of the concept of strategic agility and the related concepts. The concept of strategic agility itself seems to be applied in a vast range of research, spanning that on strategic management (strategic agility, strategic flexibility), information systems (agility, flexibility of information systems), organization (Strategic flexibility, organizational agility),

marketing (strategic adaptability, strategic flexibility), and production management (agile manufacturing strategy, manufacturing flexibility). Although the concept of strategic agility has been advanced by different disciplines, the main emphasis remains unchanged—the need to react to the changes in the market environment. Where strategy, marketing, and organizational studies emphasize a firm's capacity to identify market changes, and the assimilation and implementation of knowledge, the production economics approach tends to highlight the flexibility of manufacturing systems and agile manufacturing. The literature on IT systems highlights their role in facilitating flexible order-deliver processes.

As strategy is formulated and reformulated through organizational decisions and actions, it is constantly changing and is thus adaptive. New strategy tools and facilitating information systems should be developed over time to implement strategic agility throughout the organization. Business intelligence systems might provide answers to the question of strategic agility, if organizations learn how to effectively utilize such systems.

## The Concept of Business Intelligence

Today's firms are more data driven than ever before, because the Internet facilitates more effective collection, development, and utilization of data. For instance, Google, one of the iconic companies of the age of digitization, defines its decision making as being centrally data driven:

> We're a data-driven company. At Google, you really don't walk into a meeting talking about your gut feel on something. You need to have the data to back it up. And so data is another key tenet of what's made our decision making really successful. (Jon Kaplan, VP, US Sales and Operations, Google; McKinsey & Company 2015: 1)

The information systems that support management in making decisions have given rise to several expressions adopted in recent studies. Those terms include knowledge management, business intelligence, man-

agement information systems, DSSs, executive information systems, and knowledge management systems. Here, business intelligence is understood as deriving from a DSS that stores, analyzes, and communicates information to guide top and middle managers and management teams in their strategic decision making. Information systems provide storage, processing, and communication power, which can be utilized in the development of strategic knowledge.

Typical BI systems intend to (1) provide a single view of an organization, (2) facilitate communication, and (3) facilitate organizational development (Ramakrishnan et al. 2012). The mechanisms through which the information system produces positive outcomes have been modeled simply, disclosing the necessary moderators as contingencies: system quality → information quality → use → user satisfaction → individual impact → organizational impact (DeLone and McLean 1992).

However, more recently, BI systems have in practice moved to facilitate a self-service approach, enabled in large part by user experiences that bring within the reach of non-specialized business users previously complex problems of modeling metadata, data transformation, and complex aggregation that were strictly in the domain of the Information Technology department. Although this change has attracted little formal research, the market dynamics are already clear and appear to be driven by greater user satisfaction. Firms still face the challenge of moderating either a single view of the organization or finding a method suitable for resolving contrasting, or even contradictory, views developed by individual self-serving users. Nevertheless, despite the significant changes in practice that this new approach involves, the key driver for adoption of these systems remains the development of tactical and strategic decision making and collaboration, driven by data. With regard to the scientific terms, very little is known about the interplay between information systems and strategy, that is, what types of micro-practices are utilized with information systems. These fields of research, such as DSSs, and strategy do not seem to have any interaction.

Figure 3 presents a framework for business intelligence suggesting the dimensions that might be utilized when collecting, assimilating, transforming, and exploiting data to support decision making in a top

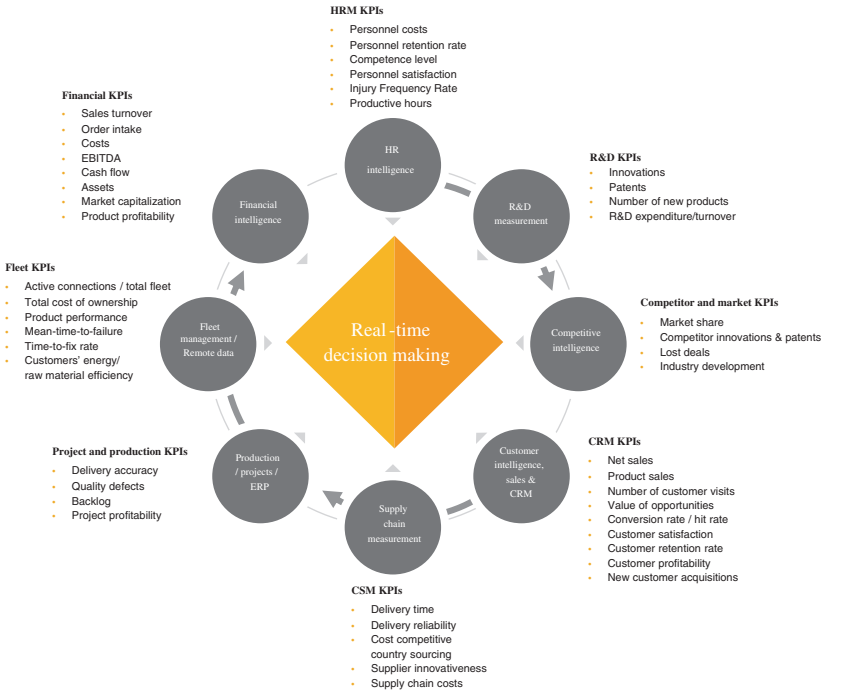


**Fig. 3** Business intelligence framework

management team and at a middle-management level. Reflecting the core functions in a technology company, the framework provides measures for different dimensions, such as finance, customer relationship management (CRM), competitive intelligence (CI), R&D, production systems, supply chain management (SCM), human resource management (HRM), and fleet management. The figure uses the dimensions to provide an overview of the scope of decision making, and the applied measures, suggesting that these measures could be used for target setting, follow-up on strategic initiatives and implementation of investments, and setting reward policies by the management team. The framework presented can serve as a tool for real-time strategic management. Each dimension in the figure integrates some main measures used by the case companies studied when developing these frameworks.

Moreover, the framework should prove useful for middle management, who could use the knowledge collected by these measures to manage a department.

## Aligning Strategic Practices and Bi Technologies

The existing literature on strategic agility portrays strategy as closely related to absorptive capacity, which provides a central process for business intelligence, because business intelligence is about the effective utilization of external and internal knowledge for decision making and implementation. The process of business intelligence, that involves collecting, extracting, transforming, and loading data (ETL) for data mining and analysis, is strongly influenced by the practices related to strategy work. Hence, as illustrated in Fig. 4 below, we intend to align

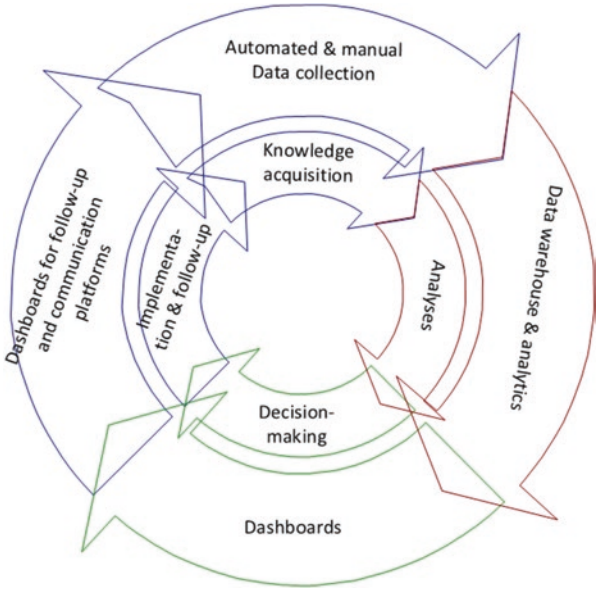


**Fig. 4** Aligning strategic practices and BI technologies

**Table 3** Alignment between strategic practices and BI technologies

| Knowledge creation process | Enabling practices | Enabling technologies |
|---|---|---|
| Knowledge acquisition | Decide on measures and frameworks<br>Design data collection<br>Use frameworks to collect data<br>Use both qualitative and quantitative data<br>Collect variety of information<br>Store the data | Data sources (external data sources, internal databases) |
| Knowledge assimilation | Share knowledge within the organization<br>Provide access for a variety of managers<br>Develop knowledge further maintaining the links to raw data | Extract, transform and load<br>Data warehouses |
| Knowledge transformation | Develop collected knowledge<br>Utilize knowledge for decision making<br>Utilize knowledge for product/service development<br>Transform knowledge into new ideas | Online analytic processing<br>Dashboards<br>Spreadsheets |
| Knowledge exploitation | Provide implementation activities and schedule for the organization<br>Lead the knowledge implementation through interactions<br>Provide the required targets and support | Complex event processing engines<br>Dashboards<br>Spreadsheets |

the strategic practices (inner circle), and the facilitating BI systems—so-called enabling BI technologies (outer circle). These are clarified further in Table 3.

Firms need all the complementary capabilities to support successful knowledge absorption. The search for competitive advantage may be limited by the organizational inertia emerging from the path dependency of the organization. As important as organizational capabilities are, they may turn into core rigidities, limiting the organization's ability to adapt to changes in the environment. Sometimes companies are trapped

by their past success or resources and become incapable of un-learning and removing organizational learning traps (Sirén and Kohtamäki 2016). Thus, most organizations are somewhat limited by their past as well as the capacity to absorb and utilize knowledge. Table 3 illustrates how strategic practices and enabling BI technologies are aligned.

## Directions in User Experience and Future Developments

Two of the most significant changes in the business environment for business intelligence are the increasing data literacy of a new generation of employees and the trend toward self-service user experiences in commercial software. In the past, only IT departments could deploy the expensive storage and computing power needed for effective analytics. Indeed, only IT understood the technical issues and, very importantly, only IT could secure the data and the resulting analysis to ensure the right people had the right insights.

In truth, there was always a dark side to this model. When developers struggled to manage the analytics life cycle quickly enough for agile businesses, business users simply used spreadsheets as a merely adequate tool, often copying or exporting from reports for further analysis. In such cases, there was no shared view of the organization, no agreement on key measures, and no formalized schedule of implementation or testing. As a result, although information collection and knowledge sharing happened in practice, weak analyses or even sharing of confidential data could proliferate in the wings of an organization. It was also difficult for organizations to realign with knowledge acquired and shared in this way, as there was no formal paper trail enabling a structured review of the data behind decisions or the strategic effectiveness of choices made.

More recently developed self-service BI technologies are now in the mainstream of enterprise analytics. These tools primarily use visualization to enable users to find patterns and communicate insights easily and effectively. In-memory storage brought data handling and computing power to the desktop that was once only available in the carefully

managed server room. While these tools are within reach of many business users, more data-literate employees may find they have a significant advantage in agile decision making (and therefore agile strategizing) through the use of these tools and their consequent ability to build persuasive, data-driven arguments.

In practical terms, we should first recognize that the classic BI architectures we have described will still deliver *mission-critical decision support*. For example, the enterprise data warehouse, with its consolidated metadata model, will be with us for year-on-year consolidated financial reporting, tax analysis, human resources analysis, and other well-defined, strategic analysis. In this model, IT provides the full life cycle of analytics. Administrators secure the systems, offering data access as needed and as permitted. IT departments, in short, take on a serious role as gatekeepers.

In the self-service environment, IT departments may move from being gatekeepers to being something akin to shopkeepers. A gatekeeper aims to keep the wrong people out, while a shopkeeper invites the right people in, preparing, presenting, and provisioning their goods to encourage appropriate use. In IT terms, a data provisioning team can rapidly and effectively build models designed for business users to serve themselves from. Rather than opening the gate to give users access to source systems, a functional team can instead provision data out toward the users: cleaned, consolidated, and even anonymized as necessary for effective analysis and good governance. In this model, what the IT function does not need to do is to prepare every source for a specific use: the business analysts use their own tools—perhaps even according to personal preference—to help themselves to those solutions. IT monitors the use of these models and, with the help of automation, can iterate new sources, extensions, and enhancements with greater agility compared to having to rebuild the entire analytic supply chain for every change.

In this supply chain model, where the IT function acts akin to a shopkeeper, it still plays the major role in ensuring compliance. Its oversight responsibilities include managing the deployment, user permissions, server performance, and scaling of the self-service environment. But IT must also understand what data sources analysts use, who they

share their apps and visualizations with, and how the data is prepared and refreshed. We look forward to seeing future research in this area. It will be important to explore the user experiences that enable both the IT and business user side of this equation to function well. This should include a thorough understanding of the role of mobile and touch technologies in decision making. Moreover, the impact of this greater organizational independence on organizational flexibility merits more attention.

## Synthesis

In the context of development increasing apace, digitization sets a challenge for companies to adapt to the changes in the environment. This chapter sets out to utilize strategy-as-practice, organizational renewal, and business intelligence research to illustrate the challenges faced by technology companies. From the perspective of organizational renewal, or dynamic capabilities, our paper highlighted the role of absorptive capacity, and the capability to acquire, assimilate, transform, and exploit knowledge effectively. Absorptive capacity was complemented by the strategy process and strategy-as-practice literature, suggesting a micro-practice of strategy work, through which companies continuously tend to craft strategies. Our approach aligns with strategy-as-practice in considering strategy as something that companies do (Whittington 2006). It follows that the management information systems employed, such as business intelligence systems, should support the everyday decision making conducted at the top- and middle-management levels. In accordance with prior studies, we emphasize the role of middle management in crafting and implementing strategy. Hence, the BI system and the user interface should support the work at the middle-management level.

This chapter develops and discusses the concept of real-time strategy, by which we mean strategic practice bolstered by almost-real-time information to support particularly effective management of the

organization. We consider the concept to involve a physical, and/or, virtual space that enables the effective review and modification of the received, stored, and processed information, which is aligned with the strategy and measurement framework developed according to contingencies (such as the characteristics of the business environment) and which creates the basis for the top- and middle-management decision making and the implementation of those decisions. We envisage the concept of real-time strategy being implemented through BI systems enabling interaction with the data on a real-time basis at the top- and middle-management levels. While the current BI systems provided by software suppliers offer opportunities for effective utilization of data in decision making, it is obvious that these capabilities will be stretched further in the future. Therefore, companies need to pay attention to the quality of the collected data and operate strategically when selecting the measures utilized to ensure they support the firm's business targets.

Building on the research conducted for this study and prior research on strategy-as-practice, organizational renewal, and business intelligence, some managerial guidelines can be presented for improved real-time strategic management:

- Design a strategy and BI system to guide the process of knowledge absorption.
- Clarify strategic logic and a few measures to guide management at different organizational levels.
- Collect knowledge for a purpose; know what you are doing it for.
- Ensure to/continuously develop data reliability and validity.
- Provide data and tools for self-service analytics where appropriate.
- Develop a single user interface utilizing reliable data for mission-critical decision making.
- Make decisions and design simple guidelines for knowledge implementation.
- Manage knowledge implementation and exploitation effectively.

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## Authors' Biography

**Marko Kohtamäki** is a Professor of Strategy and a Director of the "Networked Value Systems" (NeVS) research program at the University of Vaasa. Previously he worked as Head of Department of Management as well. Prof. Kohtamäki also works as a Visiting Professor in the Luleå University of Technology and takes special interest in industrial service business or servitization, strategic practices, and business intelligence or management information systems in technology companies. He has published in several distinguished international journals, such as Strategic Management Journal, Industrial Marketing Management, Technovation, Journal of Business Research, and Strategic Entrepreneurship Journal. Kohtamäki has served as a project director in large-scale research projects, such as "Future Industrial services" and "Solutions for Fleet Management."

**Donald Farmer** is the Principal of TreeHive Strategy, a strategy consulting firm based in Seattle. Donald is an internationally respected thinker in the fields of data analysis and innovation, with over 30 years of experience. His background is very diverse, having applied data analysis techniques in scenarios ranging from fish-farming to archeology to advanced manufacturing. He has worked in award-winning start-ups in the UK and Iceland and spent 15 years at Microsoft leading teams designing and developing Business Intelligence products. Donald also worked as the Vice President of Innovation and Design at Qlik Technologies, during which time the firm was recognized as one of Forbes Top 10 Innovative Growth Companies. He is an advisor to globally

diverse government agencies and investment funds on data and innovation strategy. He also advises several start-ups worldwide, developing products and services ranging from restaurant management software in the Philippines to graph database analytics in Silicon Valley. He mentors individuals from junior inside sales reps to globally focussed executives. Donald lives with his wife, Alison, an artist, in an experimental woodland house in Seattle.

# Business Intelligence—Capturing an Elusive Concept

Yassine Talaoui, Marko Kohtamäki and Rodrigo Rabetino

## Introduction

In their search for competitive advantage, company executives' need improved real-time knowledge with regard to their internal organization and external business environment to rapidly adapt to changing circumstances (Howson 2014). That means companies need improved business intelligence systems to deliver optimal strategic decision making. However, firms have faced increasing challenges in trying to utilize business intelligence (BI) systems to deliver effective acquisition, assimilation, and implementation of knowledge. While producing endless amounts of data, companies face challenges

Y. Talaoui (✉) · M. Kohtamäki · R. Rabetino
University of Vaasa, Vaasa, Finland
e-mail: yassine.talaoui@uva.fi

M. Kohtamäki
e-mail: mtko@uwasa.fi

R. Rabetino
e-mail: rodrigo.rabetino@uva.fi



M. Kohtamäki (ed.), *Real-time Strategy and Business Intelligence*,
DOI 10.1007/978-3-319-54846-3_3

in assimilating and exploiting data in strategic decision making. In addition, previous research has examined the impact of environmental (Ebrahimi 2000; Boyd and Fulk 1996), organizational (Ramakrishnan et al. 2012; Yasai-Ardekani and Nystrom 1996; Maltz and Kohli 1996; Qiu 2008), and managerial antecedents (Cho 2006; Elbashir et al. 2011; Babbar and Rai 1993) on business intelligence. The fragmented nature of BI research, however, leads to research focused on the operational and the tactical level (Li et al. 2008; Qiu 2008; Fleisher et al. 2008). Such research flags technological changes and not only tends to emphasize best practice, but also tends to overlook the strategic dimension (Li et al. 2008; Qiu 2008; Fleisher et al. 2008).

Moreover, the extant literature is a mixture of overlapping, if not competing, concepts: environmental scanning; the Executive Information System (EIS); competitive intelligence (CI); and BI. The proliferation of such concepts fosters discrepancies between the intelligence needed and that offered, and exacerbates the challenge associated with the measurability of the added value of the intelligence. To date, there is little or no evidence confirming the usage of any intelligence process capable of providing measurable, actionable intelligence that bolsters executives' strategic decision making. To develop managerial insights from the existing business intelligence research, the present chapter reviews the existing literature on business intelligence and thereby improves our understanding of the matter.

## Theoretical Foundation

The business intelligence literature is multidisciplinary in nature. The inception of BI can be traced back to environmental scanning (ES) grounded in the strategic management research (Hofer 1978), competitive intelligence dominated by the marketing discipline (Wright et al. 2009; Dishman and Calof 2008), and the EIS drawn from decision support systems pegged to information management (Singh et al. 2002; Leidner et al. 1999; Walters et al. 2003). During the 1970s and 1980s, environmental scanning dominated the field until it was overshadowed by competitive intelligence. With the advent of the

internet, research on business intelligence was built around the concepts of Executive Information System and Decision Support system, before it was replaced by the specific term BI following the suggestion of Howard Dresner in 1989.

Traditionally, environmental scanning was the first link activity through which firms could comprehend their environment and remain on top of any changes (Hambrick 1981). Because firms' actions are constrained by their external environments (Brownlie 1994), the sustainability of competitive advantage hinges on the monitoring of events occurring in the external environment. However, the information collected through environmental scanning is not valuable unless it is matched with a thorough evaluation and analysis. Consequently, the competitive intelligence research stream adopted a four-phase process (comprising planning, collection, analysis, and dissemination) to identify, examine, evaluate, and communicate intelligence to decision makers (Wright et al. 2009; Dishman and Calof 2008). Nevertheless, both environmental scanning and CI schools of thought overlooked the internal analysis of a firm. The external environment, with its opportunities and threats, captivated scholars of both streams and overshadowed the appraisal of firms' internal strengths and weaknesses. Upon the emergence of the EIS in the late 1980s, executives were able to retrieve internal and external information through BI technologies that swiftly became capable of integrating large volumes of multisource data and providing intelligence for an organization's decision makers (Turban et al. 2010; Chaudhuri et al. 2011). Subsequently, BI would constitute a new research stream motivated by the development (and upgrading) of what are commonly referred to as BI applications or technologies.

## Delineating the Business Intelligence Concept

Based on the selected literature, Table 1 provides a summary of the definitions associated with each concept. Though such concepts are considered separately within the collected literature, addressing the complementarity between the four strands of research is a sound contribution of this chapter.

**Table 1** Definitions of the four concepts of BI

| Concept | Definition | Authors |
|---|---|---|
| Environmental scanning | The *acquisition of information* regarding the happenings in the external environment of a firm. | Lau et al. (2012), May et al. (2000), Wei and Lee (2004), Fabbe-Costes et al. (2014), Ebrahimi (2000) and Cho (2006) |
| Competitive intelligence | A *process of* intelligence creation involving planning, information collection, analysis, and dissemination of intelligence which is the *product* that CI represents. | Calof and Wright (2008), Liu and Wang (2008), Fleisher (2008), Xu et al. (2011), Mariadoss et al. (2014) and Fleisher et al. (2008). |
| Business intelligence | A *process* that transforms internal and external data into knowledge and communicates it to the business user via a set of *applications.* | Ramakrishnan et al. (2012), Cheung and Li (2012), Moro et al. (2015), Elbashir et al. (2011), Popovič et al. (2012) and Zheng et al. (2012) |
| Executive information System | A *computerized system* that provides data access and analysis capabilities to executives. | Singh et al. (2002), Leidner et al. (1999) and Walters et al. (2003) |

*Source* Author's own

## Environmental Scanning

The available definitions illustrate a shared conceptual meaning regarding the nature of environmental scanning as an activity that ends once the external information (i.e., on the market, competitors, customers, suppliers) has been collected. The purpose of this concept—also known as peripheral sensing or peripheral vision—is to assist executives to proactively scan a rapidly shifting environment (Lau et al. 2012; Wei and Lee 2004; Cho 2006; Fabbe-Costes et al. 2014). However, the lack of a comprehensive framework to effectively depict shifts at the periphery combined with the bounded rationality of executives renders

environmental scanning a complex task (Haeckel 2004; Fabbe-Costes 2014). In the absence of a formal rational mechanism to interpret the events surrounding organizations, environmental scanning will inevitably involve a subjective evaluation influenced by executives' cognitive systems. Paradoxically, studies, herein, focused more on the influence of environmental uncertainty on executives scanning behavior, rather than the factors explaining and regulating such uncertainty (Haeckel 2004; Fabbe-Costes 2014). On the other hand, environmental scanning was repeatedly presented as an activity generating information appropriate for input into the strategy formulation or decision-making process (Lau et al. 2012; May et al. 2000; Wei and Lee 2004; Ebrahimi 2000; Cho 2006; Fabbe-Costes 2014). Notwithstanding its paramount importance, environmental scanning is not apt when reality sets in, for piles of data lacking appropriate analysis are undoubtedly unhelpful. To date, environmental scanning is yet to be associated with proper analysis heuristics that ensures data manipulation to deliver enhanced real-time decision making (O'Reilly and Tushman 2002; Brown 2004).

## Competitive Intelligence

A look at the CI literature reveals a multifaceted concept rooted in environmental scanning (Calof and Wright 2008). Albeit eclectic, the definitions of CI distinguish between two research streams: CI as a product and CI as a process. The former regards CI as the intelligence product or knowledge relating to both the remote and task environment delivered to the business user (Slater and Narver 2000; Zheng et al. 2012; Xu et al. 2011); the latter considers it as a sequential activity through which intelligence is funneled to support organizational objectives (Wright et al. 2009; Dishman and Calof 2008; Liu and Wang 2008; Fleisher 2008). In reality, such distinctions merely benefit the researchers' purpose. If viewed as a product, the generation of ready-to-use CI, from open or human sources, becomes the center of the debate; if viewed as a process, attention shifts toward the transformation of acquired information into usable intelligence. As such, this research stream stresses the necessity of analysis; yet, for the most part, it remains prescriptive.

## Executive Information Systems

The computerized decision support system (DSS) that CI analysts use to collate the intelligence requested by executives prompted the design of an EIS to retrieve information on internal operations and the business environment (Leidner and Elam 1993). That said, the definitions of EIS found in the literature reveal a consensus among scholars vis-à-vis the nature and purpose of the DSS that ensures a two-way flow of information from subordinates to executives and vice versa, via a cross-organizational-integrated technology and customized user interfaces (Volonino et al. 1995; Belcher and Watson 1993; Walters et al. 2003). This system supports executive decision making with multisource data in a textual, graphical, or tabulated format through a user-friendly interface. This research seems focused on the EIS's graphical display and rapid access to consolidated external and internal data as opposed to the EIS underpinning technology that is still deemed intricate for the executive: the sole receiver of intelligence (Walters et al. 2003; Belcher and Watson 1993).

## Business Intelligence

It is worth highlighting the distinction between a system and bundle of technologies revealed by the study of the BI literature. Albeit BI technologies occupy a considerable part of the extant body of knowledge, it seems that a scholar's background—most being from the computer science or information management fields—influences the choice of perspective used to describe BI. The concept has been presented as comprising joint applications necessitating constant upgrading to overcome the challenges posed by the advent of Web 2.0 (Chen et al. 2012, 2002; Srivastava and Cooley 2003; Chung et al. 2005; Chau et al. 2007). In this context, most research appears oriented toward the technical issues related to the rising volume and complexity of data that challenges BI applications. That said, rather than evaluating the BI performance based on meeting the firm's requirements and the business users' needs (Lin et al. 2009), the common trend was the evaluation of proposed upgrades or prototypes, along with a customer satisfaction survey (Srivastava and Cooley 2003; Chung et al. 2005; Chau et al. 2007).

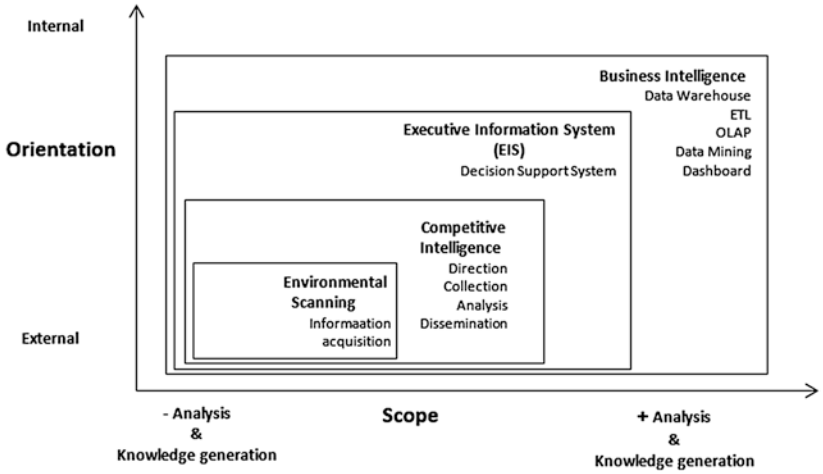


**Fig. 1** BI domain (adapted from Fleisher and Bensoussan 2003, 2007)

## Toward a Unified Definition of Business Intelligence

Although the foregoing literature generated overlapping concepts, there seems to be no holistic view linking the four related yet detached BI constructs. An overarching perspective on BI is illustrated in Fig. 1, where the BI domain is elucidated via two dimensions: environment and knowledge generation. The first level of BI encompasses environmental scanning externally oriented with rare analysis. This latter is part of the CI sphere and responsible for the scrutiny of the collected external information and intelligence dissemination, although it suffers from the lack of clear heuristics. On the other hand, EIS appears as the third level of BI, supporting the decision-making process with ease of access to both internal and external data. Finally, the BI concept that we introduce in this chapter is an all-embracing construct that comprises all of the above-mentioned concepts as sophisticated applications, not overlapping terms, to ensure real-time analysis and handling of multisource data to support real-time decision making.

To summarize, a careful scrutiny of the literature identified four research streams based on the conceptual approaches chosen by scholars to explore firms' BI-oriented practices, prescribe the optimal BI processes,

or dwell on the technical pitfalls and potential benefits of the BI system. Such a fragmented and operational-oriented body of knowledge draws from an overlapping set of definitions related to four concepts that form the strands of the BI research: environmental scanning, competitive intelligence, the executive information system, and business intelligence.

Hereafter, this chapter uses the four concepts listed above interchangeably to constitute a comprehensive definition of BI that embraces the interdependence between environmental scanning, CI, EIS, and BI. Accordingly, BI is defined as a system that uses computerized applications to collect, cleanse, store, and analyze internal and external data before they are transformed into substantive intelligence that is communicated to business users to support strategic and tactical decisions.

## Future Outlook

Today, business intelligence provides executives with the necessary technologies (data warehousing, online analytical processing (OLAP), data mining, extract-transform-load (ETL), dashboards, and user interfaces) to access a huge volume of unstructured data in a timely manner. The optimal usage of these loads of data is left in the hands of the business user, who often feels overwhelmed by the volume of information and confused by the complexity of BI terminology, only to realize later that BI over delivers in collecting data and under delivers in answering executives' queries.

Gartner (2016) claims that the caution and skepticism around business intelligence is noticeably hampering the investment in business intelligence software that is becoming absolutely vital in the face of intensifying digitization.

It should then be no surprise that BI topped the Chief Information Officers (CIOs) priority list in the Gartner (2016) CIO agenda survey. It is a position BI has occupied for five years now and the situation seems unlikely to change anytime soon as CIOs reported; in the same survey, they expected their firms' digital revenues to increase to an average of 37% of the total revenues during the subsequent five years. If this expectation proves correct, servers will be flooded with data demanding

conversion to valuable actionable intelligence. Although this logic explains business intelligence topping a CIO's list of priorities, it draws attention to a salient aspect of this equation: the transformation of data to actionable intelligence, which in turn closes the gap between executives' expectations and reality and delivers the desired return on the investment in business intelligence technology.

Furthermore, the IDC's digital universe study 2020 revealed that the amount of data deemed useful by executives did not exceed 20%, whereas no more than 5% was actually exploited. This surprising fact points to massive volumes of data being lost every year in the digital universe that companies could have benefited from to boost their return on investment. According to a study conducted by the University of Texas at Austin, a 10% increase in the usability of data could translate to $2.01 billion of incremental revenue. Similarly, a study conducted by Brynjolfsson et al. (2011) from the Massachusetts Institute of Technology (MIT) suggests that data-driven decision-making can add 4% to an organization's productivity and 6% to its profitability. Although alarming, this correlation clearly ascribes a significant monetary value to the proper analysis of data, which to date remains by far the most significant bottleneck hindering the spread of business intelligence. This in turn engenders frustration among executives, as exemplified by only one in four respondents to a Domo and Businessintelligence.com (2013) survey stating that information in their reports met their expectations, while only 9% asserted their reports contained factual actionable intelligence.

In the midst of it all, 30 years of research turned out quantity of papers seeking new ways for optimizing technologies capable of integrating unstructured and structured data, which unless they are analyzed cannot offer support to decision makers.

Gartner (2016) estimates the business intelligence market amounted to $16.9 billion in 2016 and is predicted to grow at a steady annual rate of over 5%. Ultimately, investing in state-of-the-art technologies to elicit meaning from internal and external data is necessary for companies to succeed in today's tumultuous environment. However, if executives decide such technologies are no longer an efficient means to deliver competitive advantage, the continuous investment in updating and developing the BI arsenal will eventually cease.

## Conclusion

In today's business environment, where the sustainability of competitive advantage is a moving target, room for intuition is shrinking as the need for rational predictability is growing. Data lacking proper analysis can generate no value, and sadly the International Data Corporation (IDC) predicted in 2014 that many firms will continue to waste 80% of the data they collect with the current business intelligence software. The IDC (2014) does, however, also suggest that organizations that incorporate diverse analytical tools and harvest data from a variety of sources enjoy a project success rate five times higher than firms that do not. To date, executives still face the challenge of discrepancies between needed and offered intelligence, and must address the issues surrounding the measurability of the benefits/costs associated with its implementation. This chapter argues that this state of affairs is due primarily to the choice of disparate definitions that lead to a fragmented literature, which continues to overlook strategic thinking. Despite its eclecticism, the BI research is far from exhaustive. With its roots in environmental scanning and branches in competitive intelligence, the available BI literature contributes to the enrichment of our knowledge of BI; yet it collapses under scrutiny of its strategic outcomes. This chapter, therefore, endeavors to direct scholars' attention to the strategic role BI should play to justify its cost. This chapter sheds some light on how the field is developing, and should encourage researchers to adopt an overarching view of BI that facilitates real-time decision making and strategic learning (Mintzberg and Lampel 1999) through a practical user interface.

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## Authors' Biography

**Yassine Talaoui** is a Ph.D. candidate and teaching assistant in the Management Department at the University of Vasa, where he teaches business models and strategic management. His research interests focus on delineating relationships between business intelligence and strategy research and work. He currently serves as a project researcher in DIMECC-S4FLEET project aiming the creation of a measurement tool of business intelligence that would permit CEOs to determine the exact value of the intelligence effort and product to better supplement their decision-making process. Prior to research, Yassine accumulated five years of consultancy under his belt in services, automobile, and airline industries.

**Marko Kohtamäki** is a Professor of strategy and a Director of the "Networked Value Systems" (NeVS) research program at the University of Vaasa. Previously, he worked as a Head of Department of Management as well. Prof. Kohtamäki also operates as a visiting professor in the Luleå University of Technology and takes special interest in industrial service business or servitization, strategic practices, and business intelligence or management information systems in technology companies. He has published in several distinguished international journals, such as Strategic Management Journal, Industrial Marketing Management, Technovation, Journal of Business Research, and Strategic Entrepreneurship Journal. Kohtamäki has served as a project director in large-scale research projects, such as "Future Industrial services" and "Solutions for Fleet Management."

**Rodrigo Rabetino** is an Assistant Professor of strategy in the Department of Management and a researcher in the Networked Value Systems research group at the University of Vaasa. His work has been published in such journals as Industrial Marketing Management, Journal of Small Business Management, Research-Technology Management, and Journal of Small Business and Enterprise Development. His research interests include industrial service business, servitization, business intelligence, and small business management.

# How Management Control Systems Can Facilitate a Firm's Strategic Renewal and Creation of Financial Intelligence

Tuomas Huikkola, Antti Koulumies and Ville Laukkanen

## Introduction

Deloitte, a multinational consulting company providing professional services, has stated in its report published in 2014 that "In today's highly competitive business environment, companies need more from Finance than accurate financial statements and reports. They need forward-looking, predictive insights that can help shape tomorrow's business strategy and improve day-to-day decision making in real time." Thus, strategic and dynamic resource allocation is vital for sustaining long-term profitability. The link between strategy and the finance function

T. Huikkola (✉)
University of Vaasa, Vaasa, Finland
e-mail: tuomas.huikkola@uva.fi

A. Koulumies · V. Laukkanen
Outotec Oyi, Espoo, Finland
e-mail: antti.koulumies@outotec.com

V. Laukkanen
e-mail: Ville.laukkanen@outotec.com



M. Kohtamäki (ed.), *Real-time Strategy and Business Intelligence*,
DOI 10.1007/978-3-319-54846-3_4

has, therefore, become even more important. Economic turmoil, product commoditization, technological development, vertical disintegration, and increased competition from low-cost economies have forced many western companies to renew themselves to generate profits in their industries, and in some cases just to remain a viable entity in the market. A firm's ability to create new capabilities, leverage and shed its existing resources (Danneels 2011; Huikkola et al. 2016; Sirmon and Hitt 2003), make strategic decisions in high-velocity business markets (Eisenhardt 1989), change its operations and organizational routines (Eisenhardt and Martin 2000; Feldman and Pentland 2003; Teece 2012), innovate new products, services and processes, and adapt to altered circumstances (Wang and Ahmed 2007) has been acknowledged as central to attaining sustainable competitive advantage in the business markets. In the long run, a firm's ability to learn and change might be the only viable strategy for sustained existence (Teece et al. 1997; Teece 2012). In other words, these dynamic capabilities explain a firm's success in the long run, which will depend on its ability to sense and seize new business opportunities and adapt the type and level of its resources to address ever-changing business requirements (Teece 2007, 2012).

The life spans of listed companies have been declining for some time (Birkinshaw and Gibson 2004), leading managers and scholars to emphasize the importance of establishing flexible and agile organization structures (Doz and Kosonen 2007; Sull 2009), and of creating an entrepreneurial organizational culture to avoid organizational rigidity and inertia (Leonard-Barton 1992; Sirén et al. 2016). While the extant strategy research has considered digitization as a context (Brown and Eisenhardt 1997; Eisenhardt and Sull 2001) or enabler (Hagiu 2014), it has overlooked the central role of business intelligence (BI) in a firm's renewal. Given the importance of dynamic resource allocation in sustaining profitability, strategic plans need to be solidly grounded in financial projections. Furthermore, a clear link must exist between strategy, budgeting, and resource planning to facilitate strategy implementation. Traditionally, the role of management accounting systems in particular has been seen as relatively rigid, given that such systems are primarily seen as existing to control risks rather than facilitating organizational renewal (Langfield-Smith 1997). Financial information

has typically been result-oriented, meaning that the numbers generated have taken center place in the discussion. These financial data have thus typically been descriptive rather than prescriptive. However, more important than knowing the exact numbers is the ability to understand why the company has achieved or has not achieved those numbers, and which are the key factors affecting those outcomes. As a minerals processing company, Outotec's former Chief Financial Officer (CFO) Mikko Puolakka stated in an interview: "The only way to have an influence on financial figures is to go to the sources of those figures. Numbers are only the manifestation of sales, purchasing, and production operations." Thereafter, financial department managers and other managers with a profit-and-loss responsibility should strive to understand the reasons behind the revenues, sales, and profits, and diligently extract the factors affecting those numbers. This underlines the importance of establishing and reviewing operative key performance indicators in addition to financial ones, as well as the role of the finance function, in understanding the business. Ultimately, the finance function can become an important discussion partner in formulating and enabling the execution of strategy.

The current chapter sets out to present how management control systems and financial intelligence can facilitate a firm's strategic renewal. Simons (1995: 5) defines management control systems as "the formal, information-based routines and procedures managers use to maintain or alter patterns in organizational activities." Subsequently, the strategic accounting literature (e.g., Laitinen et al. 2009; Simons 1995) has recognized the importance of financial intelligence or financial analytics to a firm's strategic decision making and formulation of strategy (Deloitte 2014). However, the question of how management control systems can help a firm to revamp and reallocate its resources has been overlooked in the prior strategy literature. This work discusses the theoretical foundations of the strategic business intelligence (the strategy implementation view, dynamic capability perspective, and management accounting systems) and presents a conceptual model of how advanced management accounting systems can foster a firm's strategic renewal. Practical examples are presented to illustrate the emergence and existence of the phenomenon in the different business contexts.

This chapter is organized as follows: the introduction describes the background of the phenomenon. The following theoretical section discusses the main theoretical lenses and the literature used in the study, namely the strategy implementation view, the dynamic capability perspective, and the management accounting systems literature. The conceptual framework discusses the nine building blocks contributing to the firm's strategic renewal. These building blocks consist of the intersection of different timeframes (past, present, and future) and dynamic capabilities (sensing and seizing opportunities and also modifying resources). The conclusion paragraph summarizes the previously discussed content and its practical relevance, and the chapter ends with the outlook for the future of financial intelligence.

## Theoretical Background

Information, and particularly apposite quality information, is a key intangible asset for any modern organization (Barney 1995; Clarke 1999; Porter and Heppelmann 2014, 2015). Information helps management and personnel to make better decisions, to track the organization's performance, and ultimately, to generate (sustainable) competitive advantage (Porter and Heppelmann 2015). Financial information held in an organization's information systems provides opportunities to increase the firm's productivity, market share, cost-savings, and performance (Ceci and Masini 2011; Maciariello and Kirby 1994). Additionally, quality information enables an organization to develop new products, services, processes, and innovations (Nevo and Chan 2007). Financial information offers reports on how past actions affected the markets, and can be utilized when planning future moves and evaluating their likely consequences. As a whole, information intertwined in the organization's information systems can facilitate its strategic and operational activity, decision-making practices, and the actions that support organizational renewal that incorporates reshaping the firm's strategy, structures, and resources.

Building on strategy creation and implementation views, the dynamic capability perspective, and the strategic accounting literature

(particularly that on management control systems), this chapter contributes to defining the intersection of these theoretical grounds. The overall aim of the work is to conceptualize how advanced management control systems providing real-time data can facilitate agile strategic initiative creation and implementation processes, and thus, a firm's strategic renewal. Hence, the work combines three concepts of strategic management: (1) strategy creation and the implementation perspective (strategy into practice), (2) the dynamic capability view (resources and processes evolvement), and (3) management control systems (strategic accounting/financial ICT systems). These research streams are briefly discussed below.

*Strategy implementation* can be defined as the activities and initiatives needed to accomplish a strategic plan (Wheelen and Hunger 2011) and to transform a decision into practice. Implementing a strategy consists of decisions and activities to achieve a desired strategic outcome or an overall organizational goal. Strategy implementation also covers how organizations should develop, deploy, and amalgamate their organizational structures, control systems, and cultures to create wealth. In today's volatile business conditions spanning many sectors, strategy creation and implementation may occur simultaneously. This situation increasingly demands the seamless integration of strategic and operational activities.

The *dynamic capability* perspective accords with a firm's ability to learn and to renew itself in such a way as to create wealth for the firm (Doz and Kosonen 2007; Teece et al. 1997) and provide long-term benefits for the firm's key stakeholders (Long and Vickers-Koch 1995). Strategic learning, organizational learning, and ambidexterity are typical contents of discussions on a firm's dynamic capabilities (see also Birkinshaw and Gibson 2004; Easterby-Smith et al. 2000; Kuwada 1998; Thomas et al. 2001). Dynamic capability has been defined as the firm's ability to (1) sense and shape new business opportunities and threats, (2) seize such fleeting business opportunities, and (3) reconfigure and modify its resource base to address changes in its marketplaces (Eisenhardt and Sull 2001; Teece 2007, 2012). Following an extensive literature review, Wang and Ahmed (2007) classified dynamic capabilities into those relating to a firm's (1) innovative capability, (2) adaptive capability, and (3) absorptive

capability. Innovative capability refers to a firm's ability to develop new products, services, and markets through aligning strategic initiatives with innovative behavior and processes. Adaptive capability, on the other hand, accords with the firm's ability to identify and capitalize on emerging business opportunities. Third, absorptive capability is defined as a firm's ability to recognize the value of new external information, and assimilate and exploit such information to commercial ends. In sum, dynamic capabilities encapsulate a firm's ability to change itself strategically by altering its resource bases, processes, routines, and capabilities (Danneels 2011; Huikkola et al. 2016; Teece 2012).

*Strategic accounting* and particularly management control systems refer to information systems that are used to foster strategy creation, implementation, evaluation, and performance (Maciariello and Kirby 1994; Simons 1995). This includes both monetary and non-monetary information to support managers in their decision-making practices (Anthony and Govindarajan 2007). Management control systems are vital in steering an organization toward its strategic objectives by allowing the firm to better prioritize and reallocate its (perhaps scant) resources. Management control systems have been described as having several dimensions such as the source of information (internal vs. external), the type of information (financial vs. non-financial), and the timeline of the information (history vs. future). Moreover, the extant studies (e.g., Laitinen et al. 2009; Tillema 2005) have classified the information produced by management control systems into (a) narrow scope of information, (b) average scope of information, and (c) broad scope of information. The first refers to historic information that is financially quantifiable; the second encompasses both financial and non-financial information about future events; and the broad scope of information label covers a combination of the financial and non-financial, and the future-oriented external information. Advanced management control systems enable a firm to act proactively because future cash flows, sales, and strategic actions taken by competitors can be better predicted and analyzed. In addition, information systems provide accurate real-time data on a firm's sales and profitability in different market and product areas. Third, historical data can be utilized when evaluating future business opportunities and analyzing previous actions' value that have been undertaken in a firm's history.

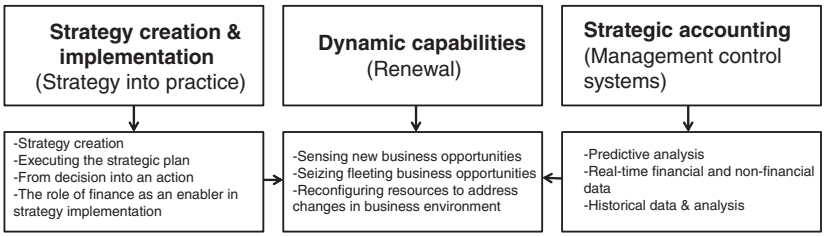


**Fig. 1** Theoretical grounds of the work

Figure 1 below summarizes the theoretical grounds of the work. Strategy creation and implementation include executing a strategic plan, the process of turning a decision into an action, and activities required to deliver a firm's vision. Strategic accounting and management control systems include a firm's use of predictive, real-time, and historical data and analysis. The term dynamic capabilities refers to the firm's strategic change and renewal, and includes a firm's processes to sense and seize new business opportunities, and to modify its resources to address changes that occur in the ever-changing business environment (Teece 2007).

## Conceptual Framework

The following framework conceptualizes and incorporates the above-mentioned research streams. We follow Teece's (2007) definition of dynamic capabilities and consider them as the firm's ability to renew itself by (1) sensing and shaping new business opportunities, (2) seizing these fleeting business opportunities, and (3) reconfiguring and modifying its resource base to address changes that occur in the business environment. Management control systems, on the other hand, are systems that collect, use, and assimilate information to evaluate a firm's (financial or non-financial) performance (Simons 1995). Management control systems are used to steer a firm toward its strategic objectives and implement its strategy by facilitating resource reallocation. Figure 2 conceptualizes how financial intelligence acquired through an MCS can facilitate a firm's creation of dynamic capabilities.

| | | Dynamic capabilities | | |
|---|---|---|---|---|
| | | Sensing new business opportunities | Seizing business opportunities | Reconfiguring and modifying resources |
| Management control systems | Predictive analysis (future) | - Proactive sensing of the most promising markets in the future<br>- Future business markets<br>- Future products and services<br>- Future customers | - Piloting new products, services and business markets<br>- Future investment decisions<br>- Decisions of what opportunities to reject | -What resources should be created acquired and integrated to address future needs<br>-Resource leverage for future extensions<br>-What resources need to be dropped in the future? |
| | Real-time data (present) | - Real-time data on current sales and profits<br>-Real-time data on existing products and customers | - Seizing the most profitable products and services at the moment | -Investingin existing resources<br>-Leveraging existing resources |
| | Historical data and analysis (past) | - Historical data on former sales and profits<br>.Historical data on rejected products and services | - Analysis of unseized products and services | -Development of current resources and capabilities<br>-Analysis of decayed resources and capabilties |

**Fig. 2** How management control systems and financial intelligence facilitate a firm's strategic learning and renewal processes

# The Impact of Predictive Analysis on a Firm's Ability to Renew Itself

## Predictive Analysis to Sense Future Business Opportunities

The top management team's main responsibility is to guide their organization to continuously seek underlying market opportunities to create growth in the future. This may include sensing new products, services, customers, business markets, or market areas. Advanced management control systems provide historical financial data, and potentially real-time financial data that can be used as grounds on which to model the future (Tekavčič et al. 2008). Maintaining solid predictive financial models is key for making strategic decisions and following up on them. This is an important role of the finance function.

For instance, Electric car manufacturer Tesla has forecast that it will deliver 80,000–90,000 Model S and Model X vehicles during the year 2016. Elon Musk, Tesla's founder and CEO describes the firm's future potential: "Tesla is doubling its cumulative sales every year. I'm not sure this has happened in the car industry in a century. This year, we will potentially double the size of the fleet. That's pretty exciting." Forecasting is difficult, particularly in consumer and high-technology businesses (for

instance sales projections for the Apple Watch testify to that difficulty) but firms are typically aware of global megatrends and typical business trends affecting their industries. Identifying these trends enables firms to determine which products or markets they should concentrate on in the future. Managers should evaluate how their current MCS is utilized to sense new markets, products, services, or business markets. Therefore, companies should acknowledge the importance of building predictive modeling capabilities within the company. To build this capability, people responsible for sensing new product or market development should have occasional conversations with the financial personnel to increase mutual understanding of the future business opportunities.

## Predictive Analysis to Seize Future Business Opportunities

In addition to sensing capabilities, firms must be able to seize the most promising business opportunities in the markets. As digitization and turbulent markets provide more opportunities than a single firm is able to exploit, a shortage of management and financial resources means businesses must reject most opportunities and focus only on the most promising and relevant (Eisenhardt and Sull 2001). This means that the information systems should provide information on the new products, services, and markets that have the greatest business potential in terms of growth, profits, or other benefits such as increased customer satisfaction or better strategic fit. As Apple's CEO Tim Cook phrased it: "We believe in saying no to thousands of projects, so that we can really focus on the few that are truly important and meaningful to us." The usage of these information systems can for instance explain why streaming media provider Netflix has been able to create so many successful series. Netflix, described as a data-driven company, has been able to develop algorithms and analytics to make decisions on the most promising series. Whereas the success rate of a new series launched on conventional television is about 35%, Netflix series have a success rate of around double that. Netflix has a luxury that conventional operators do not have: advanced customer data. The data reveal when the customer pauses, rewinds, or

fast-forwards the content, what date and time the content is watched, where the content is watched, what devices have been utilized to watch the content, how the contents have been rated, and what searches have been done, etc. Based on the analysis of the rich data it receives, Netflix can predict which series and movies are likely to succeed in the future and why. Seizing opportunity is particularly about making decisions based on the quality and accuracy of data rather than intuition. Managers operating in different sectors should evaluate how their current systems are utilized when making decisions on which opportunities the firm is about to seize or options it will reject. Moreover, personnel responsible for making investment decisions and accounting personnel should team up to improve their mutual understanding of Future Breakthrough Products

## Predictive Analyses to Modify Resources

The best companies are proactive in terms of modifying their resource bases. Reactiveness in terms of changing a firm's resources typically indicates a failure of sensing and seizing activities. Advanced management control systems enable a firm to understand what type of resources it will need in the future, what extant resources should be reinforced and invested in, and what resources should be released to address changes that will most likely occur in the future business environment. For instance, the world's second largest manufacturer of elevators and escalators, KONE, sold its operations in South America to its main competitor ThyssenKrupp Elevator in 2001 to generate enough capital and slack resources to develop its businesses, operations, and resources in Asia, particularly in China. Even though it is easy to see the logic of this successful strategic initiative afterwards, the decision required that KONE conduct a proper financial analysis of future business opportunities globally and undertake initiatives in terms of creating and developing valuable resources in China. In another example, Apple's strategic initiatives regarding the (self-driving) car industry development include recruiting engineers from Tesla to build competencies related to car design. In sum, predictive analysis seeks to find out where the money will be coming from in the future. To get the most out of a business opportunity, a

firm must build its future resources proactively based on a fine-grained analysis of future trends. Managers should consider how their current systems are utilized to create new resources, and leverage and shed their existing resources as necessary. The top management team should focus on defining the global megatrends and industry-specific business trends that most affect their company. Part of the discussion during the top management team meetings should focus on future trends and future actions. Hamel and Prahalad (1994) estimated that top managers spend only 3% of their time discussing future opportunities. If considering the future were an agenda item in every management team meeting, developing a future trend outlook could become routine for managers, which would further promote discussion of future scenarios and business trends. To understand future trends better, firms should gather future data and information through associations, universities, and other research institutes (particularly with futures studies researchers), and other firms. The data gathered could be matched with firms' own internally collected data for further validation. Decisions on resource reallocations could be based on proper analysis made through active collaboration with external parties. Successful resource allocation could be further facilitated by active dialogue with the finance function during strategy formulation such that budgeting and resource allocation incorporate strategic thinking.

## Using Real-Time Data to Facilitate a Firm's Strategic Renewal

### Using Real-Time Data to Sense New Business Opportunities

ICT companies among others have successfully utilized real-time data to develop new products and services. For instance, the Finnish mobile game development company, Supercell, famous for its Clash of Clans, Clash Royale, Hay Day, and Boom Beach mobile games, exploits real-time data on customer purchases made during its games to sense and develop new commercial products. This type of freemium business model requires continuous development of existing products based on customer purchasing

and playing behavior. Monetization gives direct feedback on how customers/gamers evaluate their satisfaction with the new product. In a similar manner, as manufacturers are increasingly becoming like software companies (see Porter and Heppelmann 2014, 2015), they can also benefit from extensive real-time data. New remote technologies enable manufacturers to monitor data on customer processes and optimize those processes by undertaking preventive maintenance, or by consulting customers on how the firm could optimize its production capacity to increase its profits or revenues. Utilizing real-time data to make quick decisions is far from easy, but can potentially create economic rents for the firms, as the examples available from the ICT sector indicate. Managers should review how their current systems utilize real-time data to sense and develop new products, services, and business markets. Real-time analysis should not be based on temporary peaks (snapshots) but instead on indications of trends (both growing and declining). Digitization supports companies in increasingly utilizing real-time data to develop new products and services. For instance, KONE can utilize its real-time data gathered on product malfunctions by guiding its technicians to make immediate visits to certain customers. For instance, if KONE detects an error in the customer's automatic door, it can send the closest available technician to see if he or she can repair it immediately. This is possible because of *dynamic dispatching*. Different mobile devices can thus be utilized to increase instant sales.

## Using Real-Time Data to Seize Business Opportunities

Real-time data can be leveraged to seize the most promising business opportunities. Seizing the most promising business opportunities means that the organization invests in them, develops them, adds them to, and integrates them into their offerings, and ultimately sells them. This means that some new business markets and products will have to be rejected. Those rejected should typically be those with the lowest levels of sales, profit, or customer satisfaction and retention estimates, or the weakest strategic fit. Subsequently, the question is not only where to invest but also where *not* to invest because today's business environment and information technology continuously provide thousands of fleeting

opportunities (Eisenhardt and Sull 2001). While traditional product development takes a long time, and considerable effort and money, to progress from idea to execution, today's advanced systems allow firms to decrease the time and costs required to test which products and services are in demand and therefore offer business opportunities, and which do not. (Schmidt and Rosenberg 2014). Fast piloting can be an effective means to test which products and services are the most viable to develop in the future. In the mobile games industry, Canada is often used as a good test market to pilot new mobile games because the market provides reliable data that is comparable to other major markets such as the USA. Canada is simultaneously both big enough and small enough. Supercell's famous Hay Day exemplifies this phenomenon: "The Hay Day beta went live in Canada in May 2012. Until this point, every single beta launch we'd had as a company had been lukewarm at best and had eventually led us to kill the game later on. A few of them had garnered some initial interest, but player engagement soon started to wane. But Hay Day was different. The engagement was crazy from day one, and it just kept growing. Slowly we started to realize that perhaps, finally, we were onto something."

In grocery stores, storekeepers and entrepreneurs can evaluate the currently popular products based on real-time data. This does not automatically mean that the prices should be higher when the demand is higher. Swedish furniture giant, IKEA, has become famous for selling umbrellas cheaper on rainy days (weather data are considered real-time data in this context). To accelerate the sales of umbrellas (alongside other IKEA products at the same time), the firm not only reduced umbrella prices (which many organizations would not) but also displayed them prominently to boost their overall sales. This strategy may lower income/profits for a short time-period but increase customer satisfaction and business performance in the long run. Thus, good business decisions sometimes seem counterintuitive. Managers should evaluate how real-time data are currently utilized in making seizing and investment decisions. Increasingly these seizing decisions are based on advanced (and automatic) algorithms and heuristics. For instance, a robot can decide what stocks to buy and at which price on an investor's behalf, after it is programmed with the relevant parameters.

### Using Real-Time Data to Modify Resources

Management control systems enable a firm to map in real time the type of resources a firm should possess at any given time, what new resources should be built and acquired, which existing resources should be leveraged and nurtured, and which should be released to address changes in the business environment. At the corporate level, real-time data provide opportunities to optimize and reallocate a firm's limited resources. Although some resources, especially human resources, are typically relatively immobile, using real-time data hints at the possibilities of reallocating resources within the corporation. For instance, an airline company that dynamically changes ticket pricing based on demand patterns can optimize its fleet capacity. Another example from the service industry is McDonald's. A McDonald's franchisee who owns multiple McDonald's stores in the same area (town or region) might be able to transfer employees from quiet restaurants to busier restaurants based on real-time sales figures. In sum, real-time data can be utilized to better meet the prevailing supply and demand. Managers should consider how the real-time data provided by the current systems are utilized to reallocate existing resources. Sharing real-time data with external firms has been increasing because of the evolution of enterprise resource planning (ERP) systems and the interconnectivity between firms. This has helped firms to optimize their production and operations across regions, as it is far easier to see the free capacity currently available.

## Using Historical Data and Analysis to Facilitate a Firm's Strategic Renewal

### Using Historical Data to Sense Business Opportunities

It has been said that history does not predict future performance. It has also been said that people and governments have never learned from history, or acted on principles deduced from it (Danneels 2011). Companies, however, should use historical data to evaluate future business opportunities. The data used in management accounting systems

have typically been historic. This makes sense, because regulations and official reports, for instance, require accurate financial data on the firm's past performance (because of taxation and local legislation issues). Utilizing longitudinal historical data (e.g., panel data) can reveal historical patterns (whether of success or failure) to the firm commissioning the study, and the firm can then tailor its decisions accordingly. Supercell's CEO and co-founder Ilkka Paananen commented on the firm's success and how it has learned from its mistakes: "That reminds us that our success is built on past failures and learning from them. That's an important legacy that is helpful even now, because remembering the failures helps people to keep their feet on the ground." Therefore, previous mistakes can be reevaluated as learning steps. Managers should evaluate how the historic data collected can be used systematically to sense new products, services, or business markets. The people responsible for developing new products, services, and markets should collaborate with those working in the finance department to review historical patterns, which can be useful when designing new products and services. For instance, observed patterns between country's gross domestic product (GDP) and demand for a certain product may create opportunities for new related products and services. If China's GDP increases, the demand for premium cars will most likely increase too. An increased number of premium cars leads to an increased demand for garages. Firms building, marketing, and selling garages may use this data to sense new opportunities available to them.

## Using Historical Data to Seize Business Opportunities

Historical data can be capitalized on with regard to new products, services, and business markets. Firms can use past data to assess when it would be most beneficial to launch a new product or product extension. For instance, in the automotive industry, the product life cycle of mass produced cars typically ranges from 4 to 6 years. The car manufacturer can use historical data to evaluate the optimal timeline for launching a totally new model, pushing out a new facelift, or ending the model production completely. During the production time of a model,

competitors will introduce new products, or increase market share for different reasons. Historical data can be utilized to respond to this stiffening competition, because such data can illustrate if it is worth marketing a facelift version (typically 2–3 years after the original model was launched to offset revenue erosion) or launching a new model. Managers should consider how the historic data gathered through the established systems are utilized to seize new business opportunities. Personnel from different organizational units should also identify patterns that emerge from the historic data.

## Using Historical Data to Modify Resources

Historical data can be utilized when reallocating resources in a new way or for new purposes. Historical data may reveal repeatable patterns over history and enable a firm to add, release, or nurture dedicated resources at the right time. Based on historical analyses (or tacit knowledge), many service firms know when the size of the workforce should be temporarily increased or decreased. For instance, Wal-Mart announced that declining earnings would force it to close 269 of its stores, affecting 16,000 workers in North-America (mainly in Wal-Mart Express stores). Simultaneously, the firm stated that it would be developing its digital and supercenter businesses. The stated actions included personnel training and increasing the firms wage bill (by approximately $1billion) and opening 300 new stores globally. Historic data could reveal what types of stores have been the most profitable and where the company sees the most promising business opportunities. To address these concerns, a company decides what resources it should create in the future (e.g., Wal-Mart builds its digital capabilities or pick-up services), what resources it will leverage for other purposes (e.g., Wal-Mart invests in its Supercenters), and what resources it needs to shed (e.g., the closures of Wal-Mart Express outlets). Usually, the historical trend (whether growing or declining) is more important than the current numbers in a given period when deciding where to focus efforts. Managers should evaluate how systematically the historical data are used to address firm's resource reallocation decisions.

## Conclusion

Strategic renewal is difficult as the competitive environment might be turbulent, customers' preferences change continuously, or there might not be easily understandable change management models available. However, the only constant is change. The role of management control systems in a firm's renewal has been overlooked in the prior strategy literature. This chapter conceptualizes how these systems can facilitate a firm's strategic renewal by taking into account different time dimensions (past, present, and future) and modes of change (sensing, seizing, reconfiguring). Through combining these elements, the data generated through management accounting systems can potentially help managers to strategically renew their companies in a more systematic way.

More advanced management control systems, a turbulent business environment, changing customer needs, technology turmoil, and more intense competition not only create a challenging situation for many companies but also provide tremendous opportunities for those firms prepared to be forerunners and to dedicate themselves to being agile. First, manufacturers should evaluate how interactive, accurate, and developed their current management control systems are. Managers should ask if their firms' management control systems permit predictive analysis and offer real-time data, or whether they were built to mainly address mandatory regulatory requirements. Second, managers should evaluate how management control systems are used in strategy creation, implementation, and follow-up: Is the link between strategy and its key enablers such as tactical financial planning and resource allocation decisions clear enough? Is strategy implementation followed up based on trends in financial and operative performance indicators? Is the CFO the only person in the management team utilizing the MCS? and how are the systems used to support sensing and seizing new business opportunities? At the operational level, managers should ask how often people from different silos come together or collaborate. At all levels (or between firm boundaries), knowledge-sharing between functions, firms, and people has become increasingly important to facilitate organizational change.

Established firms should consider, test, and learn the best fast piloting practices typically applied in start-up firms. Digitization and advanced information systems enable a manufacturer to continuously seek, sense, and seize new business opportunities, to pilot and test them on selected customers and business markets, and leverage or release resources relatively quickly. Business and product development models of the "scale fast or fail fast" type should be encouraged among established companies to obtain rapid results from customer experience and demand in the markets (Schmidt and Rosenberg 2014). Modern advanced systems enable companies to conduct fine-grained analysis of future opportunities, the current situation, and past performance.

The conceptual model developed in this chapter seeks to advance managers' general understanding of their firm's strategic renewal. The model attempts to conceptualize how management control systems can facilitate a firm's renewal by taking into account different timeframes and change modes. Moreover, the model can be tested in firms and could improve collaboration between the different organizational functions. For instance, financial administration and R&D could jointly use the model to understand and evaluate costs, investment decisions, and future cash flows. Thereafter, firms who want to renew strategically through utilizing management accounting systems could establish cross-functional teams to improve mutual understanding of the initiatives required. Financial analytics answers specific business questions and enables firms to establish initiatives that facilitate the components of strategic renewal.

## The Future of Financial Intelligence

In the future, big data will get even bigger. Just as the banks have learned how to utilize big data systematically to improve their customer intelligence (see the chapter on CRM in this book), financial departments need to develop their capabilities to exploit the opportunities offered by big financial data in their organizations. Specifically, as the Internet of Things (IoT) develops rapidly in the manufacturing sector, managers responsible for financial issues should collaborate with the

business functions to better understand the linkage between the core business and the financial figures. For instance, customer satisfaction in some industries can be predicted from the unexpected breakdown rate of the firm's equipment. Utilizing IoT to evaluate potential breakdowns could help a firm to improve its customer satisfaction levels, and eventually, customer-specific profits. Thereafter, the finance department should delve deeper into the firm's core business and grasp the business strategy, initiatives, and patterns. The CFO in the future will not just be a gatekeeper of financial assets, but will actively participate in the strategic discussions related to the firm's new product, market, and business development opportunities. Overall, more advanced analytics might be applied to diminish organizational silo effects as knowledge and data become integral to future decision-making processes.

In some scenarios, digitization and new technologies such as blockchain-based technology have been predicted to make traditional finance departments obsolete. It is very likely that new technologies will reshape the finance department's role because monitoring, trade processing, and transaction costs ought to decrease in the future. Another way for organizations, and especially their finance departments, to develop their processes and improve their cooperation with the firm's other departments is to centralize standard processes and tasks in service centers. In these service centers, organizations could effectively cost standard tasks such as accounts payable processes and standard monthly report creation. Doing so would free time in the business control function spent on report creation to enable the analysis of past performance and predicting future performance. The centralization would also allow the business control function to focus on supporting business management with its decision making and strategic renewal processes. However, the finance department's analytical expertise could be better exploited throughout the organization to improve the quality of decision making across its business functions. This would further lessen the impact of the silo effect. In the future, the finance department should invest in developing machine learning or artificial intelligence capabilities to automate transactional work, and enable it to focus on decision-making activities, analytical modeling, strategic renewal processes, and collaboration between the functions and boundaries.

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## Authors' Biography

**Tuomas Huikkola** is a researcher in the Networked Value Systems research program at the University of Vaasa. His special interest is in industrial services and the strategic, dynamic, and relational capabilities of manufacturing companies. He has published in a number of journals, including Industrial Marketing Management and Research-Technology Management.

**Antti Koulumies** heads Outotec Plc's Corporate Controlling as well as Strategy and M&A functions. He has overseen Outotec's recent restructuring and focuses on improving the implementation of strategy by ensuring a close link to the finance function. Previously Antti worked at McKinsey and Company as a management consultant based in Helsinki and Johannesburg. He holds an MSc degree in Industrial management from Aalto University School of Science and Technology. Antti is currently based in Helsinki, Finland.

**Ville Laukkanen** holds an MSc degree in management accounting and finance from University of Vaasa as well as a Master of International Business degree from Macquarie University, Sydney, Australia. Ville has worked for Outotec for the past 6 years in various corporate-level controlling tasks and projects, including the development and implementation of a new management controlling system. Currently, Ville is on a 2-year assignment in South Africa looking after the Sub-Saharan Africa Market Area business controlling for Outotec.

# Competitive Intelligence—A Strategic Process for External Environment Foreknowledge

Yassine Talaoui and Rodrigo Rabetino

## Introduction

Since the early 1990s, globalization and the consolidation of the new knowledge-intensive organizational paradigms have been redefining competition processes while highlighting the non-price factors of competitiveness, such as quality, sales, design, and service. Moreover, with the advent and widespread adoption of microelectronics and cybernetics, products have become easy to access and even easier to replicate, which eventually jeopardizes the first mover advantage of companies that once believed in the sustainability of competitive advantage (D'aveni et al. 2010). This scenario is also characterized by a greater segmentation of demand and by the increasing volatility of markets, in which uncertainty hampers strategic decision making. In such a rapidly

Y. Talaoui (✉) · R. Rabetino
University of Vaasa, Vaasa, Finland
e-mail: yassine.talaoui@uva.fi

R. Rabetino
e-mail: rodrigo.rabetino@uva.fi


M. Kohtamäki (ed.), *Real-time Strategy and Business Intelligence*,
DOI 10.1007/978-3-319-54846-3_5

changing environment, firms afflicted by organizational inertia seem doomed to failure. So how can companies outperform their rivals while dodging any potential threat regardless of the nature of their business environment, whether hostile or benign? The answer is not straightforward. Company performance depends on the interaction of the organizations that influence the creation and delivery of value. Complexity increases because organizations are not islands and are affected by both competitive dynamics (attacks and counterattacks) and a need to exist symbiotically with their business ecosystems (Lansiti and Levien 2004).

Consequently, firms ought to understand their environment and learn to cope with any change capable of jeopardizing their survival. Ultimately, the game then shifts to a knowledge race among companies within the same ecosystem, which involves companies' competitors, customers, suppliers, partners, and institutions. With the advent of the industrial Internet and the Internet of things (IOT) , this thirst for information becomes a survival necessity, in the age of digitization where data bypasses human approval and is automatically exchanged between the physical object and the software.

## Theoretical Foundation

The industrial make and sell model of the twentieth century is long gone. The polar opposite of Fordism, the new techno-productive paradigm, is based on a sense-and-respond framework baked into the rationale of today's information age (Haeckel 2004). As a result of the increase in competitive pressure, firms have started to pursue new strategic responses while combining scale and scope economies, introducing changes in the marketing and the business management, and moving toward the consolidation of quality and complex knowledge—and service-intensive value propositions. Accordingly, the role firms assign to the development of information-intensive innovation activities must expand, which can be conceived as a process of static and dynamic accumulation of competences (Teece et al. 1997). These learning processes aim to adapt new knowledge—or new combinations of knowledge—in order to develop and improve value propositions and processes,

progress organizational change, and forge new links with the market (Ernst and Lundvall 1997). Undoubtedly, such an approach resonates with Drucker's (1959) concept of the knowledgeable worker, skilled at capturing and translating happenings into meaningful insights, which in turn supplement the day-to-day decision making of managers. The process of information retrieval and scrutiny suddenly becomes a major link between a firm and its environment, through which it can comprehend external events and remain vigilant to changes (Hambrick 1981).

Through either human or open sources (Fleisher 2008), organizations adhere to this new rule and direct the utmost attention to information gathering, notwithstanding the risk of obsolescence or falseness. The new millennium, with its economic, political, and technological discontinuities further fueled this soaring thirst for knowledge and drove most companies to create formal or informal cells tasked with scanning their business ecosystem, and inferring meaning from what might have seemed mere noise. That concept was termed Competitive Intelligence (CI).

Competitive intelligence is a strategic cycle that involves not only the collection, combination, and analysis of key information on the competitive environment and its trends (which includes competitors, customers, suppliers, and potential business relations), but also the distribution of that information throughout the organization, and also the management of the learning process to translate the information into strategic knowledge.

## The CI Concept

A quick look at the definitions prevalent within the CI literature stream clearly reveals the multifaceted nature of the concept (Table 1). These interpretations, though eclectic, have more homogeneity than might at first appear, as they voice a plain distinction between two descriptions of CI: as a product and as a process.

CI is typically considered the outcome of a focus on the market, competitors, and customers; collaboration with other firms; an experimentation with new avenues of value creation; and/or accumulated experience (Slater and Narver 2000). Thus, CI can be seen as a product

**Table 1** Definitions compiled from the extant literature

| Author(s) | CI definition |
|---|---|
| Wright and Calof (2006, p. 454) | "… CI is creating knowledge from openly available information by use of a systematic ***process*** involving planning, collection, analysis, communication, and management… synonymous to BI." |
| Liu and Wang (2008, p. 749) | "… Systematic ***process*** involving planning, collection, analysis, communication and management of intelligence or knowledge from competitors, customers, suppliers, technologies, environments, and potential business relations… using human, electronic and other means… from openly available information for the decision maker…" |
| Bernhardt (1994, p. 13) | "Both a ***process and a product***… is an analytical process that transforms disaggregated competitor, industry, and market data into actionable strategic knowledge about the competitor's capabilities, intentions, performance, and position… and the end product, or output, from that process." |
| Wright et al. (2009, p. 942) | "The ***process*** by which organizations gather information on competitors and the competitive environment." |
| Vedder et al. (1999, p. 109) | "Synonymous to BI… is both a ***process and a product***. As a process, it is the set of legal and ethical methods a company uses to harness information. As a product, it is information about competitors' activities from public and private sources and its scope is the present and future behavior of competitors, suppliers, customers, technologies, acquisitions, markets, products and services, and the general business environment." |
| Dishman and Calof (2008, p. 768) | "… A systematic and ethical ***process*** involving, planning, collection, analysis, communication, and management…" |
| Tanev and Bailetti (2008, p. 5) | "… Actionable recommendations arising from a systematic ***process*** involving planning, gathering, analyzing, and disseminating information on the external environment for opportunities, or developments that have the potential to affect a company's or country's competitive situation…" |

(continued)

**Table 1** (continued)

| Author(s) | CI definition |
|---|---|
| Society of Competitive Intelligence Professionals, http://www.scip.org/ | "The ***process*** of ethically collecting, analyzing and disseminating accurate, relevant, specific, timely, foresighted and actionable intelligence regarding the implications of the business environment, competitors and the organization itself … is of strategic importance to the organization…" |

often acquired at a high price from third-party sources (e.g., consultancy companies and market analysts), or distilled from customers' reviews, and Web 2.0's abundant, and often overwhelming volume of information. The last two sources are largely accessed in-house; therefore, they offer a far cheaper route for companies to acquire valuable information to determine key competitive measures such as market penetration, market share, and competitors' share of wallet, based on site-centric data alone (Zheng et al. 2012); or to identify potential weaknesses and benchmark strengths of competitors' products by extracting comparative relation features from entities and words (Xu et al. 2011).

In addition, CI is a process. The process focus tends more toward the complete gamut of sources yielding the intelligence. In other words, CI is seen as more of a system—an iterative sequence that typically involves four steps: (1) management direction, (2) information collection, (3) information analysis, and (4) intelligence dissemination (Bernhardt 1994). A priori, this process often originates and is engineered according to two approaches: a comprehensive approach and a project-oriented approach. The first is an all-inclusive approach that fits best with broad strategic decisions and prompts the need for holistic formal CI activity within organizations; whereas the project-oriented tactic is a narrowly focused method launched to nurture ad hoc agendas with more specific objectives (Prescott and Smith 1987).

Obviously, the product–process distinction generates more confusion than it could ever resolve, and most importantly it distracts both researchers and managers from the real issue at hand, which is how the information gathered might be turned into actionable intelligence.

How could CI specialists separate the quantity from the quality? How might they ensure that management gets what it needs and what it considers valuable intelligence? As a corollary, it appears vital to rejuvenate the existing plethora of CI definitions with this all-encompassing description: In an order of hierarchy where environmental scanning occupies a zero order, CI ranks first at filtering information gathered through the scanning of the focal firm's external environment (i.e., customers, suppliers, rivals, industry/market, government or legal institutions) then analyzes and evaluates the material via strategic analysis tools, mathematical models, technological applications, before it is disseminated to the business user in a customized format appropriate to both need and level of responsibility. In other words, CI should be thought of as a system that guarantees an updated flow of external information to the firm before it filters and transforms it into meaningful insights, and then communicates it to the business user as a form of actionable intelligence capable of supplementing the decision-making process.

## The CI Cycle

When defined as a process, CI is believed to be ideally orchestrated around a set of steps commonly referred to as the CI cycle, which incorporates four phases: (1) planning; (2) collection; (3) analysis; and (4) dissemination (Fig. 1).

## The Planning Phase

The planning phase starts in the boardroom where the top management team plans and produces roadmaps to achieve quarterly or annual targets. Once the destination is defined, attention moves to the path choice. There is an evident requirement to understand the needs, strengths, and weaknesses of the focal firm and the road to be taken, especially if that involves other contestants in the race to the same finish line. Therefore, a wise decision maker would ultimately initiate this

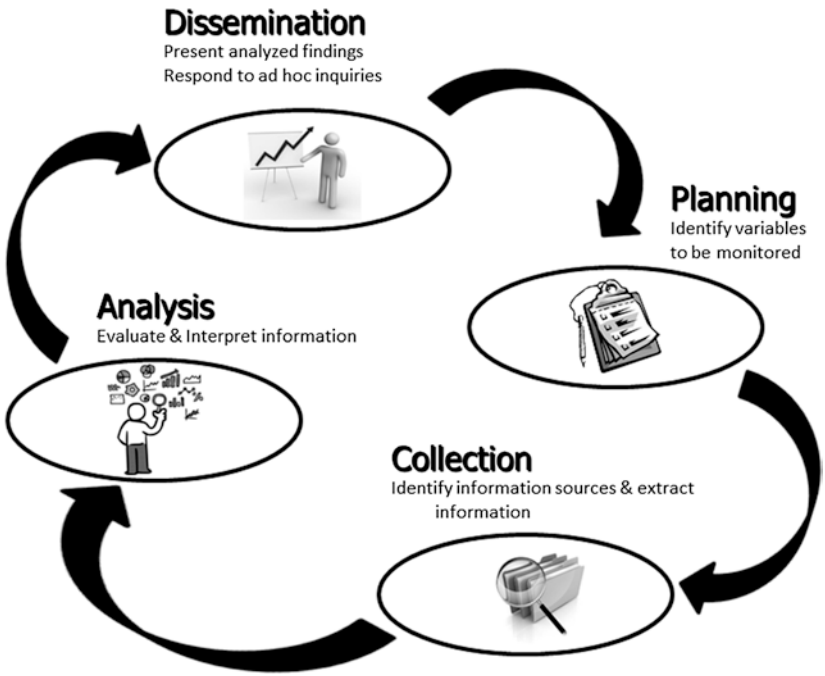


**Fig. 1** CI cycle (Developed from (Bernhardt 1994))

process by thoroughly delimiting the ecosystem on which the focal firm depends, (i.e., the external environment mentioned earlier) lest any variable ought to be monitored or neutralized.

## The Collection Phase

At this stage, all the constituents of the outer layer environment of the competitor firm have been identified and targeted for a lawfully executed infiltration. The dilemma herein is the fine line between transparent, legitimate practices, and industrial espionage. Whereas the former is legitimate practice under the umbrella of jurisdiction, the latter is considered a felony. In this context, organizations should be wary to gather (legally) primary and secondary data through open (reports, Web2, etc.)

or human (salesmen, customers, etc.) sources, which currently are still a common currency among firms and have the advantage of trustworthiness compared to third-party sources that are often historical.

## The Analysis Phase

If the two previous stages can be called observe and learn, the analysis phase is definitely that where the transition from *what's out there?* to *why does it matter?* takes place. While much ink has been expended on recommending more emphasis on analysis, the available body of knowledge on CI still lacks tangible models and applications to evaluate and interpret the external information collated. Hence, the prevalent confusion of the concepts of CI and BI, for the latter at least offers specific technologies to help the business user slice and dice the data via online data processing (OLAP) or data mining. Tools such as Porter's five forces, scenario analysis, fishbone analysis, Pestel and SWOT frameworks have been around for decades, despite their quantitative issues. Although these frameworks fall short in evaluating the validity and reliability of the collected information, they have undoubtedly repeatedly established their suitability to interpret and draw conclusions on tactical or strategic endeavors. In addition, commercial software, available through third parties, is often utilized to discern key competitive measures (Zheng et al. 2012). Although costly, commercial engines seem incapable of transcending the sheer clustering and display of tactical data in a user-friendly manner, leaving tasks such as scenario analysis and predictive planning to the user's interpretation.

## The Dissemination Phase

As mentioned previously, whether it stems from a holistic or an ad hoc approach, the outcome of the analysis stage will become no more than an obsolete piece of advice if it is not communicated correctly and on time. This means the intelligence product must be channeled to the concerned business user promptly via clear and user-friendly platforms.

Sadly, a rift between the CI and decision support system (DSS) literature is the advanced reporting tools developed in the latter, which have left the body of knowledge defining CI far behind. An example would be the user interfaces that allow managers to access findings in a customized and sophisticated manner. Empirical studies, however, show that written forms of communication, as well as informal channels, remain popular among managers as means to receive requested intelligence.

## The CI Function

The Wright-Pickton best practice model epitomizes the ultimate tool capable of deciphering the CI function within any given organization (Wright et al. 2009). This model is used to elucidate the CI practice within a given

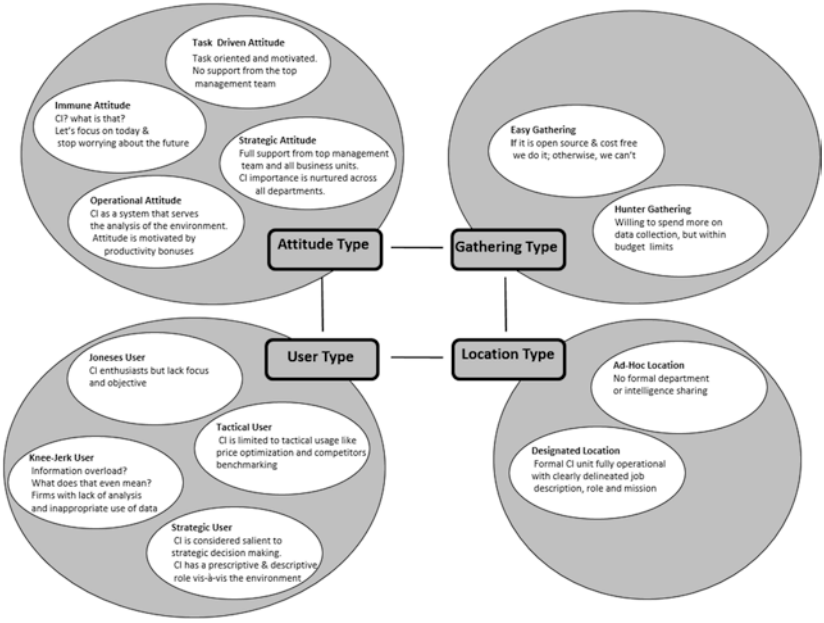


**Fig. 2** Wright-Pickton best practice model (elaborated based on Wright et al. 2002, 2009)

organization via four pillars: (1) attitude type; (2) gathering type; (3) user type; and (4) location type (see Fig. 2). In the process, this model provides a clear idea of whether the firm is properly involved in a strategic use of CI and grants the utmost salience to its outcomes, by allocating the right resources to its operation in the best possible circumstances.

The Wright-Pickton best practice model represented an ideal benchmark against which CI practices in Finland were juxtaposed as shown in Fig. 3. We incorporated data from a sample of scholars, experts, and representatives of 38 companies participating in five thematic workshops organized on the sidelines of the strategic service business intelligence sub-project of the FIMECC S4Fleet research scheme.

While the dashed rectangles point to the utopian CI situation advocated by Wright et al. (2009), the shaded boxes indicate how participants in the workshop operated at many different levels with respect to the four strands of the model. There follows a discussion of each typology:

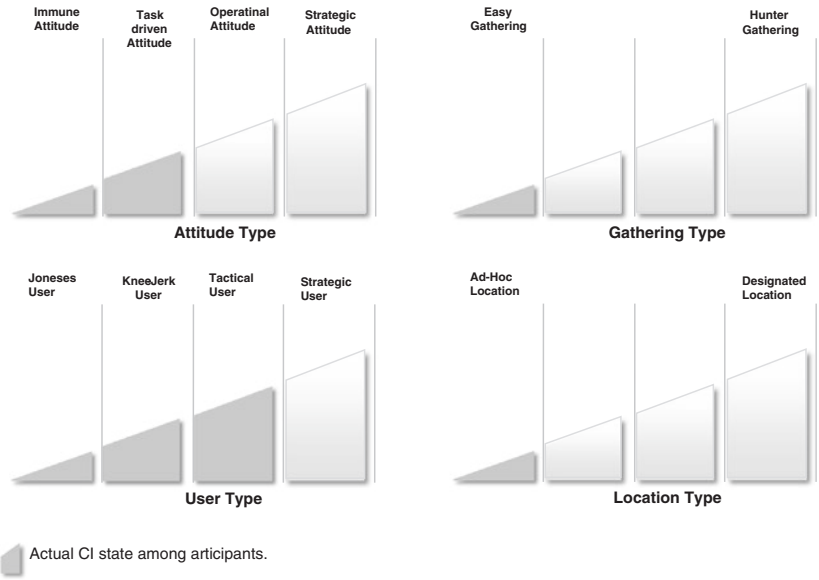


**Fig. 3** A benchmark between CI best practice and actual CI performance of S4Fleet consortium participants (elaborated based on Wright et al. 2002, 2009)

*Attitude Type*

The disparate importance of CI to participants, let alone the various definitions they adopt to refer to the concept, raised questions about the attitude of participants to CI. This consideration investigated the longevity of CI usage and the terminology adopted by participants to refer to the intelligence process (Wright et al. 2009). When asked to give a specific start date for any CI-related activities, most participants suggested that CI was always present in some form in their respective companies, and yet the majority failed to provide a timeframe for the claimed CI practice.

It is possible to conclude a priori that CI is an integral part of the participants' practice, although it remains unclear whether such a practice is standardized, let alone how it is implemented. Therefore, the CI attitude of the participants falls into the task-driven attitude of the Wright-Pickton typology. Furthermore, the terminology used to identify CI was also tested during a two-panel workshop, as it can reflect the place CI occupies in the minds of participants (Wright et al. 2009). The workshop responses were similar to the findings of Wright et al.'s (2009) study of the CI practices of UK banks, which revealed two themes that prompt the use of CI: benchmarking and fostering business insight.

Within the first theme, competitor intelligence was used interchangeably with CI. However, ample research calls for a distinction to be drawn between the two terms (Wright et al. 2002, 2009). CI is oriented toward activities whereby a company assesses its industry and competitors to anticipate their actions, making the competitor a component of the broader and more comprehensive CI (Lauginie et al. 1994; Lendrevie and Lindon 1990). According to the participants, the perceived importance of CI resides in a firm accessing data on its customers, and its competitors' private and public data on their business activities, and on their respective customers (Table 2).

The second theme of the findings revealed a willingness to improve the understanding and awareness of the events in the industry. Such

**Table 2** Participants' perceived importance of CI

| Actual use of CI | |
|---|---|
| Customers | Customer size, number of employees, net sales per customer, customers' feedback, deficits, faults, product recalls, current products/service utilization or categorization, and customer satisfaction |
| Competitors | Revenues, employees, profit margin, strategic insights, structure, geographical presence, real decision makers, bid winners and offerings, products, pricing and technical features, number of patents, share price variations, M&A history, value proposition, market share, and customer satisfaction |
| Suppliers | Suppliers' R&D plans, technology investments, competences, capabilities, shipping capacity, pricing track record, products quality, cost structure, profit and loss statements, capacity levels and current clients' database, and the on time delivery risk |
| Industry | Environmental regulations, labor unions, within country investments, consumer trust levels, industry data (quantitative), electricity information, data ownership laws, technology hypes, and the overall EU policies and protocols |

willingness emanates from a perceived need to sustain innovativeness and creativeness (Wright et al. 2009). Table 2 indicates how respondents also viewed CI as means to obtain a comprehensive picture of industry intricacies, such as historical trend patterns and suppliers' cost structures.

Finally, bringing together the two themes above highlights two different behaviors: a reactive behavior emanating from CI; and a proactive demeanor resulting from R&D investments (Wright et al. 2009). Overall, participants showed a common understanding of intelligence despite the lack of a common terminology, which in turn validates the clustering of their CI attitude as *Task Driven.*

*The Gathering Type*

Following the workshops held as a part of the S4Fleet project, four intelligence types were discernible based on the purpose driving the use of intelligence. First, most participants reported employing a collection of intelligence that supports a better understanding of customers such as: market share values, product feedback, customer preferences, and sales trends. For this purpose, Web 2.0 and market research companies

were the primary sources of knowledge. Second, participants seemed determined to improve their understanding of their competitors' moves. Although such determination is essential if the participants' firms are to have effective strategic positioning, their emphasis on public domain data excludes any dynamic approach to understand their competitors' behavior (Wright et al. 2009). Third, participants unanimously voiced a very strong desire to acquire their supplier's financial data, particularly the cost structure, and similarly, sought the opportunity to review R&D investments and technological patents obtained via public and informal data. Fourth, participants showed an interest in better positioning within the confines of industry trends, and shielding their firms from political intrigue or legal issues and from disruptive technological threats. Unfortunately, this proactive orientation was hampered by a simplistic reliance on free public reports, which become obsolete almost as soon as they are published.

Moreover, as shown in Table 3, the participants suggested they used an eclectic data gathering approach relying on a wide range of sources. Ostensibly, intelligence gathering is undertaken daily and sources are selected according to pressing momentary need. This method seems identical to a scatter gun approach that almost inevitably produces overlapping efforts and coordination deficiencies (Wright et al. 2009). Overall, the intelligence gathering process reported by the participants is superficial at best and fragmented at worst. Such a rearward facing effort is far from effective, as it lacks fertilization across intelligence foci

**Table 3** Sources of information used according to participants

| Sources of information | |
|---|---|
| Customers | Customers, annual reports, workshops, internal information, LinkedIn |
| Competitors | Marketing materials, technology fairs, job advertisements, scientific publications, competitors' customers, social media, social events |
| Suppliers | Engineers' feedback, and assistant aids, information spreadsheets are filled and data needs are identified. The collection then takes place via supplier meetings–discussions with chosen suppliers |
| Industry | Newspapers and third-party agencies |

and falls short of offering a well-prepared future assessment (Wright et al. 2009). Firms applying the previously stated conclusions fall right into the *Easy Gathering* type.

*User Type*

A close scrutiny of participants' responses regarding the stated purpose of CI practices revealed two purposes of CI: strategic planning and comprehension of competitors or markets. Table 4 itemizes the workshop responses in tandem with those two purposes. According to the respondents,CI varied according to whether the associated purpose was strategic planning or understanding markets or competitors. Obviously, little is known of how the CI process or its perceived value changes based on the original need. Needless to say, the listed responses reveal a multifaceted drive of CI that fluctuates and is ultimately tailored to suit its intended use. This reality therefore labels those favoring the approach *Tactical Users* of intelligence.

Furthermore, in line with the findings of previous studies (Fleisher and Bensoussan 2007; Wright et al. 2009), there seems to be a real weakness with respect to analysis heuristics. A lack of familiarity with,

**Table 4** Purpose of competitive intelligence reflecting participants' responses

| Purpose of CI | Matching responses |
|---|---|
| Strategic planning | Potential strategy of customer (short next year, long 5-year plan), real decision makers, customers' needs and association with strategy, customers' outsourcing strategy, strategic changes, core innovation development, product life cycles, product and service development |
| Competitors and markets comprehension | Disruptive technologies prediction, key features and technologies, customers' value drivers, matching products, customer relationships (partnership, seller–buyer, symbiosis), customers' markets and market share, underexplored markets and segments, demand expectations, earnings' variations, deals profitability |

**Table 5** Analytical tools and dissemination methods applied by the participants

| Analytical tools | Communication tools |
|---|---|
| SWOT | E-mail |
| Brainstorming | Intranet |
| Data mining | Upon request |
| Statistical software | Reports |
| Financial analysis | Meetings |

and a failure to implement, advanced analytical tools was clearly evident among the participants. The responses tabulated below (see Table 5) clearly indicate a weak use of tools rather than organizations seeking predictive actionable intelligence to sustain their competitive advantage in a dynamic market where only proactive players prosper. These findings run counter to the astute user typology and confer on the relevant participants the *Joneses* user status.

The workshop discussions also identified the face-to-face, electronic, and paper form of communication tools the participants' used (see Table 5). Whereas the interpersonal mode is by far the most preferred channel of intelligence communication for its ability to offer speed, feedback, and dialogue, both electronic and print modes were seen as jeopardizing the effectiveness of the dissemination of intelligence, owing to the absence of dialogue in the former, and lack of speed and feedback in the latter (Wright et al. 2009). That being said, it seems that the average user in Finland could be classified as a *Knee-Jerk* user.

Lastly, participants reported using no mechanism to check the accuracy of information. It seems information quality depends on the trustworthiness of its source, while every piece of data is believed valuable for some task. Such findings appear to straddle both types: *Joneses* users and *Knee-Jerk* users.

*Location Type*

The workshops also revealed the absence of procedures or designated teams for conducting tasks related to the CI cycle (Table 6). Moreover, most processes communicated during the workshops shared two common characteristics: mainly informal and situational. Despite the unanimous belief among participants that CI practices

**Table 6** Existing processes of competitive intelligence among participants

| Intelligence topic | Processes |
|---|---|
| Customers | Interviews, surveys, observation |
| Competitors | Hiring key persons, scenario planning, war, game, networking |
| Suppliers | Product analysis, benchmarking |
| Industry | Scenario planning and analysis, data mining, data analytics |

were established in their organizations, there was no strong evidence to substantiate the existence of a standard system deemed crucial (Wright and Calof 2006) for any mature CI unit. That notwithstanding, it seems that participants were overwhelmed by data overload and the propensity of their respective departments to adopt informal tools. If this is indeed the case, it would raise another question vis-à-vis the intelligence communication and sharing, not to mention the organizational structure of CI (centralized vs decentralized). As a corollary, participants might not have, and/or might not know who has, direct control over the generation and dissemination of intelligence within their organizations. In a nutshell, the situational basis of intelligence tasks along with the lack of sharing mechanisms casts significant light on the descriptor that best fits the location type of intelligence across findings: Ad hoc *location.*

## The Value of CI

The current research points to the rudimentary nature of the CI practices of companies, which is in line with past research (Dishman and Calof 2008; Wright et al. 2009). In fact, between the absence of a common understanding of the matter and shallow usage, CI seems more of a trend companies adopt for the sake of compliance rather than expediency. After all, no evidence supports or rejects CI's role in enhancing return on investment or performance in any form. The salience of the concept itself lies more in a perceived importance that has been around for decades now and prophesies that the more managers know, the better off they (Bernhardt 1994) will be. It goes without saying that CI is becoming a necessity for organizations to acquire;

however, most companies seem to run their CI activities in an ad hoc fashion, not to mention with a low level of formality (Dishman and Calof 2008).

Tremendous efforts have been made to ensure CI produces tangible results, but as yet to no avail. This is not to say that the investment in CI is pointless; on the contrary, it is a survival aid useful in today's unpredictable business environment. However, evidence overwhelmingly points to a tactical side of CI rather than a strategic aspect, which could be equated to the achievement of long-term goals (Hughes et al. 2013; Mariadoss et al. 2014). Thus far, the perceived contribution of CI to strategy has its roots largely in a common belief as opposed to any tangible outcome. This could be traced back to the scarcity of rigorous explanatory studies, or even the hesitance of managers to open their secret practices to scrutiny. Notwithstanding the ambiguity surrounding the strategic value of CI, this concept is surely associated with other outcomes of a tactical order; that said, CI seems highly regarded for its ability to inform users about price optimization, expanding product lines, service improvement, and new customer acquisition (Peyrot et al. 1996).

Furthermore, CI is also associated with defensive measurements—those deployed by organizations to protect their databases from infringement. Such a defensive aspect of CI would constitute a preemptive measure taken by the focal firm to create what is commonly referred to as: "Commercial Information Operations," that is, an information gap created to degrade the competitor's capabilities and protect those of the focal firm (McCrohan 1998). This gap is formed after a firm utilizes CI to identify the information the competitor seeks, and how the firm envisages acquiring it.

## CI Challenges

CI has been around for more than three decades now; yet it seems that the root cause of the issues related to its proper practice has not been addressed properly and neither have the barriers to information acquisition. For instance, findings from the

S4Fleet workshops repeatedly indicated organizational culture and structure were impediments to proper data collection, for employees often lack the proper training and necessary resources to conduct scanning activities. Similarly, heterogeneous mindsets within organizations might lead to dissimilar priorities, a lack of trust, and conflicting views over the information required, not to mention over where it should be sourced. Furthermore, except for repetitive attempts to pinpoint the lack of analysis and tools permitting the necessary knowledge transformation, little is known of the real barriers to its usage (Dishman and Calof 2008; Michaeli and Lothar Simon 2008). Therefore, it appears essential to raise the lack of a clear idea about what information is really needed, the existence of a huge amount of disconnected systems, and the lack of a single user interface, not to mention the absence of an exploitation phase within the CI cycle.

Merging the CI cycle with the process of knowledge absorption (Zahra and George 2002) nonetheless suggests a striking similarity

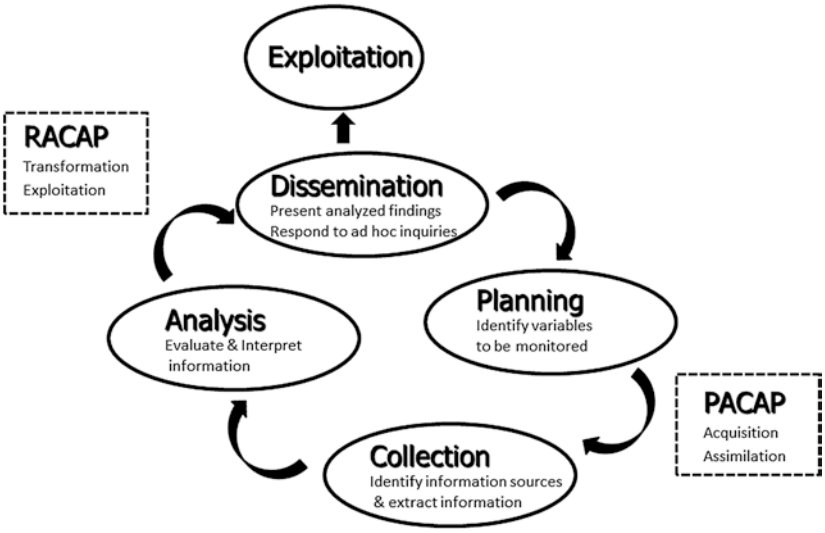


**Fig. 4** New CI cycle (Authors' elaboration based on Bernhardt 1994; Zahra and George 2002)

between the two sequences, bar the missing exploitation phase. Accordingly, research should focus on updating the CI cycle that seems incapable of coping with a shifting business environment, where even CI should switch to a continuous learning process. Accordingly, Fig. 4 complements the old CI cycle with: (1) potential absorptive capacity (PACAP) that highlights a firm's level of readiness or receptiveness to acquire and assimilate external knowledge; and (2) realized absorptive capacity (RACAP) that mirrors the capability of implementing the intelligence disseminated (Zahra and George 2002). Adding both elements of absorptive capacity would prompt a new phase for the CI cycle: exploitation that follows organizational actions and traces synergies and/or conflicts back to the communicated intelligence.

## Conclusion

Despite the significant number of publications rooted in the strategic management and marketing fields, the body of knowledge on CI is still in an embryonic stage. It seems that throughout the last two decades, scholars have been preoccupied with deciphering whether or not companies are incorporating CI in their business activities. These explorative journeys have been marked by unsophisticated methods that might give the appearance of a profiling of CI characteristics within the focal company, but certainly fail to add any prescriptive value for both research and management practice, as exemplified by, for instance, there being no common definition of CI; the equivocal approaches to the CI process; the strong focus on data collection; and inappropriate analysis (Dishman and Calof 2008; Wright et al. 2009).

Although primary sources appear to be more trusted than open or third-party sources, which are considered archaic or unreliable (Fleisher 2008), using such information, mainly collected from corporate employees, necessitates a certain competence to decode soft data. In response, organizations opt to renew their interest in open source data, primarily inexpensive information derived from Web 2.0, despite the information overload, as well as the volatility of the Internet, which thwart the transformation of data into actionable intelligence (Fleisher

2008). Besides the aforementioned transition, at the other end of the user interface, a significant disparity exists between real and reported intelligence needs; a situation that fuels managerial skepticism of the suitability of CI as a tool to support decision making. Moreover, the contradiction between the CI approaches, that is, the comprehensive versus the project-based modes, does more harm than good to the soaring need for resilience, because it shifts attention to the structure of the CI unit rather than the outcome.

In this context, strategic agility becomes a prerequisite of CI; not its result. Thus, managers and researchers alike face a chicken-and-egg causality dilemma. In fact, creating a formal CI unit responsible for both comprehensive and project-based CI, or nurturing an informal ad hoc approach to support a formal broad CI unit, is easier said than done, unless organizations are already agile or ambidextrous to a certain extent. This is undoubtedly a hard-to-measure condition for practitioners and academics, since the concept of agility is in itself a very nascent one and still subject to exploration, not to mention being one that is remarkably challenging to measure.

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## Authors' Biography

**Yassine Talaoui** is a PhD candidate and teaching assistant in the management department at the University of Vaasa, where he teaches business models and strategic management. His research interests focus on delineating relationships between business intelligence and strategy research and work. He currently serves as a project researcher in DIMECC-S4Fleet project aiming the creation of a measurement tool of business intelligence that would permit CEOs to determine the exact value of the intelligence effort and product to better supplement their decision-making process. Prior to research, Yassine accumulated 5 years of consultancy under his belt in services, automobile, and airline industries.

**Rodrigo Rabetino** is an Assistant Professor of Strategy in the Department of Management and a researcher in the Networked Value Systems research group at the University of Vaasa. His work has been published in journals such as Industrial Marketing Management, Journal of Small Business Management, Research-Technology Management, and Journal of Small Business and Enterprise Development. His research interests include industrial service business, servitization, business intelligence, and small business management.

# Human Resource Intelligence—Enhancing the Quality of Decision Making and Improving Business Performance

Jesse Heimonen, Jaakko Mattila and Susanna Kultalahti

## Introduction

Human resource information system (HRIS) software and human resource analytics (HRA) are changing the availability and delivery of human resource (HR) knowledge supporting decision making at every level of an organization (operational, managerial, and strategic). It has been a long journey from the earliest versions of HRIS in the 1960s and 1970s that automated simple employee records and payroll management. In the early 1980s, the first PC software supporting applicant tracking, performance appraisal, and training information offered

J. Heimonen (✉) · S. Kultalahti
University of Vaasa, Vaasa, Finland
e-mail: jesse.heimonen@uva.fi

S. Kultalahti
e-mail: sukulta@uva.fi

J. Mattila
Sympa Oy, Lahti, Finland
e-mail: jaakko.mattila@sympa.fi



M. Kohtamäki (ed.), *Real-time Strategy and Business Intelligence*,
DOI 10.1007/978-3-319-54846-3_6

the foundations for management information systems facilitating HR managers' work (Dulebohn and Johnson 2013). Thereafter, the focus was on developing increasingly sophisticated analytical tools to manage human capital and facilitate improved decision making. Today, HRIS spans everything from a simple employee spreadsheet to huge enterprise resource planning systems assimilating employee data to other intra- and inter-organizational data (Dulebohn and Johnson 2013). The most modern HRIS software also provides real-time access to data without geographical limitation, measures impact rather than activity, and attempts to look forward instead of only reporting the past. Thus, HRIS software can enable HR to move closer to becoming a strategic partner (Yeung and Berman 1997).

However, the movement from HR's administrative and transactional role toward that of an integrated strategic partner has been slow and painful, requiring a shift in the mind-set of both HR professionals and managers in the different functions of an organization. The manner in which HR professionals operate and communicate must change in order to transform the way the HR function is perceived (Kavanagh et al. 2011). HR professionals must be able to bring something to the table and communicate knowledge in a way that is both understandable and meaningful, that is, in numerical and financial terms (Higgins 2014) to justify their involvement and contribution to strategic decision making. Ultimately, the real value of an HRIS and HRA can be captured through the developmental activities and interventions that affect how human resources execute business activities and eventually improve the performance of an organization. In other words, managers expect the HR function to show how it can contribute to business success, and that they can measure that contribution (Beatty et al. 2003).

To improve understanding of how HR professionals can add value to decision making and improve business performance, the current chapter complements the discussion on some of the central aspects of HRIS and HRA. We will begin by briefly introducing human resource management (HRM) practices, also known as high-performance work practices (HPWPs), which are not only important in understanding the context but also central to extracting the benefits of HRIS and HR analytics. Thereafter, we discuss the role of an HRIS in decision making, followed


**Fig. 1** Chapter structure

by a section concerning HR metrics including a brief introduction to HRA implementation (Fig. 1).

## High-performance Work Practices

Human resource management refers to all practices and policies that deal with the personnel in an organization (Beer et al. 1984: 1–2). HRM practices are today seen as critical and valuable assets for the organization, and treating them as such can result in improved business process performance, competitive advantage, and increased organizational performance (Colakoglu et al. 2010: 31; Guest 1997; Huselid 1995). HRM practices designed to improve firm performance are often grouped in a high-performance work system (HPWS) package (Huselid 1995), which on a more practical level includes various HPWPs (Posthuma et al. 2013). Human resources practices exist in every company regardless of its size or nature, even if they are not always formally organized. However, formal recognition of HR practices enables organizations to identify opportunities to improve key business processes and firm performance by developing HPWPs.

In terms of the effectiveness or success of an organization, its people are the key: Huselid (1995) was the first to show the relationship between a HPWS and turnover, profits, and a firm's market value. Rather than directly affecting the financial result indicators of a firm, HR practices tend to have a positive impact on other performance-driving phenomena. For example, HR practices can influence business performance at the collective level by building organizational capabilities, culture, and the social and psychological climate. Further, as the success of business processes undertaken by people is dependent on the success of individuals, the collective performance of individuals eventually determines the success of an organization. At the individual level,

HR practices affect the success of individuals by affecting employee behavior through the so-called AMO model: referring to the abilities (A), motivation (M), and opportunities (O) of an individual. HR practices drive business performance through the impact on knowledge, skills, abilities, and other characteristics relevant for performing a particular job; an individual's willingness to perform; and opportunities to express their talent. For example, HR practices can be designed to foster the development of an appropriate skill set for sales personnel through training and development, encourage the prosecution and steer the execution of certain sales activities through a compensation policy, and ensure appropriate resource sufficiency to execute all the assigned sales activities through job design (see Fig. 2). Thus, in facilitating employment relationships on an individual level, organizations are striving for desired organizational outcomes, such as better performance through HPWPs (Wright et al. 2005).

Since Huselid's (1995) seminal research, researchers have advocated different, though somewhat overlapping, sets of HRM practices that could deliver improved performance. For example, Delery and Doty (1996) have identified seven strategic HR practices that are linked to organizational performance: internal career opportunities, formal training systems, appraisal measures, profit sharing, employment security, voice mechanisms, and job definition. In addition, Pfeffer (1998) categorized seven practices, or best practices: employment security, selective hiring, self-managed teams or team-working, high pay rates contingent on company performance, extensive training, reduction of status differences, and sharing information. One of the most recent categorizations regarding HPWPs has been that of Posthuma et al. (2013), who categorized 61 specific practices identified from previous studies into nine categories: compensation and benefits; job and work design; training and development; recruiting and selection; employee relations; communication; performance management and appraisal; promotions; and turnover, retention, and exit management. The topic of HPWPs and how they are to be categorized continues to engage scholars (see e.g., García-Chas et al. 2014; Patel et al. 2013; Snape and Redman 2010; Zhang and Jia 2010; Kroon et al. 2009; Wu and Chaturvedi 2009).

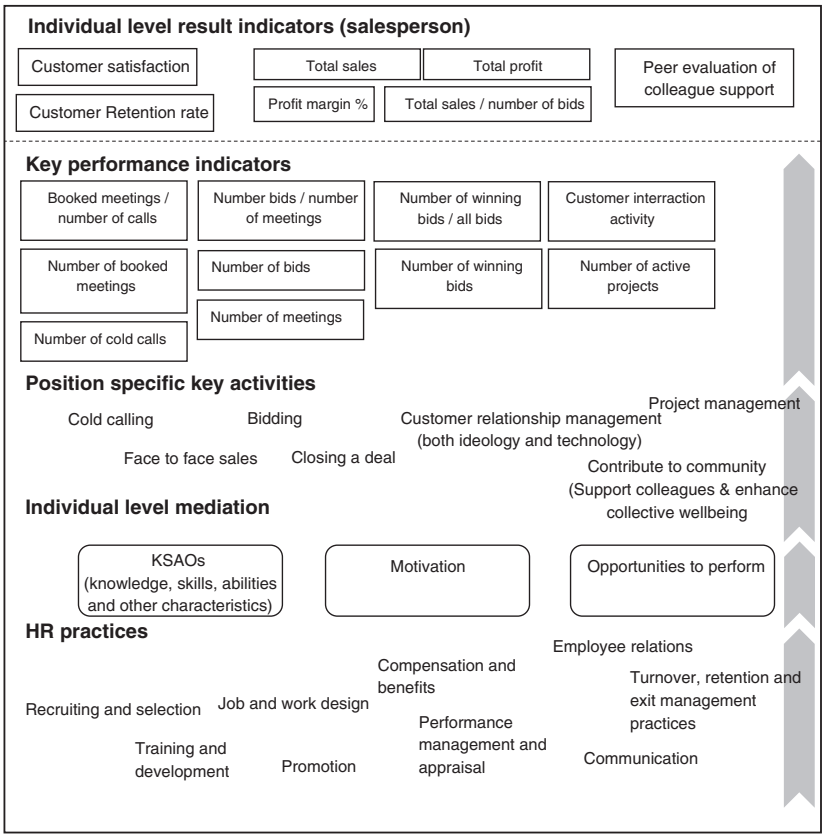


**Fig. 2** Example of how HR practices affect result indicators through an AMO model of the position-specific key activities, key performance indicators, and result indicators

Extant research appears to support the importance of undertaking HR-related practices to influence activity at the individual level and thus enhance the performance of the organization. Typically, the aim is to increase productivity and efficiency, but in some cases there might also be other desired output characteristics such as creativity. For example, in research and development or in marketing positions, the preferred outcomes may be innovative, and not necessarily the most cost-efficient option.

The following sections discuss how analytics and metrics could be utilized in the field of HR. Implementing HRIS and utilizing analytics helps organizations to improve their HR practices on an operational level. At the same time, analytics can provide metrics and detailed information on workforce-related issues and thus improve the quality of decision making at the higher levels of an organization.

## The HRIS and Decision Making

The primary purpose of HRM is to attract, select, motivate, and retain talented employees in their roles (Katz and Kahn 1978; Stone et al. 2015). Implementation of technologies facilitating the execution of core HR tasks has not only increased the communication between HR practitioners, managers, and employees, increasing the transparency of HR practices and policies (Stone and Deadrick 2015), but also transferred some of the work of HR professionals to managers and employees (Stone-Romero et al. 2003). Thus, it is not only HR professionals or HR managers that contribute to the creation or utilization of HR information, because such information is increasingly deployed at different levels of an organization and accessed by staff in a range of roles.

Technology and technological solutions can have two primary roles in managing human resources. First, they assist in performing HR-related administrative tasks more efficiently (Dewett and Jones 2001). In the best-case scenario, technology can be deployed to improve the user's experience of HR processes in a way that increases employee engagement and retention (Deloitte 2016). Second, information systems can increase the speed and quality of decision making where information on HR is required to improve either HR processes and practices or key business activities. Thus, the role of HRIS and HRA in decision making is dependent on the context in which the decision is made and is defined by the information necessary to make the decision.

One possible way to approach information need is to identify the complexity of the problem (the problem structure) (Dulebohn and Johnson 2013; Gorry and Scott Morton 1971). The level of routinization, the possibility of automating the decision, and the extent of

human judgment required define the structure of a problem (Simon 1960). In general, standard solutions can be applied to the structured problems, whereas highly unstructured problems are not straightforward, do not have standard solutions, and the associated decisions demand human judgment (Niu et al. 2009). The complexity of a problem tends to increase when moving from the operational to the managerial and ultimately to the strategic decision-making level. HRIS can serve different business processes in a rather broad way by providing access to a wide range of HR information, where HR analytics seek to add value to the decision making by providing detailed insight into a specific issue, resource, activity, or process. Although, HRIS and HR analytics can be used directly to solve standard problems and may enable a firm to identify factors requiring attention and even suggest corrective actions, those analytics might not be able to provide a single bespoke solution to nonstandard, highly complex, and unstructured problems. Thus, it appears that at the higher decision-making levels, where the complexity of the problems tends to increase, the role of the information available via HRIS and the insight gained through analytics appears to serve a supportive and advisory function rather than offering a direct solution.

The operational-level decisions ensure that routine tasks transforming inputs into outputs are executed effectively. Operational activities are monitored and steered by management and involve fairly straightforward decisions on generally well-defined tasks and resource allocation. The majority of HR's administrative activities, such as employee record keeping and salary administration, are operational and require no human judgment (Dulebohn and Johnson 2013). HRIS can be applied to enhance HR data accuracy and efficiency, so decreasing the costs of such activities. An HRIS can also support semi-structured problem solving such as a recruitment process; in that, HRIS software can identify a qualified and motivated pool of applicants (Stone et al. 2015). Online applicant tracking systems can be used to standardize part of the recruitment process by encouraging applicants to submit basic information on their skills, education, and experience relevant for the applied position, and which can subsequently be utilized in filtering out the candidates. Afterward, the process may be continued with more unstructured

steps such as the evaluation of a cover letter and personal interviews. Information technology can also facilitate the interview process via recorded video interviews, real-time videoconference interviews, or telephone interviews (Silvester et al. 2000; Straus et al. 2001), but it does not remove the need for human judgment. Thus, HRIS software and information technologies can support semi-structured decisions through effective data entry, storage, and filtering processes, and also communication facilitation, but technology will not overcome the need for some individual judgment. In addition, an HRIS can support unstructured operational decisions by providing accurate and timely data. For example, if several operational line workers are unexpectedly absent, information systems can help identify potential replacements, provide access to their work schedules, the overtime hours they have already committed to, and bring up their contact information (Dulebohn and Johnson 2013). However, human judgment is required to analyze the depth of the resource gap, to identify the need for a solution, the options available, and to implement corrective action.

Decisions taken at the higher levels of management tend to focus on operational unit performance and how efficiently resources are being utilized. Such decisions are usually made by a number of managers, but the extent of their decision-making autonomy tends to be delimited by strategic plans and policies (Dulebohn and Johnson 2013). Decisions concerning strategy implementation, the ongoing evaluation of results, and corrective actions are commonly made at this level. HRIS software can assist in assessing the current performance of employees, identifying high and low performers and providing feedback to both employees and managers (Stone et al. 2015; Fletcher 2001; Spinks et al. 1999). An HRIS package can also address structured managerial-level questions, for example, on the efficiency of a recruitment process, or how successful the organization is at attracting, motivating, and retaining talented employees (Stone et al. 2015). Other metrics in the same category include structured knowledge related to human capital such as profit per employee, or cost per employee in relation to competitors or industry standards. Semi-structured problem solving may be supported by efficiency and impact metrics (see Table 1). At this level, HR analytics are utilized to enhance the knowledge of specific managerial issues

**Table 1** Types of metrics

| Type of metrics | | Example metrics |
|---|---|---|
| Descriptive | Human capital measures (size, quantity, quality, efficiency, and effect) | • Number of employees: Total Full-time Equivalent (FTE)<br>• Expense factor: (Operating Expense/Total FTE)<br>• Profit per employee: (Revenue—Operating Expense/Total FTE)<br>• Labor cost factor: (Compensation + Benefit Costs)/FTE<br>• Revenues per employee: (Turnover/FTE)<br>• Level of education<br>• Employee satisfaction<br>• Intention to leave<br>• Employee/talent retention rate<br>• Salary at risk ratio (salary at risk/total amount of salaries) |
| | HR practice measures (quantity, quality, and efficiency) | • Total costs of training activities<br>• Number of training programs<br>• Number of participants to a specific training program<br>• Perceived quality of a specific training program<br>• Salary per employee/industry average salary per employee<br>• Cost per recruitment<br>• Number of cross-functional teams<br>• Number of promotions |
| | Key activity measures (e.g., at the sales position) (quantity, quality, and efficiency) | Measures, e.g., at the individual sales person level<br>• Number of booked sales meetings/Number of cold calls<br>• Number of bids/Number of customer sales meetings<br>• Number of closed deals/Number of bids<br>• Total sales<br>• Total sales/Number of closed deals<br>• Total profit<br>• Average profit margin |
| | Impact ratios (change, ROI) | • Different impact ratios can indicate the effect gained through different actions or investments, e.g., change in booked meetings per number of cold calls/investments in cold call training |

(continued)

**Table 1** (continued)

| Type of metrics | | Example metrics |
|---|---|---|
| Predictive and prescriptive | Analytics providing predictions and suggestions for improvement | Correlations<br>• Correlations can reveal the existing positive and negative relationships between different measures; e.g., relationship between the quality of safety training and the number of occupational accidents<br>Regressions<br>• The linearity and possible nonlinearity can be tested and visualized between two variables. Also possible positive and negative effects of additional variables may be tested by investigating interaction effects, e.g., relationship between safety training and the number of occupational accidents and possible positive interaction effects of safety signs<br>Structural equation modeling (SEM)<br>• The causal impact of multiple variables on explaining key activity performance may be tested through SEM; for example, leadership skills possessed by a supervisor can affect not only the motivation and skills of the supervisor but also the motivation of the subordinates affecting team performance. The results can suggest a need for leadership training for supervisors with low level of leadership skills |

requiring great amounts of human judgment and the analytics thus improve the quality of the decision. In addition, impact metrics can signal if HR activities have had the desired effect on those metrics central to the execution of the chosen strategy. For example, if there are areas of technology and related competencies that are scarce in the market and the firm strategy builds on them, there may be an HR run program for securing the retention and development of key human resources. In that case, multiple metrics such as cost per employee in relation to competitors, retention rate, participation in development programs, flight risk, and the progression of personal employee development plans could be applied to evaluate the success of the program. Monetizing the impact of such programs has been found to affect the way HR work is perceived by top management in the organization (Sullivan 2014). Finally, unstructured decisions at managerial level involve novel situations where human judgment plays a central role, and an analysis of issue-related knowledge can offer no direct support. For example, a large project such as the implementation of HRIS or HRA packages could require a vast amount of individual judgment on questions such as what features and modules should be included, what technology to deploy, which vendors to approach, and how to run the implementation process (Dulebohn and Johnson 2013). The existing information systems such as project management tools can support the process and thus add value to unstructured decision making, but actual data analytics offer only limited value.

Strategic-level decisions are decisions made at the highest level in the organization and tend to be externally oriented and forward-looking in nature. They often involve complex and non-routine problem-solving activities deploying internal and external data. Strategic decisions are most commonly made by a small group of people, and the decisions may evolve over time (Dulebohn and Johnson 2013). According to Lawler and Mohrman (2003), there are four possible roles that HR can adopt in strategic decision making: (1) no role, (2) implementation only, (3) input and implementation, and (4) a full partnership role. *Implementation only* refers to HR being solely reactive in terms of strategic decisions and just supporting the implementation of strategic activities. The *input and implementation* role contributes to strategic

decision making by providing some HR-related knowledge and thereafter assisting in the implementation process. The most strategic role of HR is *full partnership* where HR is responsible for informing and directing the acquisition, development, and allocation of organization talent and human capital. HR can assist strategic-level decision making by providing data related to human capital and setting HR-related priorities and objectives. Analysis of resource gaps and business performance can be used to drive factor identification with advanced data modeling, and thus improve the quality of strategic decisions. However, even huge amounts of data and rigorously executed analysis offer little practical value if the objectives are not clear and relevant in terms of the current strategic business issues. Real business problems should be contributed from outside of the HR function (Rasmussen and Ulrich 2015). At the strategic level, questions can rarely be answered by a singular analysis, and instead solutions tend to combine snippets of information collated from various sources. Thus, HR's participation at the highest level of decision making can enhance the ability to formulate the right questions, for example, in the evaluation of possible options related to a specific strategic decision, to evaluate the readiness of the organization's human resources, and the level at which required actions can be facilitated through a holistic understanding of the human capital available and the existing system of HR practices.

## Human Resource Metrics and Analytics

Human resource metrics and analytics can be deployed not only to illustrate the status quo and the evolution of human capital, but also, and perhaps even more importantly, to show how developmental efforts, HR practices, and changes in HR practices affect business performance through different activities and processes. The essence of utilizing HR metrics lies in the attempts to support decision-making processes and provide not only required information—but also insight beyond imagination—to better describe and understand human-related processes, both input and output, that in turn lead to thoughtful and well-established decisions (Carlson and Kavanagh 2012). In addition, it

has been claimed that HR measures should be impact-oriented rather than activity-oriented, forward-looking instead of backward-looking, and take into consideration the entire HR system instead of single HR practices (Yeung and Berman 1997).

Analytics can be divided into three types: (1) *descriptive* reporting of the past, (2) *predictive* using models based on historical information, and (3) *prescriptive* deploying data models to specify optimal behaviors and actions (Davenport 2013). Where human capital metrics, like the majority of other business analytics currently utilized by companies, tend to be rather descriptive in indicating size, quantity, quality, and efficiency in utilizing human resources, metrics describing the behavior of human resources can also be deployed to analyze the impact of HR practices and policies on key business activities performed by people. Predictive analytics can provide an estimate of the future level of a certain outcome variable, such as the talent retention rate, based on past data, and prescriptive analytics enable modeling of what would happen to the levels of that outcome variable if the level of some related variable changed. Thus, metrics and analytics can provide valuable insight into the causalities connecting actions and outcomes and can be utilized to determine the actions necessary to improve performance-driving activities (see Fig. 2).

The most commonly used human capital measures, such as number of employees, cost per employee, revenue per employee, profit per employee, and average level of education are seen as descriptive metrics (see Table 1). Some indicators such as employee satisfaction, intention to leave, employee retention rate, and salary at risk may be used to reflect the effectiveness of HR practices. However, without more fine-grained measures and analysis of HR practices and key activities performed by different functions, human capital-related result indicators can reveal little about the actual factors causing the results. Thus, understanding the mechanisms affecting the outcome measures and the role of different HR interventions and practices in performing the key activities can enhance the value of decision making and the ability to manage human capital. Therefore, analyzing impact can produce findings that can contribute to improved firm performance.

The impact analysis builds on the deployment of descriptive metrics of both HR practices and the phenomena considered as a result, for

example, the performance of a key activity. The easiest way to investigate impact is to analyze how investments in a particular HR practice influence the key activities enabling the organization to investigate the return on investment. Ulrich and Dulebohn (2015) recommend splitting the ultimate goal into smaller targets to deliver an early impact of HR investments; the key message is to show the relation between the HR investments made, the HR outcomes, and the business outcomes. An example in the context of sales might work from the fact that sales activities affect the annual revenues of the firm and accordingly investigate how sales activity performance (e.g., the number of customer sales meetings booked divided by the number of cold calls) changes due to investments in cold call training. The HR function as the function responsible for organizing training and measuring the impact can provide information on the success of training investments. Existing scientific (and also more practical) research has provided evidence on the positive effects of different HR practices on performance-driving key activities and firm performance (Posthuma et al. 2013). Accordingly, firms might undertake improvement initiatives based on expected causalities without actual correlation or causation investigations. Actually, for many companies, this may be simple enough and the most appropriate level of analytics, as they might lack the competencies to conduct more advanced analysis.

Whereas descriptive dashboards and scorecards are able to handle the enormous load of statistical information on what has happened, show what has been the direction of the indicators, and as such can provide valuable information, only predictive analytics, such as correlations and regression, are able to explain which factors affect a particular phenomenon (Ulrich and Dulebohn 2015). To increase the level of investigation, analytics could be deployed to identify correlations between different human factors or HR practices and the business activity undertaken. Correlations indicate whether there is a positive or negative relationship between two variables, such as the quality of the safety training program and the number of occupational accidents. This means that the correlation envisaged here can indicate whether an increase in the quality of safety training is related to the increase or decrease in the number of accidents. However, correlations do not directly indicate the causalities,

meaning that one cannot say whether one variable is an antecedent or an outcome of another variable. Furthermore, correlations do not indicate what sort of relationship, linear or perhaps curvilinear, exists between the two variables. In addition, correlations can exist by chance. The larger the volume of data used to run the analysis, the better the chance that even weak results indicate statistically significant correlations. A good example of the worth of correlation investigations and HR analytics is explained by Garvin (2013) in his Harvard Business Review article describing how Google used data analytics to prove to its employees the importance of managerial skills for supervisors. The initiative led to Google's Oxygen program to increase the leadership skills among its managers becoming an established tool to improve talent retention in the firm and its performance.

To better understand the type of relationship between two variables, regression analysis can be deployed. For example, such analysis could reveal how safety training in the construction business reduces the incidence of workplace accidents and the time lag between the safety training and accidents could help to predict the optimal frequency of running safety training. To further increase the sophistication of the analysis, more variables can be added into the regression analysis to investigate whether other variables interact with the dependent variable, that is, occupational accidents, and change the shape of the curve, indicating a more complex structure for the issue. For example, the positive effect of safety training could possibly be maintained for longer if safety signs are installed on a construction site, and thus, the number of the installed signs might have a positive interaction effect on the number of workplace accidents.

Possibly one of the most advanced analysis methods currently available to address well-specified business problems is to build a structural equation model of several different variables and try to explain a certain result indicator. For example, Rasmussen and Ulrich (2015) demonstrate how data models can help explain the differences in performance between oil rigs operating under similar circumstances and enable the operating firm to identify activities likely to improve performance. They deployed both quantitative and qualitative methods and advanced analytics to identify customer satisfaction driving factors such

as operational performance, employee competences, employee safety, and leadership quality, and to then develop a change plan and a process to improve the performance of poorly performing oil rigs. By being able to increase knowledge of a particular business problem, showing options for corrective actions and facilitating the implementation of the selected interventions, HR may be able to offer more value than might be expected. However, due to the requirements for highly specialized skills in advanced analytics, the most sophisticated methods may be currently available to only a few companies. Therefore, as predictive and prescriptive analysis also builds on descriptive metrics, a safe starting point for the analytics journey would be to deploy descriptive metrics and scorecards to monitor the status quo and changes in factors driving business success.

## Implementation of Human Resource Analytics in a Nutshell

Identifying a key business problem should be considered the starting point for implementing human resource analytics (Rasmussen and Ulrich 2015). Firms should not concentrate on what is easy or convenient to measure, but rather on measuring what is essential and important (Ulrich and Dulebohn 2015). This is thought process shared by Sheri Feinzig, Director of IBM, who argues that the current data is not the ideal starting point for analytics; that would be identifying the key issues driven by business needs and thereafter choosing the methods required to solve the problem. The HR-related questions CEOs frequently ask include: "How do we know we have the right size of workforce and at an appropriate cost? What is our workforce productivity and is it improving? Are we hiring, promoting, and retaining the best talent?" (Higgins 2014: 13). Rasmussen and Ulrich (2015) call this the pull phenomenon because it starts from the business case.

After identifying the business problem, HR should assemble the appropriate set of skills to start adopting the analytics (Rasmussen and Ulrich 2015). Partnering with the IT department and bringing a data

expert into HR can help in adopting the right tools and capabilities (Deloitte 2016). Then, HR should carefully identify the key causalities, metrics, key performance, and key result indicators based on the chosen business problem (Tootell et al. 2009). If those factors are correctly identified, management will be able to monitor the input to these causalities. Next HR management should adopt an appropriate process for data gathering and analytics to monitor the chosen indicators. Once these elements are in place, the actual analysis and the communication of the results can start.

Thereafter, a change plan and concrete actions for changing business processes and HR practices affecting the critical processes should be developed and initiated. Finally, the last stage in the implementation path is the evaluation of the progress delivered by the actions implemented. Jeremy Shapiro from Morgan Stanley summarized the implementation of HRA in an IBM (2015) report and noted how the analytics journey must focus on business priorities, results should be communicated through storytelling, analytics should be understood as a tool for decision making, analysis does not require perfect data, and finally, one should be able to understand the past, view the present, and attempt to predict the future to get the valuable insights to support the decision making leading to concrete improvement efforts. In addition, Ulrich and Dulebohn (2015) emphasize the importance of gaining the line managers' support and suggest that they should be involved throughout the analytics process from the goal setting and HR metric selection as they will usually be the ones utilizing the analytics in decision making and implementing the development initiatives.

Although the competencies required of today's HR professionals are discussed more specifically elsewhere (see Cohen 2015), we can conclude that practitioners implementing analytics are not only required to understand the core business, the underlying organizational structures, the interrelation of processes, the role of human resources in performing key business activities, and the influence of HR practices and policies, but also be able to perform the actual analysis from the technical point of view (Carlson and Kavanagh 2012). The required set of competencies appears rather extensive and could be challenging to assemble in organizations where the role of HR is not only to serve other business

functions through the execution of administrative HR tasks, to provide support to line managers in managing their human resources, and to professionally design HR practices and HR interventions, but also to actively participate in strategy development and execution. A more evidential or fact-based approach to evaluating the added value of the HR function would increase its credibility as a strategic business partner. As reported in the Deloitte Global Human Capital Trends 2015 survey, 75% of 3300 HR and business leaders considered HR analytics important, but only 8% of them considered themselves strong in the area (Deloitte 2015). Ulrich and Dulebohn (2015) argue that one of the reasons why HR analytics has lagged behind the implementation of analytics in other business functions is the fact that the majority of HR professionals are not interested in business statistics, although statistics cannot be longer neglected even by the HR professionals. Even for junior positions in the HR profession, analytical and critical thinking skills and knowledge of strategic management equipped with technological capabilities are becoming increasingly important to the ability to successfully apply HR principles and practices affecting the success of the organization (Cohen 2015).

## Conclusion

This article set out to contribute to the discussion on how human resource management facilitated by an HRIS and HRA can improve business performance not only by supporting the execution of HR practices, but also by improving the speed and quality of workforce-related decision making. Where HRIS software can improve the availability and accessibility of workforce-related information, HRA can support improvement efforts by providing advanced knowledge of human resources, practices related to human resources, processes performed by human resources, and the impact on those processes by developing and executing interventions under different categories of HR practice. Analytics provide an organization with a quantifiable insight into its current status and into the changes in the selected HR-related phenomena. As analytics builds on understanding the causal relationships of

HR inputs and outputs, the formal recognition of existing HR practices already enables a firm to make HR practices more tangible and identify opportunities to affect the performance of different business activities through HR interventions and changes to HR practice. Numerical metrics can be used by a broad range of decision makers at every level of an organization to identify, plan, and execute corrective actions, through which the real value of analytics is ultimately realized. At the strategic decision-making level, analytics can offer a deeper insight into specified business problems and is commonly perceived as a tool enhancing decision quality, not as a bespoke solution. Therefore, HR metrics, including all descriptive, predictive, and prescriptive metrics, have the potential to equip HR practitioners to add value and contribute to decision making and business success. However, as only a few companies currently possess sufficient competencies to capture the full potential value of analytics, the future role of HR appears to be dependent on the ability to adopt the competencies required to understand and solve critical business problems with the help of technology.

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## Authors' Biography

**Jesse Heimonen** is a project researcher and Ph.D. candidate at the University of Vaasa. His research interests are in strategy, innovation, entrepreneurship, and business intelligence. Mr. Heimonen teaches business planning and gives visiting lectures in areas such as strategic management and industry analysis. As a promising young scholar, he has presented his academic work at multiple international conferences such as Academy of Management (2015), Industrial Marketing and Purchasing (2015), and International Council of Small Business (2016).

**Jaakko Mattila** is a Business Development Manager at Sympa Oy. He is responsible on process development and service design projects in Sympa. Previously, Jaakko has worked at Oracle as a Customer Success Manager on Oracle's cloud HCM customer portfolio and at Sympa Oy in multiple roles related to customer advocacy, partner management, consulting and project management around their SaaS e-HR software.

**Susanna Kultalahti** is an Assistant Professor in the University of Vaasa, in the Department of Management. Her doctoral thesis "It's so nice to be at work!" Adopting different perspectives in understanding Generation Y at work (2015) was nominated as Highly Commended Winner in 2015 Emerald/EFMD Outstanding Doctoral Research Awards, and The Research Act of the Year in the University of Vaasa. Kultalahti also works as a Program Manager in research project "HRM in SMEs" and is responsible for teaching in several courses. Her current research interests lie especially in age management, and HRM practices in SMEs.

# Business Intelligence Within the Customer Relationship Management Sphere

Jukka Partanen, Sharareh Mansouri Jajaee and Ossi Cavén

## Introduction

The conditions of doing business in today's society are changing rapidly. To cope with such changes in the competitive landscape, companies are using different strategies and approaches to attract and retain customers and to successfully differentiate themselves from competitors. One such approach is customer relationship management (CRM). Rooted in the domain of relationship marketing (e.g., Morgan and Hunt 1994; Palmatier et al. 2006), the CRM approach views customer relationships as (one of) the most valuable and manageable assets of a firm (Thomas et al. 2004).

J. Partanen (✉) · S. Mansouri Jajaee
Department of Management, University of Vaasa, Vaasa, Finland
e-mail: jukka.partanen@uwasa.fi

S. Mansouri Jajaee
e-mail: smansour@uva.fi

O. Cavén
Procter & Gamble, Espoo, Finland
e-mail: ossi@caven.fi


M. Kohtamäki (ed.), *Real-time Strategy and Business Intelligence*,
DOI 10.1007/978-3-319-54846-3_7

As such, CRM, defined here as a strategic, customer-centric and IT-enabled approach that aims to build, manage, and retain long-term profitable customer relationships, has attracted a great deal of interest from both academics and executives (Plakoyiannakii 2005).

More specifically, the past few decades have seen a dramatic increase in the acquisition of CRM-related systems and technologies. Understanding and responding to customer requirements and improving customer service have become significant elements of corporate business strategy, and CRM systems are used by various types of organizations to support these strategies (Ali et al. 2013). Researchers also agree that usage of CRM systems has been growing exponentially over the past 10 years (Kalaignanam and Varadarajan 2012; Trainor et al. 2014). Such robust growth is driven by the spread of data-intensive approaches to understanding and building relationships with customers and companies (Johnson et al. 2012). The attention that CRM and its recently expounded close cousins, such as customer engagement (Sashi 2012) and customer experience (Brodie et al. 2011), continue to receive from practitioners is echoed by the expanding body of literature on the topic within the marketing and information system (IS) domains (Rapp et al. 2010).

However, developing successful CRM is not possible only by implementing new information technology (IT) solutions, because the changes must be strategic in nature. Indeed, despite the vast amount of published material available on CRM, there seems to be a lack of consensus on what CRM actually is and how it should be seen in relation to a company's strategy (Payne and Frow 2005). This disparity in the way CRM is interpreted can be seen in the major differences in the frameworks generated relating to customer relationship management. Furthermore, as the Hagemeyer and Nelson (2003) reported that approximately 70% of CRM projects result in losses or no bottom-line improvements in performance, clearly there is a need for a better understanding of the topic.

Given the current situation of CRM research, we propose that a more uniform strategic framework is needed. Hence, the objective of this chapter is to provide an outline of the recent knowledge on CRM and to explore the distinctive elements of CRM in the B2B context, but

more importantly to provide a managerial framework for assessing what kind of business intelligence an efficient CRM system can collect, analyze, and deliver to facilitate operational and strategic decision making.

## Benefits of CRM

Well-implemented CRM is a powerful approach to facilitate more valuable customer acquisition and customer retention (Buttle and Maklan 2015). There is a strong economic argument in favor of customer retention. While the ultimate purpose of CRM is to "build and maintain a profit-maximizing portfolio of customer relationships" (Zablah et al. 2004: 480), thus suggesting that the core benefit of CRM is greater profitability, a detailed review of the benefits of CRM reveals a more fine-grained view on how such profitability can be achieved (Reichheld 1996). Research has shown that, for instance, a slight increase in customer retention rate has a considerable effect on company profitability owing to it cutting the cost of attracting new customers (Tsoukatos and Rand 2006). In brief, the benefits of CRM can be categorized depending on whether they are related to increasing a firm's revenue or reducing its costs.

### Revenue Enhancing Benefits of CRM

**Premium-pricing**. Satisfied customers may reward their suppliers for the relationship by paying higher prices. So, while poorly planned and executed premium-pricing poses the risk of customer exit or "defection," i.e., customers leaving and/or shifting their purchases to an alternative vendor (Page et al. 1996), well-functioning CRM helps companies to distinguish themselves from competitors (Jain 2005) by detecting changes in customer requirements and customizing their products or services. Such customization, in turn, tends to improve customer satisfaction and loyalty, thereby increasing the customer's willingness to pay a premium price (Heskett et al. 2008; Smith and Wright 2004; Theoharakis et al. 2009). In addition, a sophisticated CRM

system generates in-depth customer knowledge, which may provide new up-selling opportunities.

**Customer lifetime value**. Loyal customers come to know their suppliers, and typically, such customers tend to commit more of their spending to suppliers that have historically best satisfied their needs. A related outcome is that since suppliers have a better insight into their customers and their changing needs, cross-selling becomes more efficient.

**Customer referrals and word-of-mouth (WoM)**. Customers who are strongly committed to a preferred supplier are generally more satisfied with the relationship than customers who are not committed. For this reason, committed customers are more likely to spread positive word-of-mouth and thus influence the beliefs, attitudes, and expectations of others. Committed customers may also have better access to such relevant and easy-to-spread information (e.g., a firm's offerings and other messages) owing to the firm's CRM initiative.

## Cost Saving Benefits of CRM

**Lower customer management costs over time**. The start-up costs associated with a new customer relationship can be relatively high. Therefore, it may take several years before profits cover acquisition costs; especially in the B2B context, maintaining an ongoing relationship can be relatively cost-effective in comparison with the costs of winning a new account. The cost of maintaining an acquired customer reduces over time as the parties become closer and processes become more automated, something that leads to lower transaction costs.

**Reduced marketing costs.** Enhancing the customer retention rate lowers a firm's marketing costs. Return customers offer the greatest opportunity to keep cost down because they tend to purchase more from a company, meaning the company must spend less prospecting for new customers. For those interested in how loyal relationships translate into cost savings given the cost of serving a long-standing customer versus the cost of courting one (Reichheld and Detrick 2003), it has been estimated that an advertising agency, for instance, would have to pay at least 20 times as much to recruit a new customer as it would to retain a

current customer (Buttle and Maklan 2015). In addition to the reduced cost of customer acquisition, the cost to serve existing customers also reduces over time. Ultimately, the management of existing customer relationships might almost become automated, as is observable in some B2B markets.

## Different Perspectives on CRM

While the prior studies offer several definitions for CRM (e.g., Reimann et al. 2009; Cunningham 2002), the concept can also have a significantly different meaning to the various parties using it (Buttle and Maklan 2015). Information technology providers, for example, use the term to describe software applications used to support sales, marketing, and service functions in companies, whereas others with a managerial perspective state that CRM is a strategic approach where technology might, but does not necessarily, have a role. In order to resolve this difference of views, scholars divide CRM into three different categories: the operational, the analytical, and the strategic forms of CRM (Buttle 2004).

**Operational CRM** aims to automate customer-facing business processes. It can be divided into three main groups by user: marketing automation, service automation, and salesforce automation (SFA). A CRM system is designed to integrate, unify, and automate processes in these functions in order to make them more tuned and measurable.

**Analytical CRM** covers capturing, storing, extracting, processing, distributing, using, and reporting customer-related data to enhance customer (and subsequently company) value. Customer-related data is gathered from various sources inside the company: those providing sales data, financial data, marketing data, service data, etc. This customer data can be enriched by data from external sources, for example, business intelligence organizations or market research companies. Data mining tools permit a company to resolve questions including: Who are the most valuable customers? Which customers should we aim a specific new product at? Which customers are likely to switch to competitors?

Analytical CRM provides valuable information for both strategic CRM and operational CRM (Buttle and Maklan 2015).

**Strategic CRM** focuses on developing a customer-centric culture that aims to create and deliver value to customers in order to deliver competitive advantage. Strategic CRM is based on the idea that resources should be allocated to where they enhance customer value, and that reward systems should promote employee behavior that improves customer satisfaction and retention. Strategic CRM also emphasizes the meaning of customer information and sharing and applying it across the entire business. However, it is also important to remember that an organization's CRM strategy is limited by its operational and analytical (CRM) capabilities (Buttle and Maklan 2015).

## Business-to-Business CRM

The concept of the customer differs significantly between the B2B and B2C contexts. In B2C operations, the customer is the end consumer—a household or an individual—while in the B2B context, the customer is an organization—a company (producer or reseller) or an institution (nonprofit organization or government body). The typical characteristics of B2B operations include a smaller base of customers, a relatively complex customer buying process, and larger and more valuable individual transactions. Hence, B2B firms tend to rely on a relational approach when managing their customer relationships such as direct marketing, personal selling, and attending trade fairs (Coviello et al. 2002). Such face-to-face interaction is essential to build trust between the B2B firm and its customers (Edvardsson et al. 2008).

Similarly, buying in the B2B context is formal and typically done by skilled professionals. More specifically, buying decisions can involve people in several different roles such as initiator (e.g., the person who recognized the need), end user (the personnel using, e.g., software), influencer (e.g., technical evaluator), gatekeeper (e.g., an executive assistant), approver (e.g., lawyer), buyer (e.g., purchasing manager), internal sponsor or champion (i.e., an individual who eagerly prosecutes the project within her/his organization), and the decider (i.e., the person

with the final say). This group, often labeled the buying center, thus includes, "all those individuals and groups who participate in the purchasing decision-making process, and who share some common goals and the risks arising from the decisions" (Hutt and Speh 2001).

More importantly, CRM in the B2B sphere varies considerably depending on whether a B2B firm is acquiring new customers or offering new products or services to existing clientele, or indeed whether it is satisfying the known needs of existing customers. The literature on organizational buying behavior, which adopts the customer perspective, labels these two options as *new task* and *re-buy*[1] (Robinson et al. 1967). In the **new task** situation, the customer faces uncertainty as the problem or need is perceived to be totally different from previous experience due to issues like technological complexity or the strategic long-term nature of the purchase. Hence, the customer faces a lack of well-defined criteria for comparing products and requires a significant amount of information to justify the decision. In these situations, the buying process of the customer is argued to advance along the following path: (1) problem recognition; (2) general need description; (3) product specification; (4) supplier search or request for information (RFI); (5) acquisition and analysis of proposals or request for quotes/tenders (RFQ/RFT); (6) supplier selection and negotiations; (7) order-routine specification; and (8) performance review. In new task situations, the buying center typically includes several individuals, making the process relatively long. In the **re-buy situation**, in turn, customers face a routine, low priority decision or problem and require little (if any) information to facilitate their decisions. So, the buying process is typically more streamlined. In its extreme form, the two valid buying stages can be expressed as product specification and performance review. This is especially true if a B2B supplier is on the list of approved vendors, and the procurement process is automated via an online platform, for example.

From the business intelligence perspective, the requirements for CRM vary depending on these situations. In a new task situation (i.e., acquiring a new customer or selling completely new products to an existing customer), the key challenges include generating leads and obtaining access to prospective customers, discerning their unmet needs, and identifying those involved in the decision-making process

(i.e., the buying center), and more importantly who has the final say. In the re-buy context, the focus of business intelligence is on anticipating and forecasting demand, and streamlining the interaction and business processes between the firm and the customer (e.g., delivery scheduling, response times, and automated purchasing processes). In brief, we argue that to develop CRM within the B2B sphere, it is useful to distinguish between these two buying situations because information needs, relationship management approaches, and performance metrics vary significantly between the two. We link these buying situations to the context of CRM as we describe below.

## A Framework for Capturing Customer Intelligence in the CRM Context

The existing body of knowledge provides several models for framing CRM. The majority of those models acknowledge that successful CRM stems from a strong customer orientation (Coltman 2007; Goldenberg 2008; Kumar and Reinartz 2006; Kale 2004; Lindgreen et al. 2006) and thus highlight such well-known concepts as the value proposition, customer segmentation (Radcliffe 2001), customer interaction (Peppers and Rogers 2004; Buttle 2001), and multichannel integration including call and service centers, a salesforce, and branch offices (Kim et al. 2003; Payne and Frow 2005). Prior studies also recognize the important role of IT. Indeed, CRM allows companies to harness the power of databases, data mining, and interactive technologies to collect and store extraordinary amounts of customer data and build knowledge crucial for the profitable management of relationships (Zablah et al. 2004). But as recent studies have advocated, IT resources alone are not sufficient to deliver significant performance increases (Chang et al. 2010; Coltman 2007).

Nevertheless, existing models remain somewhat vague on the specific role of customer intelligence and tend to simply emphasize the vital role of customer knowledge (Kim et al. 2003), customer understanding (Radcliffe 2001), or customer intimacy (Buttle 2001) in successful CRM. In other words, existing models do not delve deeply into two essential questions: (1) What kind of customer intelligence should a

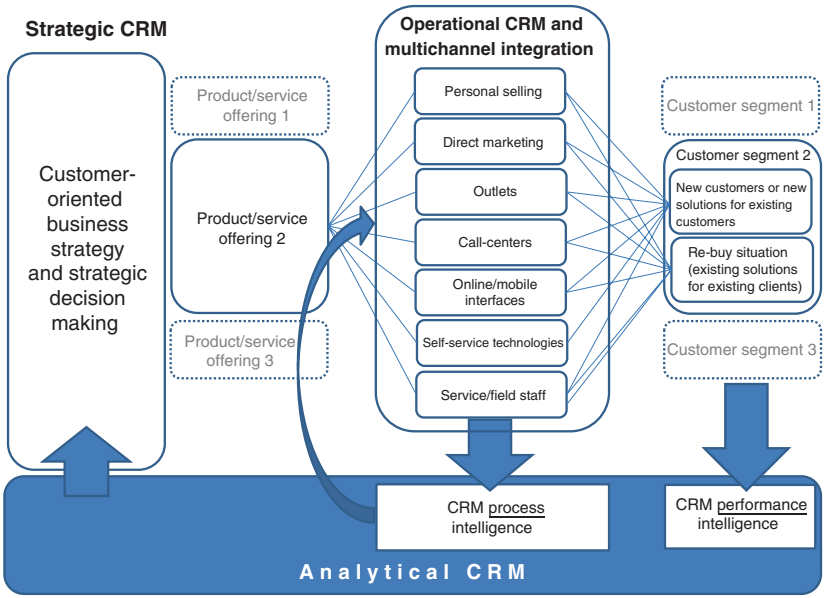


**Fig. 1** A synthesizing framework for capturing customer intelligence in the CRM context

CRM system collect, measure, and deliver that is in line with the CRM being a *process* of managing customer relationships, and (2) what kind of customer intelligence should a CRM system collect, measure, and deliver as an *outcome* or performance of managing customer relationships. We build on these studies and develop a framework for capturing CRM with a special focus on customer intelligence (Fig. 1).

As with previous frameworks, the foundation of our framework is a customer-oriented business strategy and the fit between the firm's product/service offering and the needs of the target segments (also labeled the value proposition). We also concur with prior studies and treat technology as an enabler of successful CRM (Greenberg 2009; Payne and Frow 2005). However, the current model extends the existing frameworks by distinguishing between CRM process intelligence and CRM performance intelligence and linking them with the three forms of strategic, operational, and analytical CRM. More specifically, we propose

that it is the main duty of operational and IT-enabled CRM to store and deliver customer intelligence on the CRM as a process and to ensure that such intelligence is utilized in day-to-day operations and multichannel integration (see the curved feedback loop). In practice, such process-related intelligence refers to any relevant information and knowledge that is obtained (or created) in the multichannel interfaces (e.g., sales, field staff, self-service technologies, and the online environment) and supports, or even automates, the work in those domains (e.g., sales and service operations). At its best, such process intelligence provides a holistic view on the current status of the customer relationships and synchronizes the work between different domains by providing a visualized view of the relevant information for each domain (e.g., specific dashboards for marketing, sales, and services). Yet, such valuable information is also stored and analyzed by analytics (analytical CRM) and delivered to the strategic management function.

In addition, we suggest that analytical CRM also has a vital role of conducting performance-specific CRM intelligence. This form of customer intelligence answers such questions as which customer segments are the most profitable; where is the organization losing customers; where are the biggest cost-to-serve activities; and how is customer satisfaction developing. Obviously, such performance-related customer intelligence is especially vital to support strategic management and decision making as it provides a holistic view on business development and provides a basis for allocating resources and setting up motivational incentive systems, for example.

What, then, do we know of what kind of intelligence an efficient CRM should collect, analyze, and deliver? Alternatively, we might ask what are the core KPIs of CRM in the B2B context. By synthesizing prior studies (Frösén 2013; Järvinen and Karjaluoto 2015; Malthouse et al. 2013; Ambler et al. 2004; Kumar and Reinartz 2006; Terho et al. 2012), recent business insights (Griebeler 2012), and information gleaned from discussions with professionals in the field, we adopt the established B2B buying situations as our conceptual foundation and provide practical illustrative examples of the CRM process and performance metrics in Tables 1 and 2. Table 1 focuses on the new task environment (i.e., a new customer or a new solution devised for an

**Table 1** Illustrative examples of CRM process and performance metrics in the B2B context: New task environment

| Key metrics of CRM process intelligence | | Key metrics of CRM performance intelligence |
|---|---|---|
| **Web/campaign site hits**; blog reads<br>**Referrals and recommendations** from existing customers, partners, or industry analysts<br>**New contact info** received (e.g., registered trial users and their online behavior analysis, business cards, LinkedIn invitations)<br>**First contacts** made (calls, brochures/letters, sent and opened emails, face-to-face)<br>**Customer inquiries**/requests for Information (RFI) received<br>**Request for Quotes** (RFQ) received | | **Campaign ROI** (Campaign-revenue-Campaign cost/campaign cost)<br>Contracts won; **Acquisition rate** (prospects acquired/prospects targeted)<br>Customer **acquisitions costs** (acquisitions spending/new prospects acquired)<br>Customer/segment-specific **sales, costs, profitability**<br>**Sales growth per region/segment** |
| Detailed information on **open opportunities** gained via negotiations and interaction (e.g., calls, visits, workshops)<br>Documented **history** of **customer interaction** | The composition of the **buying center** (with a special focus on the **decider** and the **sponsor**)<br>Customer's **budget**<br>Customer's **rationale for buying** (external/internal)<br>Customer's **ROI/payback time** of the investment (estimated together with the sponsor)<br>Customer's **existing solution** and its cost structure<br>Solution's **value drivers** and **"value-in-use"**; the role and impact of the solution in customer's business model (revenue-generating, cost-decreasing, uncertainty-reducing)<br>**Competitor** assessment<br>**Proposals**/quotes sent | |
| Ongoing **sales probability forecasting** reflected with sales objectives/quota | | |

**Table 2** Illustrative examples of CRM process and performance metrics in the B2B context: Re-buy environment

| Re-buy (existing customers) | Key metrics of CRM process intelligence | Key metrics of CRM performance intelligence |
|---|---|---|
| Relevant (and measured separately) for **contractual, non-contractual,** and **one-off customers** | **Buying history**<br>**Size of wallet** (customer's total spending/budget in a category)<br>**Share of wallet** (customer's purchases/customer's total spending in a category)<br>Average **order value**<br>Number of **items per order**<br>**Order-to-delivery time**<br>**Feedback** and **claims** received<br>Customer **referrals/recommendations:** Net promoter score (NPS) (% of customers that would recommend a firm to their friends, family, or colleagues)<br>**Up-sell/cross-sell rate** (number of people that accept an alternative/augmented offer/total number of alternative/augmented offers) | Customer/segment-specific **sales, costs, and profitability**<br>Customer **satisfaction**<br>Customer **loyalty**/retention rate<br>Customer **churn rate** (lost customers/total number of customers)<br>Customer **win-back** rate (number of re-acquired customers/number of lost customers) |
| **Non-contractual** customers | **Conversion rate** of non-contractual customers (number of non-contractual customers converted to contractual customers/non-contractual customers) | **Market share**<br>Sales and profitability **growth** |
| **One-off** customers | **Conversion rate** of one-off customers (number of one-off customers converted to contractual customers/one-off customers) | Customer **lifetime value** |
| **Service** metrics | Average **time from request to resolution**<br>**First contact resolution** (number of customers whose question or request is resolved on the first attempt)<br>**Uptime** (the amount of time the service is available/total time)<br>**Self-service ratio** (number of customer interactions without assistance/total number of interactions) | **Service** costs |
| **E-commerce** metrics | **Conversion rate** (number of visitors/number of orders)<br>**Shopping cart abandonment** (% of times that a potential customer puts an item in a shopping cart but do not complete the purchase) | |

existing customer), while Table 2 illustrates the CRM metrics of a rebuy situation.

There are a few notions on CRM metrics in the new task environment. First, referrals and recommendation are typically important sources of new leads. Existing customers and partners can recommend the focal firm directly or in response to an inquiry (e.g., "Who did you buy solution X from, and was it good?"). Firm rankings compiled by industry analysts (e.g., Forrester, Gartner) can be used as ready-made shortlists from which the customer can select, for instance, the top-three candidates to send their RFI. Second, the two key roles in the customer's buying center are the decider and the internal sponsor. Therefore, while the information on who is the final decider is essential for closing the deal, it is the role of the internal sponsor to help in, for instance, determining the customer's ROI and to internally sell the project to the top management of the company. Moreover, the knowledge regarding the other roles in the buying center (e.g., legal) and their interdependencies typically become more relevant as the value of the negotiated deal increases.

Third, a customer might be exposed to several rationales or pressures to buy a new solution. Some of them may be external triggers such as new legislation or end-customer/consumer demand, or internal ones such as organizational changes or a demand for cost-efficiency. Nevertheless, it is vital for the firm and its sales force to understand the underlying justification behind the purchase. Fourth and relatedly, CRM can also guide the firm to dig deeper into the reasoning behind the purchase. While assessing a customer's ROI sheds some light on this, more profound insight might be available by investigating the customer's existing solution and especially its cost structure, but also by probing the customer's business model and promoting the value drivers and value-in-use of the new solution (Terho et al. 2012). More specifically, the underlying value of a new solution in the B2B context typically lies in its revenue-generating, cost-, and/or uncertainty-reduction characteristics. Such a detailed view of customer value is essential to ensure that the offering is well aligned with the needs of the customer, but also to ensure that the price is in line with what the customer is willing to pay. As such, a sophisticated CRM system should guide the sales process to probe, document, and process such knowledge. In brief,

we argue that the process metrics of CRM in the new task environment aim to support and facilitate the work on the customer pipeline, while the performance metrics assess the outcomes of the pipeline.

Again, some elaboration is required to explain CRM metrics in the re-buy environment. First, in the B2B context, it may be useful to use contractual, non-contractual, and one-off customers as one dimension in the firm's segmentation model and apply the process metrics individually among these segments. The amount of attractive up-selling or cross-selling opportunities, for instance, probably differs for contractual and one-off customers. Second, as one of the core objectives of the CRM approach is to retain profitable customers, the process metrics regarding contractual customers as well as conversion rates (from non-contractual/one-off to contractual) should be a top priority of the operations. Third, although reported separately, the process metrics regarding services and e-commerce can be applied specifically to each segment if they are used to serve such segments.

Fourth, one aspect missing from our CRM metric framework but which is nevertheless important for serving the existing customer base is that of the future outlook. Hence, companies should be cautious not only to focus on measuring the current status of their customer relationships, but also to acknowledge the changing needs of their customers. In practice, business intelligence and specific process metrics in this "market sensing" dimension might mean ongoing market research activities (e.g., customer surveys, focus groups) or development projects with pilot or lead customers, whereas performance metrics could include the number of patents or new product/service improvements, among other things.

To sum up, we propose that the conventional and widely acknowledged CRM performance metrics are important signals for the strategic management of the current status of the existing customer base. Nevertheless, we also argue that the role of CRM process metrics is valuable for strategic management. Accordingly, while the main purpose of CRM process metrics is to facilitate and synchronize work in the multifaceted operational domains that serve the existing clientele (e.g., service and the online presence), we propose that such metrics and the intelligence gained are valuable for strategic management, as they provide a processual, or even real-time, view on the development of the existing customer base.

Overall, we argue that such a structured and managerial approach is useful as it provides a more nuanced view of the role of customer intelligence in managing customer relationships in the B2B context; yet, the metrics described above are merely illustrative examples. As such, we would not encourage firms to adopt all of them into their operations, but to understand that there are firm- and industry-specific characteristics and differences. Hence, the adoption of CRM and its process and performance metrics should be conducted cautiously by focusing only on the relevant metrics that add value, and are thus meaningful to adopt and not burdensome to implement.

## Managing Unprofitable Customers

It should be clear by now that the underlying assumption behind CRM is that customer relationships are one of the most valuable assets a firm has. Nonetheless, it is not profitable to grow the customer base aimlessly, and hence, it should be noted that not all customers are equally valuable or even profitable. Some might not be worth retaining (or acquiring at all) because of issues like a high cost to serve (Buttle and Maklan 2015). So, what if a company chooses to divest some of its customers, that is, to stop providing its products or services to an existing customer? Mittal et al. (2008) argue that while in some cases customer divestment might be a viable strategic option, it can damage a firm's reputation and relationships with existing customers. Hence, it should be undertaken cautiously and only as a last resort.

For this purpose, Mittal et al. (2008) offer a five-stage framework that helps to restore the profitability flowing from customers. In their first stage, *Reassess*, the focus is on identifying the fundamental reasons why a customer or a customer segment became problematic. The key questions include, Do we really know the reason why this customer seems to be unprofitable? Has purchasing reduced because of a lack of willingness or an inability to spend? Have the customer's needs changed? Or has our strategic focus changed, causing us to ignore the customer?

The second stage, *Educate*, aims to provide information and training to help customers better understand and use the firm's offerings.

The key questions in this stage include, What are the customer's relevant knowledge gaps? What is the most suitable way to train the customer? In brief, the goal is to manage customer expectations such that the customer is more willing to adapt.

If the education initiative does not work, it is the aim of the *Renegotiation* stage to open discussions, and ideally to agree upon rather than just to communicate, the value proposition to trigger mutual benefits. Here, the facilitating questions include, Is the customer aware of our overall value proposition? Have all secondary customer benefits been built into our prices? In practice, such renegotiations may lead to new pricing and service strategies, or to the introduction of modular products and services.

If the renegotiation stage is unsuccessful, the next option is to move a still unprofitable customer to a new provider (e.g., a partner), channel, or form of payment (e.g., prepayment). The following questions help in this *Migrate* stage: Which offerings would better serve this customer? Is it in the customer's interest to move? Which other providers of goods or services would agree to take this customer?

Finally, if there is no hope of maintaining a mutually productive relationship, the last option is to end the relationship. According to Mittal et al. (2008: 101), the key task in this *Terminate* stage is to get the customer to buy into the decision by, for example, "setting up the preconditions for divestment with the customer and by establishing mutually agreed upon schedules for divestment."

## Further Thoughts on Assessing the Value of the Customer

Mittal et al. (2008) also advise top management to consider the company's overall relationship with the customer, not just profitability. In practice, this means that even unprofitable customers may be strategically valuable in three different ways. First, especially well-known reference customers are known to be valuable sources of reputation and credibility. So, if a B2B firm is able to establish and maintain a viable business relationship with well-known customers, other customers can

rely on the qualification criteria of these pioneering large firms (Stuart et al. 1999). This form of reference value is especially vital for smaller and relatively unknown firms (Reuber and Fischer 2005). Second, some customers can help scout and gain access to new market areas (Johnson et al. 2012) or business fields and networks (Yli-Renko and Autio 1998). Third, some customers may offer learning value, which helps a firm to develop new innovations and maintain its competitive edge. The role of such innovative lead customers or technology enthusiasts is especially vital in the dynamic and/or emerging business fields in which technological development is fast and unpredictable (Möller 2010; Moore 1999).

In brief, we argue that while customer profitability is an important metric for assessing how well a firm is performing today (also known as exploitation), it is also essential to look beyond the current profitability figures and assess how existing customers can lay the foundation for a firm's business in the future (typically labeled exploration).

## The Future of CRM

The key drivers of the recent development in the CRM sphere are (1) the ability to collect and store vast amounts of customer information, but more importantly (2) cloud computing which has transformed the way professionals access and utilize such information with any device in any location. Moreover, cloud-based CRM systems have created their own ecosystems in which the users are also generating innovations for such ecosystems and their platforms. Therefore, whereas in the old world, companies acquired firm-specific systems (typically with expensive updates), now even small companies can use the same platform and its recent updates as any global top-tier company. As such, it is not only the prestige of individual and well-known companies, who are using a specific CRM system that facilitates word-of-mouth within the industry, but also the collective reputation, especially the *potential innovation value* of the ecosystem, attracts customers and helps them choose the ecosystem in which they want to develop their business.

What, then, does the future hold for CRM and business intelligence in the B2B context? We argue, alongside many others, that the core potential lies in analytical CRM, in other words, the advanced utilization of data. We all know the pioneers from the B2C world such as Amazon with its recommendations, Netflix with its tailored content, and Facebook with its customized ads. Yet, these pioneers are rare in the corporate world where CRM is still mainly used as a tracking tool for monitoring sales and marketing activities. While such tools collect vast amounts of data, they simultaneously increase the frustrating administration work of the sales and marketing staff. But more importantly, they do not allow corporations to tap into the full benefits of the collected data. The reasoning for this bottleneck is twofold. First, corporations typically purchase several customer interface systems and software (e.g., marketing, sales, social media, e-commerce, and services variants) from different vendors to improve their bargain position during purchasing negotiations and to avoid becoming locked into a specific vendor. Second, established corporations have also adopted new systems throughout their lifespan as new technologies emerge. Consequently, the data is collected and stored in silos. So, excluding rapid-growth start-ups or agile and fast advancing economies who do not suffer from such legacy burden, and thus can start to develop their data systems from scratch (e.g., Estonia and its digital health-care system), the integration of such siloed data typically requires long, complex, and expensive projects with uncertain or suboptimal (e.g., difficult to use) results. To circumvent such silos, some of the leading firms in the industry offer a wide-ranging portfolio of customer-related systems, in which the data is stored on one unifying platform, while others provide solutions integrating the silos.

Nonetheless, when the issue on data integration is resolved, business intelligence and CRM will provide new, proactive, and cost-efficient ways to manage customer relationships. As such, CRM is moving toward *customer experience platforms* that collect the information related to areas including commerce, marketing, sales, products, and social media through modern data analytics. Moreover, it is not only the integration of a firm's own data that is valuable, but also the combination of internal and external data sources that can provide enormous

opportunities for B2B companies. In other words, while data has been labeled the "new oil" (Vanian 2016) unlike oil, the value of the data can be multiplied when it is combined with additional data. Therefore, empowered by artificial intelligence and sophisticated decision support algorithms (Kolbjørnsrud et al. 2016), the future of CRM looks intelligent (Shih 2016). More specifically, CRM in the future will not only measure and report marketing and sales activities, but also offer predictive guidelines and automated support for managing customer relationships. We are already witnessing such movement within the B2B context via, for example, the penetration of chabots or via the launch of Einstein by Salesforce. We also argue that such intelligent CRM provides new opportunities to both acquire new customers (e.g., by proactively generating leads, identifying a tentative buying center, and recommending and prioritizing tasks and next steps for the sales staff) and also serve existing re-buy customers (e.g., by predicting purchasing behavior, generating ideas for new product features, anticipating service peaks, and suggesting cross-sales opportunities). In brief, instead of highlighting the role of business intelligence and real-time strategic decision making, we propose that the future outlook of CRM should be complemented with *artificial* business intelligence and *predictive* decision making.

Finally, we must bear in mind that artificial intelligence and predictive data engines will not be replacing but merely supporting and facilitating the work of marketing and sales professionals by improving the focus (i.e., targeting the right people), relevance (i.e., with the right message), and timing (i.e., for an existing or even urgent need) of the interaction for both suppliers and customers. However, important skills such as building trust and conducting win–win negotiations will remain and indeed be particularly essential in the business-to-business relationship.

## Conclusion

Customer relationship management continues to be an important topic among academics and practitioners. This chapter extends the discussion by developing a more structured framework for assessing the role of

customer intelligence in the CRM context. More specifically, our framework incorporates different types of B2B buying situations while also distinguishing between process and performance intelligence. The chapter also summarizes practical guidelines for managing unprofitable customer relationships and highlights that profitability alone may not always be an adequate measure for evaluating the strategic value of the customers. Finally, we conclude by proposing that the advent of high-quality data and artificial intelligence CRM in the future will not only support real-time decision making, but also help strategic and operational management adopt predictive decision making.

## Note

1. The literature on organization buying behavior recognizes two forms of re-buys, namely straight re-buy and modified re-buy. To avoid unnecessary complexity, we discuss only the former (i.e., straight rebuy).

**Acknowledgements** The authors thank industry expert Jukka Soini, Assistant Professor Ashish Kumar (Aalto University, School of Business), and Dina Myllymäki (University of Vaasa) for their valuable comments that helped develop this manuscript.

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## Authors' Biography

**Jukka Partanen** , Ph.D. (Econ), is Associate Professor at the University of Vaasa (Department of Management). His research interests include strategic networks and alliances, industrial service business, business intelligence, high-growth firms, and organizational ambidexterity. His work has been published in such journals as *Entrepreneurship Theory and Practice, Journal of Business Research* and *Industrial Marketing Management*. As to teaching, Jukka has taught such courses as service business development,

entrepreneurial marketing, business marketing management, and capstone course for marketing.

**Sharareh Mansouri Jajaee** is a Ph.D. candidate in Economics and Business Administration at the University of Vaasa, Finland, and works as a researcher in the Networked Value Systems Research Program (NeVS), Department of Management. Her research topic focuses on the customer relationship management (CRM). With an educational background in business administration (MBA, strategic management), her research interests are strategic practices, industrial service business, business intelligence, and customer relationship management (CRM).

**Ossi Cavén** is a Key Account Manager at Procter & Gamble. He is responsible for one of the P&G's major retail customers in Finland. Previously, Ossi has been working in various positions in both B2C and B2B sales. His interests lie in strategic sales, customer relationship management, innovation, and entrepreneurship.

# Making Sense of Strategic Decision Making

Suvi Einola

## Introduction

Strategic decision making is widely studied, but is not, however, deeply understood. Existing strategy research mostly concentrates on processes and the content of strategy work, and in addition, factors that enable or hinder strategy work. There is also a growing interest in the behavioral and social influences on the decision-making process of top-management teams, but far less attention has been directed to the cognitive factors at work at both the CEO and the top management team level (Bromiley and Rau 2016). In rapidly changing business environments, where real-time strategic decision making is crucial, the role of cognitive processes and strategic cognition is both significant and interesting. Taking into account that strategic decision making is far from easy, and that strategic decisions significantly affect firms' success or failure, the cognitive

S. Einola (✉)
University of Vaasa, Vaasa, Finland
e-mail: suvi.einola@uva.fi


M. Kohtamäki (ed.), *Real-time Strategy and Business Intelligence*,
DOI 10.1007/978-3-319-54846-3_8

approach can make a key contribution to the decision-making discourse. The current book chapter aims to shed light on cognitive factors, strategic cognition, cognitive models, and sensemaking processes at the level of both top management and individual CEO.

# Theoretical Grounds

## Strategic Decision Making

Strategic decision making is widely seen as a crucial factor in explaining firms' success. Classic strategic decision making encompasses top management teams' decisions on actions taken, resources committed, and/or precedents set. Whereas earlier studies highlight the role of rationality in strategic decision making, recent studies have emphasized the role of cognitive biases. The roles of most known cognitive biases are well illustrated in previous literature (Johnson et al. 2008; Lovallo and Sibony 2006). Over-optimism and loss aversion are seen as universal human biases affecting all types of situations, including those of everyday life. For example, when we think of our future lives, we tend to underestimate the potential for negative events in our lives (over optimism). In addition, we prefer avoiding losses to making gains (loss aversion). The following biases—the *principal–agent problem, champions' bias, and the sunflower syndrome* are more specific and tend to happen in decision-making situations. Principal–agent bias is a particular concern among decision makers especially in strategic decision-making situations, "when the incentives of certain employees are misaligned with the interests of their companies, they tend to look out for themselves in a deceptive way" (Lovallo and Sibony 2006, p. 20). In addition, champions' bias indicates the likelihood of managers having too much faith in the opinions of *trusted persons* (usually an experienced manager) in decision-making situations. Finally, the sunflower syndrome shows the tendency to lead and follow senior managers' opinions in decision-making processes.

As the potential for bias in decision-making situations is well documented (Kahneman et al. 2011; Johnson et al. 2008; Lovallo and Sibony

2006), the ways used to address bias in those situations become more interesting. If decision makers were to become more aware of how biases affect strategic decision making, there would be more opportunities to prevent those effects. We believe that the role of real-time data is essential: Usage of real-time information and making data-driven decisions should be encouraged in order to overcome decision-making biases. Of course, as pointed out earlier in this book, to be able to use real-time information, companies should pay attention to data gathering, data analysis, and also to the format of the information offered to the top management team. Continuous company-level monitoring of the decision-making processes usually provides fruitful perspectives on how to enhance decision making. In addition, the potential of open discussions and shared decision making seems to be undervalued when conceiving of decision-making improvements in top management teams. Decision makers might find it helpful to construct several simultaneous alternative scenarios in decision-making situations to reduce the likelihood of biased decisions. The views of trusted, experienced managers are worth seeking, although those should not necessarily be adopted directly. In addition, seeking consensus is considered to be important to facilitate bias-free decision making. However, consensus should not be pushed through artificially, because it would cause frustration rather than create shared understanding. As we know from earlier studies (Jarzabkowski 2008; Mantere 2005), true participation in decision-making processes will increase commitment, irrespective of how a participant reacted to the actual decision in the first place. In addition to the coping mechanisms mentioned above, the determination to actually make a decision, regardless of everyone's level of satisfaction, is decisive. The time lost through lengthy discussions undertaken to ensure satisfaction among all the participants can be crucial in fast-changing business environments.

If time is crucial, so too is money. Kahneman et al. (2016) claim that inconsistent decision making is as injurious as biased decision making, because both constitute a huge hidden cost to companies. Kahneman and colleagues present useless variability in decision making as noise. Put simply, if the decision of the decision makers differs between them, it is noise. If the decision is somewhat similar

between the decision makers, but not accurate, the decision is biased. While companies expect consistency from their decision makers, the ability to evaluate a situation is often affected by many irrelevant factors, such as previous events. The radical suggestion to correct the situation caused by noise is to replace human judgment with algorithms, but as Kahneman et al. (2016) note, the use of algorithms is not without its challenges; algorithms are not practical, and they are not applicable if decisions involve multiple dimensions. As strategic decisions are hardly ever either one-dimensional or simple, replacing decision makers with an algorithm seems not to be an option for improving decision-making quality. Kahneman and colleagues do, however, suggest regular roundtable discussions to explore and resolve the differences in decision making, and the frequent monitoring of individuals' decision making would help make decision making more accurate.

## Strategic Cognition Facilitating Decision Making

To be able to make sense of strategic decision making, one must consider strategic cognition. The role of strategic cognition studies in the field of decision making is to extend the phenomenon of strategic decision making by bringing the knowledge of cognitive theory into the management context. The concept of strategic cognition links cognitive aspects and strategic management via two constituents: structure and process (Narayanan et al. 2011). In this chapter, strategic cognition structures and processes are divided in the following manner: strategic cognition structures consist of cognitive maps, strategic flexibility, organizational identity, and organizational routines, whereas the strategic cognition processes mentioned are organizational learning, strategy work, and organizational identity (cf. e.g., Narayanan et al. 2011). In recent organizational literature, identity has also been associated with the process perspective (Gioia and Patvardhan 2012). Gioia and Patvardhan suggest that identity can be, and should be, seen both as a structure and a process, and it will accordingly be discussed as such below.

## Strategic Cognition Structures

This chapter discusses the constituents of strategic cognition structures: (1) cognitive maps, (2) strategic flexibility, (3) organizational identity, and (4) organizational routines. Cognitive structures are often proposed to be stable characteristics of an organization, including top management's beliefs about strategy, the business portfolio, and the environment (Porac and Thomas 2002). In strategic cognition structures, (1) *cognitive maps* illustrate organizations' knowledge structures like a shared cognitive picture, which managers use in strategic decision-making situations. In previous literature, cognitive maps have also been called strategy frames, dominant logic, strategic schemas, or belief structures employed by top management in strategic decision making (Daft and Weick 1984; Fisk and Taylor 1991). At the organizational level, cognitive maps can be seen as a cognitive building of strategy, where the content and structure of strategy are connected in a process where cognitive maps act as lenses and filters through which managers interpret all the available information. The key characteristics of cognitive maps can be clustered or classified into two groups: complexity and focus. The former is about companies having a "diverse set of alternative strategy solutions in strategic decision making" (Nadkarni and Narayanan 2007: 246), whereas the latter "reflects the degree to which a strategic schema is centralized around a few 'core' concepts" (Nadkarni and Narayanan 2007; 246). Since cognitive maps are mental representations that actors use in decision-making situations at least partly subliminally, challenges arise when the cognitive maps of decision makers differ significantly. Building shared understanding and shared cognitive maps is a key issue for companies aiming to develop decision-making processes.

When developing strategic decision making, (2) strategic flexibility and its two main constituents, resource deployment and competitive actions (Eisenhardt and Martin 2000), are inevitably present. Strategic flexibility resonates strongly with cognitive maps, as the key characteristics of cognitive maps (complexity and focus) are extremely relevant to strategic flexibility. The degree of focus and complexity of cognitive maps directly affects a company's strategic flexibility. Focused cognitive maps drive more hierarchical strategic decision making, during

which managers concentrate mainly on a relatively narrow set of strategic actions, whereas employing complex cognitive maps increases a company's adaptability, and thus encourages more versatile strategic decisions (Nadkarni and Narayanan 2007). The more cognitive maps are shared at the company level through participation in strategy work and through discussions, the more flexibly companies react vis-à-vis fast-changing situations through both resource deployment and competitive actions.

*Organizational routines* (3) are one of the items in strategic cognition structures. As Feldman (2000) illustrates, "[organizational] routines are temporal structures that are often used as a way of accomplishing organizational work". Organizational routines are often believed to play an important role in decreasing complexity, and accordingly, "lubricate the working of the organization" (Johnson et al. 2008, 198). On the other hand, routines are often seen as slowing the pace of strategic change in organizations, because routines seem to persist over time, and even top management teams are often committed to maintaining the status quo (Hambrick et al. 1993). Routines are criticized for being a source of inertia, although some studies view them as a source of change as well as of stability (Feldman and Pentland 2003). In any case, routines are meaningful in organizations, because a large part of the work an organization undertakes is realized through routines (March and Simon 1958). Organizational routines are like patterns of behavior involving many organizational members. Although organizational routines are often defined as stable, there are studies that claim routines are often more dynamic than they are perceived to be (Feldman 2000). In this chapter, organizational routines are mainly seen as part of strategic cognition structures, but also perceived as dynamic, and in an optimistic scenario, to support strategic decision-making processes. In sum, organizational routines can be seen as the backbone of strategic decision making.

As discussed earlier, previous studies have seen (4) *organizational identity* as both structure and process (Gioia and Patvardhan 2012; Narayanan et al. 2011). As a structure, organizational identity illustrates the answer to the question of "who we are as an organization" (Gioia et al. 2000: 67). The classic way of seeing identity as a structure claims

identity is something that persists over time and something more akin to a description of an organization's *being*: or as Albert and Whetten (1985) put it, identity is *central*, *enduring,* and *distinctive*. To challenge the structure view, in the next paragraph, we discuss organizational identity as a process.

## Strategic Cognition Processes

Strategic cognition processes encompass (1) organizational identity, (2) organizational learning, and (3) strategy work. *Organizational identity* as a process illustrates the state of becoming rather than that of being (Gioia and Patvardhan 2012). Organizational identity as a process shows how identity is constructed and reconstructed in and around organizations (Schultz et al. 2012). Organizational identity as a process illustrates the *doing*, acting, and interacting, to serve the continuous reformulation of organizational identity (Pratt 2012). Looking at organizational identity as a process entails viewing organizations as continuously changing units, where identity is not something organizations have, but something constructed in everyday interactions between organizational members. In this view, strategy work constructs organizational identity. This dynamic approach challenges the traditional way of seeing organizational identity as some sort of entity (Gioia and Patvardhan 2012). In the process view, the phases of the identity process do not have clear boundaries, but instead, move back and forth between construction, performance, reconstruction, and legitimation (Fig. 1) as a continuous cycle of organizational identity work. To conclude, it seems that identity is neither a structure nor a process, but should be seen "both as some sort of entity, and as some sort of process" (Gioia and Patvardhan 2012, 53). In any case, organizational identity is at the core of strategy and strategic decision making, when organizational actions are firmly built on organizational identity (Gioia and Chittipeddi 1991).

One of the main processes in strategic cognition is *organizational learning*. Organizational learning consists of *the four I's*: intuiting, interpreting, integrating, and institutionalizing. The first phase

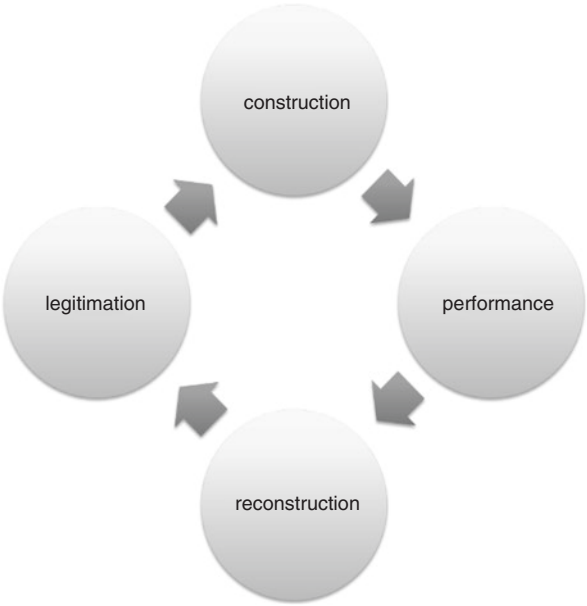


**Fig. 1** Organizational identity as a process

of organizational learning is intuiting: "a largely subconscious process" (Crossan et al. 1999: 526), where past patterns are recognized in order to learn from them. The intuition phase connects the content of cognitive maps (i.e., an organizational knowledge structure and strategy frames) with a learning process. During the interpreting phase, an organization is acting and explaining the results of the intuition phase to construct a workable form to be able to integrate and institutionalize this new knowledge into organizational life (Crossan et al. 1999). While intuiting and interpreting take place at the individual level, interpreting also occurs at the group level. Integrating knowledge occurs at the group level, while integrating and institutionalizing occur at the organizational level (Crossan et al. 1999). The four organizational learning *I's* occurring within three learning levels suggest that "the emergence of organizational learning is a bottom up and interactive process" (Crossan et al. 2011).

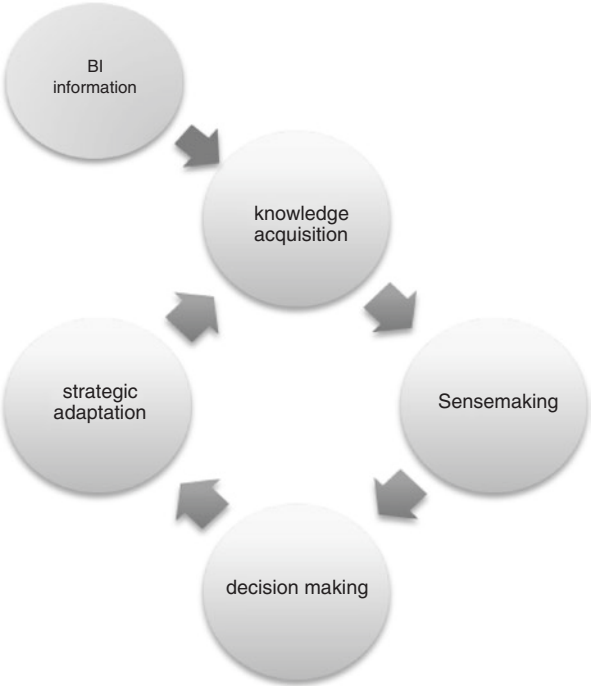


**Fig. 2** Building the concept of strategy work

## Strategy Work

One cannot talk about strategic decision making without talking about strategy work. In strategy-as-practice (SAP) research, strategy is viewed through its three interrelated concepts: practitioners (people who do the strategy work), practice (the tools and methods through which strategy work is done), and praxis (the way strategy work takes place) (Vaara and Whittington 2012; Jarzabkowski and Spee 2009). To be effective, strategy work should consist not only of phases, such as formulation and implementation, but its phases should be integrated to generate a unified process of strategy work (Fig. 2), where the boundaries between phases blur. The strategy-as-practice view might help managers

understand the different aspects of strategy work, and bear them in mind so as to improve strategy work.

The reason for strategy's ambiguous reputation and one of the reasons why only 10% of planned strategies have been implemented successfully (Mintzberg 1994) might lay in companies and researchers alike considering strategy formulation and strategy implementation to be separate processes. If strategy formulation is just for the upper echelons and does not involve a broad spectrum of members of the organization (practitioners), implementation can become challenging. Then again, if strategy is what organizations do, in the sense of emergent, dynamic, and adaptive strategic learning (Mintzberg and Lampel 1999), it should involve a broader range of actors. Participation (practice) is central to developing a shared understanding of strategy, trust between organizational members, and the sharing of the main strategic ideas (Ashmos et al. 2002; Liedtka 2000; Stensaker et al. 2008). In addition, the participation of organizational members in strategy work provides insights into the needs and opportunities inside the organization (praxis). If companies ensured wide participation among various actors, there would be no need for a separate implementation process. When middle managers and employees commit to strategy work, the implementation of strategic decisions becomes less demanding. Given that most strategic decisions are implemented at the operational level, the commitment of organizational members to strategy work from the start of the process appears vital.

Strategy work, as it is viewed in this chapter, consists of knowledge acquisition, sensemaking, decision making, and strategic adaptation. The focus of *knowledge acquisition* is often discussed in previous literature by splitting it into internal and external forms. The current work attempts to present a more holistic view on scanning the environment and building a framework to help companies collect meaningful data to enhance real-time strategic decision making. In all companies, the role of financial data is obviously salient. In addition, customer, competitor, human resources, and customer relationship management data are often collected in order to enhance strategic decisions. To be able to collect meaningful data, companies need to decide on the necessary measures, design the data collection method, and use frameworks to

collect the data. In a world where almost any piece of information is available, deciding the most relevant information to be utilized in decision making is no simple process. Ultimately, discussions with several top-management team members reveal the key issue not to be the collection of insightful data, but the utilization of data in strategic decision-making situations. Still in the era of the big data revolution, quite a number of the strategic decisions in top management teams are the product of a combination of financial data and the intuition of a few key players. It seems, therefore, that the role of the sensemaking process is even more crucial than most scholars are ready to admit.

Because *sensemaking* is a crucial item for strategic cognition processes and strategy work, this chapter illustrates the sensemaking process as setout in the retrospective sensemaking view (Weick 1979, 1995). The word sensemaking is often used quite loosely. The retrospective

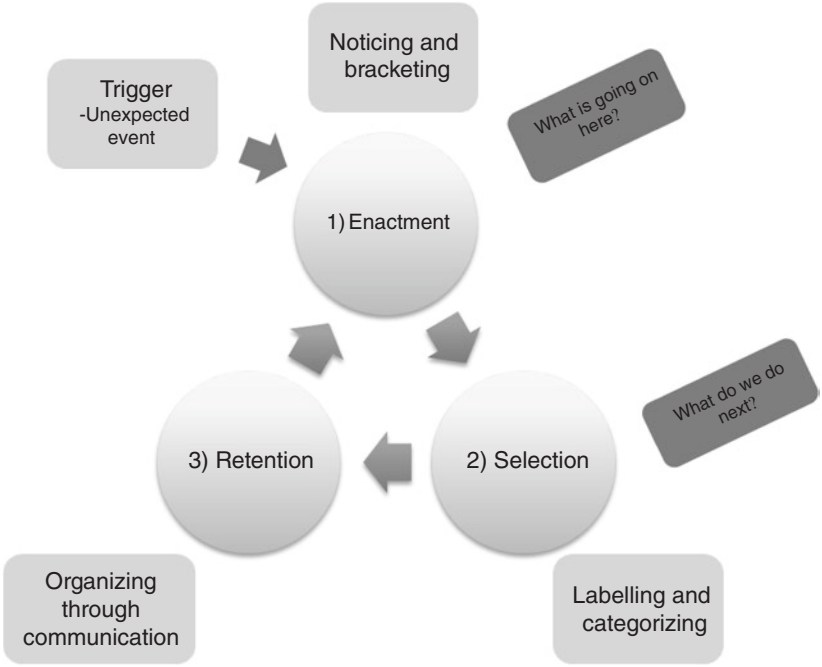


**Fig. 3** The sensemaking process (based on Einola et al. 2016)

sensemaking view defines sensemaking as a process of interactions and interpretations undertaken in ongoing dialogical discourses in an attempt to make sense of the surrounding world (Gephart 1993). This means that sensemaking is seen here as a continuous and retrospective process, in which action is not driven by sense; instead, sense is guided by action and a retrospective understanding of that action (Gioia 2006; Weick 1995).

Organizational sensemaking is realized through collective communication, interpretation, and what Giddens (1984) called 'meaning-shaping'. The earlier content of this chapter serves as a reminder of the structures of strategic cognition: the cognitive maps, organizational identity, and routines required in organizational sensemaking processes (Berger and Luckman 1966). The sensemaking process (Fig. 3) is seen as a cyclical and iterative process, a retrospective explanation of what people think they should have been doing (Gioia 2006; Weick 1995). If the sense is made retrospectively, one might wonder how to make knowledge-based strategic decisions faster and still believe the decisions to be correct. To answer this question, let us delve a little deeper into the sensemaking process.

Most of the time, participants in organizational life act on autopilot. Organizational routines lead the acting and doing in organizations. The sensemaking process is triggered when discrepancies interrupt normal action and act to trigger sensemaking and its first phase, *enactment* (Weick et al. 2005). Enactment includes noticing and bracketing equivocal events or issues and inventing possible new interpretations (Magala 1997: 324).

The second phase of the sensemaking process, *selection*, involves the variety of possible interpretations being reduced through the use of cognitive maps and connected discussions to generate an internally plausible story (Tsoukas and Chia 2002; Weick et al. 2005). To reduce the possible interpretations, actors categorize the resulting notions. The resulting categories remain tentative because they are defined by actors and adapted to local circumstances (Weick et al. 2005). In short, selection decreases the number of interpretations available for the final retention phase, where learning is enabled.

The situation attains greater solidity in the third phase of the sensemaking process, *retention*, where interpretation is connected to past

experience and can thus be used to guide forthcoming action and understanding (Weick 1979). At the retention phase, newly gained knowledge is retained into systems, structures, and processes (Krush et al. 2013).

Knowledge integration into organizational memory has often been considered an important dimension of knowledge implementation that results from sensemaking and, more specifically, from retention (Huikkola et al. 2013; Selnes and Sallis 2003). In strategy work, the role of the sensemaking process is critical, because the shared view of the organizational situation and strategy is built on the sensemaking process, which includes both conversational and social practices that are manifested both verbally and nonverbally (Gephart 1993; Gioia and Chittipeddi 1991). Organizational actors continuously construct and reconstruct organizational actions and strategy through sensemaking processes (Giddens 1984).

Because decision making in strategy work is complex and inherently includes a good deal of uncertainty, it is important for decision makers to acknowledge and appreciate the complexity of those decisions. While earlier studies highlight the role of contingency theory, that is, the either/or selection in order to find the best-fitting solution, recent literature discusses the both/and form of decision (Smith and Lewis 2011). It might be that in strategic decisions, the era of single-loop decision making is coming to an end, and what we need now is an acknowledgment of continuous change and complexity. It might be that strategic decisions should in the future be made more often through a both/and lens, as many of the challenges companies face cannot be resolved with either/or decisions. Balancing seemingly paradoxical decisions might help companies progress with their strategy work (Smith et al. 2010; Smith and Lewis 2011).

Finally, the fourth and last phase of strategy work is strategic adaptation, which can be seen as a shared movement that occurs through interactions between different organizational levels that took place in earlier phases of the strategy work (Jarzabkowski 2004). In the phase of strategic adaptation, an organization absorbs the knowledge gained into its organizational memory. Shared cognitive maps and a reconstructed organizational identity foster strategic adaptation, and again, organizational learning.

## Conclusion

In strategic decision making, and perhaps in life in general, it is not just about getting the right story, but instead about getting a story one can believe in. As strategic decision making is a complex amalgam, one where decision makers operate at the focal point of events, the use of analytics can significantly help decision makers to find the story to believe in. As discussed earlier, the structures and processes of strategic cognition significantly affect decisions. When aiming for successful strategic decision making, a few things should be thoroughly considered: (1) Companies should pay attention to knowledge acquisition to find objective assessments of facts and, therefore, should pay less attention to the intuition of a few key people if they are to avoid the biases and noise discussed earlier. (2) Companies should encourage middle managers and employees to participate in the organization's strategy work, in order to make sense of the current situation, to build shared cognitive maps among actors and to help decision making. (3) Organizational identity should be seen not only as a static structure, but also as a process where strategy work can act as a facilitator of the company's identity construction and reconstruction. (4) Organizational routines can serve as the backbone of strategy work, but it is important to bear in mind that as bones renew themselves, so should management review and replace organizational routines as necessary. (5) As strategic decisions are often entangled and complicated, balancing between tensional or even paradoxical decisions is often the only way to succeed in decision making and in life generally.

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## Author Biography

**Suvi Einola** is a Ph.D. candidate in the administrative sciences in University of Vaasa (Finland). She works as a project researcher in the Networked Value Systems (NeVS) research group in Faculty of Business Studies. Her main research interests lie in practices enabling and disabling strategy work in

organizations. Her Ph.D. research focuses on paradoxes in strategy work both in public and in private organizations. She takes special interest in strategic practices, servitization practices, and business intelligence in both private and public sector contexts. Her empirical projects concentrate on city organizations and industrial companies in Finland, projects funded by Tekes (the Finnish Funding Agency for Technology and Innovation). Besides her research, Suvi is leading a management training program in a city organization and acts as a management consultant in the field of participative strategy work.

# Project Management Intelligence—Mastering the Delivery of Life Cycle Solutions

Valeriia Boldosova and Esko Petäjä

## Introduction

The importance of projects and service-oriented business models has grown over the years, encouraging companies to shift their business models toward the delivery of life cycle solutions (Davies et al. 2007; Gebauer 2008). Project-based firms (PBFs) operate in knowledge- and service-intensive industries and provide customers with long-term solutions based on combinations of products and advanced services (Davies et al. 2007; Hobday 2000). Integrated solution (IS) providers operate as PBFs, where projects are regarded as solutions comprising a product and service offering. In the project business, information acquisition and learning from previous experiences are core capabilities

V. Boldosova (✉)
University of Vaasa, Vaasa, Finland
e-mail: valeriia.boldosova@uva.fi

E. Petäjä
Finn-Power Oy, Kauhava, Finland
e-mail: esko.petaja@primapower.com


M. Kohtamäki (ed.), *Real-time Strategy and Business Intelligence*,
DOI 10.1007/978-3-319-54846-3_9

supporting competitiveness and the survival of a firm and enabling the development of long-term relationships with customers (Koskinen 2012; Blindenbach-Driessen and van den Ende 2006). In a continuously evolving environment, PBFs have to retain a dynamic and adaptive approach to changing customer needs and to the continuous optimization of products, services, and processes (Stringfellow and Bowen 2004).

In order to enlarge the knowledge base, optimize internal processes, fully grasp the needs of customers, and satisfy their requirements throughout the project life cycle, firms are increasingly adopting the use of business intelligence (BI) and transforming themselves into intelligent learning organizations. Business intelligence systems are data-driven decision support software solutions to gather, store, process, and analyze data and enable better decision-making in PBFs through all the stages of the project life cycle: consultative selling, conceptual design and customization, product and service configuration, installation, delivery, training, spare parts, updates and upgrades, maintenance, and diagnostics.

Research contributions on business intelligence in PBFs are limited, and accordingly, this chapter provides new insights by illustrating the role of business intelligence in the delivery of solutions. Additionally, this chapter sheds light on how integrated solution providers operate as PBFs through the integration of separate project business and service business units (Gebauer et al. 2010). This chapter explicates a step-by-step project delivery process and also outlines how to use business intelligence to successfully deliver solutions as projects.

The reminder of the chapter is organized as follows: In the following section, the nature of the project business and project-based firms is discussed, and a theoretical framework underlying the project delivery life cycle is presented. The same section also presents the managerial implications relating to how to deliver solutions as projects. In the third section, the various types of business intelligence tools used in the project delivery process are discussed, and the managerial implications of integrating BI tools in projects are reviewed. In the fourth section, the role of project learning in project-based firms is examined, and the managerial implications of facilitating within and across the project learning

with business intelligence are presented. In the conclusion, the future of Project Management Intelligence is discussed and the scope of the chapter is summarized.

## Project Business and Project-Based Firms

The term project-based firms or PBFs emerged from the project business literature, where such a firm is characterized by its delivery of complete project solutions to customers (Hobday 1998). Traditionally, the project business is defined as business or "the part of business that relates directly or indirectly to projects, with the purpose of achieving the objectives of a firm or several firms" (Artto and Wikström 2005). Project business is driven by the demand for customized project deliveries, and PBFs are usually engaged in several projects simultaneously (Artto and Kujala 2008). Projects exemplify complex combinations of product and service offerings and steer the growth of project-intensive industries that include manufacturing, construction, and automation technology (Hobday 2000; Davies et al. 2007). In practice, project business can be broadly portrayed by two related concepts: project business as the delivery of an external solution to a customer and project business as an internal solution for the company's own business (Artto and Kujala 2008). The projects delivered by PBFs can be divided into business projects and innovation projects: Business projects refer to the projects delivered at the request of a particular customer, while innovation projects are targeted at the development of systems and services for a variety of customers (Blindenbach-Driessen and van den Ende 2006).

Integrated solution providers are essentially PBFs where the projects concerned involve delivering solutions comprising both products and services (Brady et al. 2005). The focus of this particular type of project-based firm is on customization and the delivery of complex solutions and systems to customers through an organization-wide integration of project and service units. The solutions delivered by project-based firms cover the entire system life cycle, including the development and the delivery of both the project and the subsequent services (Davies et al. 2007; Hobday 2000).

Delivering added value to customers through life cycle projects refers to the integration of services into the core business, resulting in long-lasting relationships with customers, and greater revenue and profits (Davies et al. 2007). Projects vary depending on the characteristics of the industry (e.g., the development of information systems, and/or of software systems, product and/or service design and installation, and operations outsourcing) and size (small-, medium-, and large-sized projects). Similarly, the type of project business determines the organizational flexibility and complexity.

The provision of comprehensive integrated solutions consisting of products and services is the key vehicle supporting solution providers in creating long-term continuous relationships with customers. The level of service offering depends heavily on the solution provider's business logic and the weight of benefits and drawbacks. Prior research distinguishes three types of solution delivery, which can be used to understand the projects at the solution level, those are: (1) transactional project deliveries; (2) project-led solutions; and (3) life cycle solutions (Kujala et al. 2011). Transactional project delivery implies simple project deliveries to a customer with a transactional service offering (spare parts, training, or support services) or no service offering. A project-led solution comprises core project delivery with an additional operation and management (O&M) service component. A life cycle solution includes a project delivery and O&M service as a single integrated solution and is focused on customer-based customization and a full-service project life cycle (Kujala et al. 2011).

## Project Delivery Life Cycle

The integration of product and services in integrated solution providers corresponds to the integration of the project business unit and service business unit within PBFs. In such PBFs, products and services are delivered throughout sequential stages of the project life cycle from the project phase to the operations phase (Davies 2004; Cooper and Budd 2007). The responsibility for project delivery is broadly divided between the sales, project business, and service business units (Artto et al. 2015) (Fig. 1).

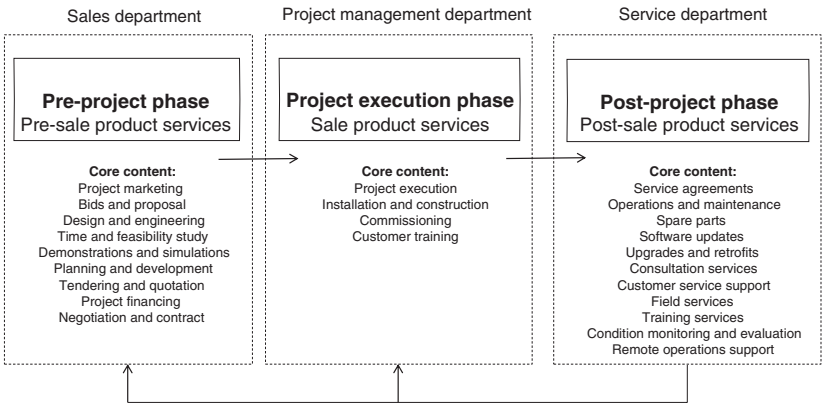


**Fig. 1** Project delivery life cycle in PBFs

All three units complement each other and support the division of responsibilities and a controlled delivery of solutions to a customer. The core function of the sales and project business units (Cooper and Budd 2007) is the delivery of a product component: negotiating the offer with a customer and executing the delivery of the project. The service business unit is responsible for the delivery of the service component as a part of a single integrated solution. In the pre-project phase of the project delivery life cycle, sales managers identify customer needs, prepare a quotation and design, offer a solution based on customer needs, and then negotiate and draft the contract. Next, in the project execution phase, project managers implement the planning, execution, and the delivery of the project to the customer. Finally, in the post-project phase, service managers deliver O&M services including service contracts, diagnostics, spare parts, consulting updates, and upgrades (Artto et al. 2015; Kujala et al. 2011, 2010; Turkulainen et al. 2013).

Despite consisting of three sequential phases, the project delivery process is not linear in nature, but dynamic and continuous. Preventive and proactive maintenance business intelligence tools used in the post-project phase support the decision-making of service managers and generate recommendations on further operational efficiency improvements in the product offering. As a result, service managers transfer the need for a retrofit solution or a software update to

the project management or sales department, which again becomes involved in the project life cycle. The use of large sets of data to compare product performance across different customers can reveal product malfunctions and software deficiencies, the knowledge that is in turn transformed into vital lessons learned practices (Milton 2010; Weber et al. 2001) for the R&D department for further product–service innovation (Chirumalla 2016). Therefore, the project delivery life cycle not only contributes to short- and long-term asset performance from the customer perspective, but also generates large sets of historical data supporting product and service development in project-based organizations.

Service offerings at the different stages of the project delivery life cycle provide financial, strategic, and marketing benefits to PBFs (Kujala et al. 2013). Drawing on the classification of product services (Mathieu 2001; Frambach et al. 1997), service offerings in PBFs cover the entire life cycle of the project delivery, depending on whether they are offered before, during, or after the project sale. During the pre-project phase, pre-sale product services support customers in the purchasing process through customization, product, and service demonstrations. Sale product services support customers during the project execution phase through planning, system installation, and technical assistance. At the post-project phase, post-sale product services ensure customer satisfaction through maintenance, diagnostics, and operation support services (Mathieu 2001; Frambach et al. 1997). Service offerings provide PBFs with detailed insights into customers' internal processes, enabling the delivery of customized and competitive projects, and leading to the creation of long-term customer relationships (Kujala et al. 2013).

While service offerings play an essential role for customers, six impact types can be distinguished to provide an outline of how services also impact business performance in project-based firms: (1) customer entry; (2) customer value; (3) competitive advantage; (4) delivery efficiency; (5) service business; and (6) innovation and learning (Artto et al. 2008). Customer entry refers to the service serving as an entry point to a customer's business. The service offering provides more opportunities to maintain a relationship and access customers during different phases of the life cycle solution. Customer value is the value of the service offering

to the customer itself. The service offering bundled with a product supports the customer's business, increases profitability, and provides other long-term strategic benefits. Given that services are difficult to imitate, an increase in the competitiveness of a product and service offering in the market generates competitive advantage from the perspective of a solution provider. Delivery efficiency depicts a positive impact of services leading to more lean and cost-effective internal processes. Training and education programs increase the level of competence, and supplementary industrial services lead to increased efficiency during the solution's life cycle. In addition to the impact of services on projects, service business itself generates value and profit through installations or customization activity. Finally, services contribute to innovation and learning. Services open new avenues for knowledge generation, the development of new capabilities and of improved products and processes (Artto et al. 2008).

## Managerial Implications: Delivering Solutions as Projects

The trend toward the provision of solutions rather than individual products or services has been steadily growing among the world's leading firms. However, managing and maintaining customer relationships in a complex context is a challenging task and requires certain measures. Services play an important role in the project business because they offer a continuous source of revenue and enable project managers to overcome what are termed sleeping phases in business projects. Prior research encourages project managers to systematically integrate the project business and service business, instead of solely relying on the pure combination of different departments. The choice of the project manager is very important, as the role is central to the integration of the project and service business units. Integrated solution providers should consider choosing a service-oriented project manager from the service unit, someone able to ensure the delivery of the solution throughout the project life cycle (Artto et al. 2015).

It is recommended that project managers involve customers in the process of decision-making on micro-level activities related to the project and service delivery. Customers tend to be interested in the detail

of the decision-making process, and such a strategic approach can contribute to building a stronger customer relationship (Artto et al. 2015). While project managers focus on the overall management of business projects, it is important not to neglect the role of front-line employees, whose behavior, competences, and motivation can positively or negatively contribute to the relationship with customers. Additionally, integrated solution providers should invest in internal marketing and provide incentives to employees to act as part-time marketers when they are with customers. These organizational mechanisms at the micro-level contribute in different ways to enhanced internal relationships and relationships with customers. To ensure the integration of both the project business and service business units, IS providers should continually focus on the development of a service-oriented mind-set, one that targets value co-creation with customers (Artto et al. 2015).

The integration of products and services is a challenging task, one that encourages PBFs to move away from traditional approaches and adopt smarter ways of working to survive in the dynamic and competitive environment. Therefore, the following section opens the discussion on how different BI tools can be utilized throughout the stages of the project delivery life cycle to facilitate efficient project delivery in PBFs. Emerging technology trends change the dynamics of inter-organizational processes, thus revealing the need for adaptation in the age of digitization. As a result, the ability of companies to stay agile and flexible is determined by their ability to adopt technology in the organizational architecture. As the vice president of R&D for the marine and energy solution company, Wärtsilä Ilari Kallio states: "Quick turns and sudden changes are the new world order. We must focus on maintaining agility and flexibility and ensuring we are equipped to embrace change." (Wärtsilä 2015).

## Business Intelligence for Successful Project Delivery

In the project business and knowledge-intensive industries, project-based firms require a customer-centered focus to understand customer needs and deliver customized solutions. Evolving customer needs force

PBFs to maintain a dynamic and adaptive attitude to innovating new products and services and to the customization of those products and services (Stringfellow and Bowen 2004). To ensure that the organization can fully grasp the needs of customers and satisfy their requirements throughout the project life cycle, firms use flexible and intelligent technologies as they pursue the goal of becoming intelligent learning organizations.

As the complexity of projects increases, firms begin to adopt information technology platforms and tools to support the management of information. Information and communication technologies enable quick and easy access to the knowledge acquired in projects for everyone in a project-based firm (Loufrani-Fedida et al. 2014). Prior research emphasizes the need to strengthen information management systems to establish an organization based on learning capable of maintaining that learning basis throughout the duration of its projects (Hartmann and Dorée 2015; Chronéer and Backlund 2015). Previous studies focusing on knowledge management initiatives and learning processes offer evidence that technology and information system infrastructure have both enabled and hindered learning processes in PBFs (Moffett et al. 2003; Connelly and Kelloway 2003; Yeh et al. 2006).

Business intelligence systems used in PBFs are information-driven, stand-alone, or cloud-based solutions covering business analytics and performance management software. They gather, organize, process, store, and analyze data to deliver valuable insights to support project management. Business intelligence tools comprise decision support systems enabling the service offering in PBFs during the pre-project, project execution, and post-project phases. In PBFs, the services supported through the use of business intelligence tools are: consultative selling, conceptual design and customization, product and service configuration, installation, delivery, training, spare parts, updates and upgrades, maintenance, and diagnostics.

A considerable volume of research has addressed the specific business intelligence software applications used in the management of projects, which are known by the generic term project management information systems (PMIS). PMIS can help project managers to plan, control, and organize projects (Braglia and Frosolini 2014; Ahlemann 2009; Caniëls

and Bakens 2012). Demand for business intelligence applications has been growing, and multiple software providers, such as Microsoft, IBM, Oracle, and SAS, now offer customized stand-alone and cloud-based solutions. The common features of PMIS cover the following tasks: scheduling, planning, resource allocation, time and budget tracking, templates and deliverables, assignments, risk management, monitoring, and quality control (Turner 2009). PMIS support project managers in forecasting and forestalling issues with the delivery of a project, and hence help firms meet planned deadlines, increase efficiency, and deliver cost savings. As the complexity of the project management field grows, the focus of the PMIS shifts from single projects to "comprehensive systems that support the entire life cycle of project, project programs, and project portfolios" (Ahlemann 2009: 19; Braglia and Frosolini 2014).

The Guide to the Project Management Body of Knowledge suggests that project success "should be measured in terms of completing the project within the constraints of scope, time, cost, quality, resources, and risk as approved between the project managers and senior management" (Project Management Institute 2013: 35). Extensive research provides evidence of diverse business intelligence applications used for data-driven decision-making processes by project managers aiming to contribute to project success. Prior scientific research has focused on building an intelligent project-based organization model providing benefits to project-oriented organizations and enterprise intelligence (Oussama et al. 2013). From the risk management and controlling perspective, more and more companies get involved in using project management tools to improve the quality of project delivery, to decrease costs, and to meet deadlines. There are risk management decision-making tools that guide a project management team choosing how best to improve its project success rate while controlling the risks of doing so. The ProRisk methodology evaluates the impact of risks on project cost and schedule, so supporting the decision-making of project managers (Marmier et al. 2013; Nguyen et al. 2013).

With regard to project management critical success factors, the methodology developed by Constantino et al. (2015) aims to help project managers assess projects during the selection phase. Based on the artificial neural network, the model "acts as decision support system for the

project selection process highlighting early signs of failure by considering the alignment of a project with corporate strategy and the riskiness of the project acceptance" (Constantino et al. 2015: 1751). The model takes into account such project critical success factors as company strategic objectives, the project manager's experience, and the competitive environment. The model can be used in any industry and helps project managers to identify the key areas in need of improvement and where resources must be allocated throughout the project life cycle (Constantino et al. 2015).

Large projects (or megaprojects) combine multiple, related, and strategically aligned projects to generate greater value. Megaprojects require different decision-making processes of project managers than single projects, and information-feed is crucial in managing them. Information-feed refers to scanning internal and external environments in order to define and forecast the factors that could influence the firm and its objectives. Prior studies show that project managers feel more confident in dealing with ambiguity, risks, and uncertainty when supported by information-feed. As a result, firms should allocate resources and investments to maintaining an advantageous project risk management system (Coulter 2000; Eweje et al. 2012).

## Business Intelligence Tools Used in Project-Based Firms

The business intelligence tools used throughout a project delivery life cycle comprise the following key systems: a product customization system, a sales configurator, a service support configurator, a design for manufacture and assembly, a project life cycle and tasks manager, a project portfolio management system, schedule management, document control management, a digital document repository, a project quality management plan configurator, a health, safety, security, and the environment (HSSE) incident investigation and reporting tool, commissioning management, project logistics and material management, a customer relationship management (CRM) system, a service cases repository, O&M reporting, a real-time monitoring and controlling system, remote access and support software, an inventory control

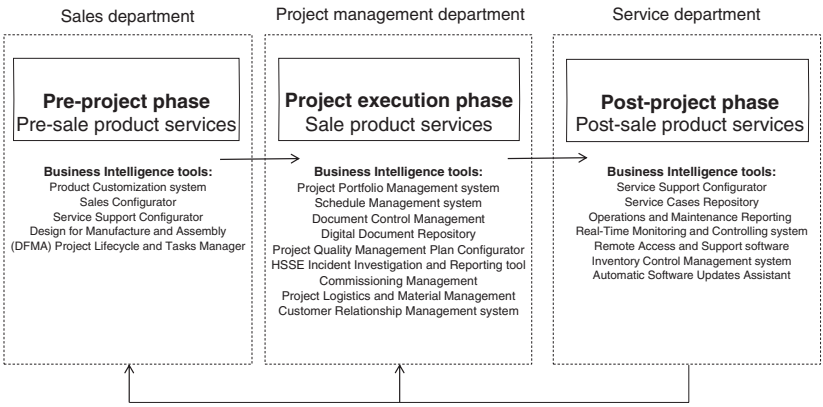


**Fig. 2** Key business intelligence tools used throughout a project delivery life cycle in PBFs

management system, and an automatic software updates assistant (Fig. 2).

In the pre-project phase of the project delivery process, firms commonly use product and service configuration tools. Product and service configuration software supports sales and service managers in the process of creating pricing in real time and constructing quotations and proposals based on the customer needs and inquiries. Configuration management software helps managers understand customer needs and co-create project solutions alongside a customer. The system is based on the concept of guided selling, where managers are able to discuss different options with the customer by establishing the relevant technical parameters. One of the ideas behind the configuration tool is to highlight customer benefits instead of focusing solely on the technical details of the solution. For example, companies in manufacturing industries use configuration management software to show their customers a 3D model of their dream factory with smart automated manufacturing devices.

In the project execution phase, project-based companies often extensively use a project portfolio management system, and also a digital document repository, and a CRM system. A project portfolio management system is a centralized warehousing and reporting business intelligence

tool that supports project managers by offering an overview of current projects, so helping to prioritize tasks and allocate resources. A project portfolio management system helps managers to cope with large volumes of information, provides visibility of ongoing operations, and thus improves operational decision-making. The system offers a common platform for collaboration and storage of topical documents, so increasing the visibility of project activities and making the content of the project accessible.

A digital document repository is a document management system designed to save time for project workers when storing, searching, and retrieving documents. A digital document repository supports project execution by providing all users with access to data on past and current projects, marketing material, images, product layouts, and technical data. A customer relationship management system supports sales managers in acquiring customer data and helps generate the most suitable proposal for a customer. The system systematically stores detailed information on customer cases and facilitates the sales process starting from the initial contact with a customer. A CRM system also collates the information on customer interactions and applies pattern recognition analysis to the customer behavior so as to improve the customer experience and customer satisfaction. A clear overview of the sales network performance and the dashboard for monitoring key performance indicators often found in CRM systems facilitates the work of sales directors and can lead to long-term improvements in the solution sales process.

In the post-project phase, firms use a service case repository and O&M reporting software. A service case repository is a reporting and online analytical processing tool used in sales, project management, and the service business unit. The repository contains such information as issue and solution reporting, troubleshooting, maintenance logs, visualization dashboards, and real-time access to data on the condition and performance of the customer's product. A service case repository supports the work of project workers through its systematic collation of the history of customer maintenance cases, field service logs, triggers, alarms, and solutions to problems.

The reporting software designed for O&M issues comprises performance analytics and product condition management features.

The system provides service managers, engineers, and technicians with a complete overview of the entire product portfolio performance through sensors, cameras, and other devices connecting the customer product with the online cloud network. The system enables data monitoring in real time and supports the decision-making of service managers by generating recommendations on enhancing operational efficiency for customers. As the CEO of Finn-Power Oy (a member of Prima Industrie Group), Juha Mäkitalo highlights: "Closeness to the customer is at the heart of our industry. That's why as customer demands are evolving, we must embrace digital evolution and the opportunities it opens up. With tools such as big data analytics, we can make big inroads into service provision and enhance the customer experience" (CECIMO 2016: 5).

## Managerial Implications: Using Business Intelligence in Projects

Despite the multiple benefits provided by business intelligence tools, its use can be challenging for project managers. While the importance of PMIS being user-friendly has been emphasized, practitioners have struggled with knowledge sharing barriers in the context of data codification (Santos et al. 2012). Knowledge sharing barriers such as inadequate IT, lack of motivation, resources, and time prevent business units from collaborating efficiently on projects by gathering and applying the knowledge learned from past projects (Ajmal et al. 2010). Firms have to ensure there are appropriate information systems supporting knowledge codification and sharing. Problems can arise if a knowledge sharing system cannot be integrated with other systems (e.g., e-mail or an intranet) or if it requires too much work (in terms of, e.g., logging in or navigation). Paying attention to and preventing such issues from arising can help ensure that employees use the PMIS. Additionally, project managers should provide proper training and incentives and encourage employees to use the BI tools. In the context of IS providers, a certain amount of time and resources must be devoted to dismantling any information barriers between project and service business units to ensure efficient knowledge sharing among units (Santos et al. 2012).

Prior findings (Caniëls and Bakens 2012) indicate project managers tend to use PMIS more frequently with multiple projects than with single projects, probably owing to the system's complexity and the time it demands. Information quality, project overload, and information overload determine the quality of a project manager's decision-making. As a result, a PMIS that is easy to use can positively affect the quality of decision-making processes. Research findings (Caniëls and Bakens 2012) suggest top management of PBFs should periodically obtain feedback from project managers on the quality of the data in the business intelligence tools. In a multi-project environment, project managers have limited time to verify the information held in the BI system. Hence, the continued use of BI by a project manager depends on how the manager perceives the quality of the information the information system supplies and the benefits conferred by the system (Caniëls and Bakens 2012).

Business intelligence tools support the decision-making processes of different business units throughout the stages of the project delivery process contributing to projects being delivered within the preset parameters of scope, time, cost, quality, and resources. Nevertheless, when operating in knowledge-based industries, project learning within and across projects is an important resource for project-based firms seeking to enlarge the knowledge base in the long term. As a result, the following section opens the discussion on the role of project learning in project-based firms, and how business intelligence tools can facilitate intra- and inter-project learning.

## Project Learning in Project-Based Firms

In project-driven industries, knowledge management practices and project learning play an important role. Project-based firms strengthen their learning mechanisms and processes to advance the firm's progress toward becoming a learning organization in order to retain and improve the firm's competitiveness. A learning organization is defined as "an organization skilled at creating, acquiring and transferring knowledge and at modifying its behavior to reflect new knowledge and insights" (Garvin 1993: 80). In the context of PBFs, learning in projects can be divided

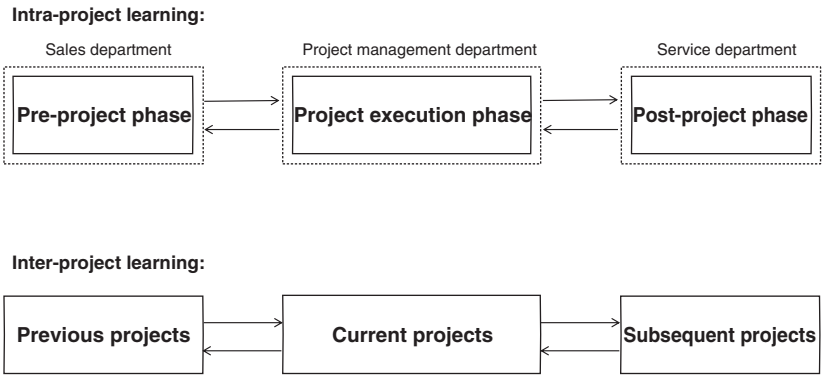


**Fig. 3** Characteristics of intra- and inter-project learning

into two types: (1) intra-project learning and (2) inter-project learning (Fig. 3) (Kotnour 2000). Intra-project learning or within project learning refers to learning processes occurring within a project and facilitating successful project delivery. Inter-project learning or cross-project learning occurs when knowledge from past projects is shared across subsequent projects with the help of information technology or meetings (Kotnour 2000). In project-based firms and integrated solution providers, the learning process starts with intra-project learning. Knowledge acquired through that intra-project learning provides the pool of best practice and lessons learned for subsequent inter-project learning (Kotnour 2000).

## Managerial Implications: The Role of Business Intelligence and Project Learning

Researchers including Chronéer and Backlund (2015) emphasize the need for firms to adopt a systematic approach toward intra-project and inter-project learning. It is recommended IS providers create "a lesson-learned cycle that collects and distributes experiences from stakeholders and thus contributes to a systematic evaluation and reflection during project closure" (Chronéer and Backlund 2015: 71).

In the pre-project phase, product and service configuration software facilitates intra-project learning through its connection to the enterprise resource planning (ERP) and automated data transfer from the pre-project phase directly to the project management department.

In the project execution phase, a project portfolio management system supports intra- and inter-project learning by providing different departments access to documentation on previous and ongoing project progress activities. A digital document repository supports learning within and across projects by collecting and storing data from different sources on previous and current projects available to all business units involved in the project delivery process. Customer relationship management tool facilitates both the intra- and inter-project learning of the sales department by collecting and storing detailed historical customer data throughout the project life cycle and enabling access to lessons learned from previous customer projects.

In the post-project phase, a service case repository contributes to within and cross-project learning by providing project stakeholders access to resolved service cases and real-time data on topical cases. In addition, lessons learned from resolved service cases support the R&D department in product innovation. Similarly, an O&M reporting system supports inter-project learning through continuously tracking product malfunctions, wearing-out of components, and software bugs as part of preventive maintenance contracts, thus contributing to product and service innovation in the long term.

Given that project-based organizations tend to focus more on problem solving than on project learning, project managers must nurture the learning culture within their organizations. Integrated solution providers should assign clear roles to project members in different project phases with the tasks related to systemic learning. Some roles should be assigned to project members who assimilate lessons learned across different projects, while the learning process owner should prioritize the knowledge derived and integrate useful experiences into practice. Knowledge sharing and integration may be fostered throughout the organizations by means of meetings or the use of different information communication technology solutions (Chronéer and Backlund 2015).

Technology is an enabling tool for the knowledge management culture; however, knowledge management processes in PBFs should be viewed not only through a lens of technology but also through a cultural lens. Organizational culture and people with different backgrounds contribute significantly to an effective knowledge management system. Global PBFs that target creating a knowledge management culture should look beyond the firm on an organizational level and should also pay attention to the cultural context. Prior research offers several sets of guidelines to help senior management and project managers to support knowledge management processes and develop a learning organization with people from different organizational, national, professional, and cultural backgrounds (Ajmal et al. 2009; Chirumalla 2016; Milton 2010).

First, to better organize the project learning process and transfer the lessons learned within and across projects, firms should ensure that employees involved in the project input the necessary documentation and information into the BI tools throughout the project delivery process, instead of doing it at the end of the project. At the end of the project, employees are usually assigned to new projects and project teams come under time pressure to fully document the lessons learned from the project. Additionally, because employees can struggle to recall the knowledge accumulated and valuable lessons learned throughout the project life cycle, inputting relevant data into BI systems at the end of the project can be challenging (Chirumalla 2016).

Second, knowledge documentation routines and the use of BI tools should be clear to everyone in the organization, and specific time and resources should be allocated to retaining acquired knowledge during and after each project (Ajmal et al. 2009). Project members should understand the fundamentals of knowledge management practices and their value. This could be encouraged by organizing seminars or workshops emphasizing the role of knowledge as the key resource in the organization (Ajmal et al. 2010).

Third, it is important to ensure staff understand the documentation policies and adhere to them as part of their daily routine (Ajmal et al. 2009; Chronéer and Backlund 2015). Project leaders should act as coordinators for the relevant employees, project, and service units to track

progress and ensure all project personnel use the available PMIS (Ajmal et al. 2010; Chronéer and Backlund 2015). Apart from project managers, senior management also have a key role in developing and facilitating the use of formal learning procedures and principles (Chronéer and Backlund 2015).

Another requirement for efficient project learning is to ensure that each department has a standard method for capturing lessons learned in BI systems throughout the project. Although BI tools used in projects differ to some extent, and reporting methods differ between departments, firms should develop a common standard policy to store the relevant lessons learned in different digital repositories to ensure data consistency (Chirumalla 2016).

Additionally, empirical research provides evidence that data reporting in BI tools through bullet points does not capture the lessons learned well and does not contribute to a rich project learning experience through BI-based knowledge repositories. It is recommended firms ensure that templates, spreadsheets, and reports in PMIS are flexible and provide project workers the opportunity to be effective in sharing their learning experience on certain topics, instead of roughly filling in all the empty (and sometimes irrelevant) blanks (Chirumalla 2016).

Finally, top management should encourage the development of a no-blame culture, where people are encouraged to be open about the knowledge held within their project team. Employees should be encouraged to share lessons learned and knowledge of job-related routines across project and department boundaries (Chirumalla 2016). The process of developing the learning organization may fail if a project manager is unaware of subcultural differences. Those who are aware can help head off conflicts and misunderstandings (Ajmal et al. 2009, 2010).

## The Future of Project Management Intelligence

While the project data volume continues to grow, it is important to tackle the issue of how different factors are shaping the future of Project Management Intelligence and what kind of emerging trends companies might face in the future. Digital business transformation is a journey,

not a destination. Therefore, companies should remain agile and treat digitization as a continuously evolving process.

The large number of BI tools used in the project delivery process is one of the key challenges that companies face at the moment. Organizations are failing to build a robust IT infrastructure, capable of integrating data from a variety of BI tools into a single platform, designed to fulfill employees needs to access project information without logging into each of the BI tools separately (McCullen 2009). In the future, Project Management Intelligence tools should be developing toward flexible integrated software programs and dashboards, providing a holistic view and improving organizational efficiency (Braglia and Frosolini 2014). Software providers and project-based firms should pay particular attention to middleware, which connects multiple BI applications together and allows the data available in one BI tool to be accessed through another.

As project-based firms continue to generate ever larger volumes of data, so the variety of different BI tools to analyze the data can be expected to grow and improve. The field of Project Management Intelligence will experience a shift toward an extensive use of predictive and prescriptive analytics in the future, which will be driven by machine learning and artificial intelligence. Project Management BI tools will calculate the value of different scenarios and the impact of future decisions based on the numerous data points and calculations. Decision-makers will be able to apply analytics to predict what is going to happen, when it is going to happen, and why it is going to happen, thus using prescriptions to shape the desirable future.

Companies operating in a digital age must not only transform internal business processes and software, but also transform their organizational culture and train their employees to be more responsive in the process of becoming a data-driven organization. It is predicted that the data-driven business and BI-enabled decision-making will become a standard practice in organizations, which will also require skills appropriate to using insights effectively. As the number of projects and the volume of data will grow, companies will recruit specialists such as *data translators*, who can analyze and derive the most useful insights from data. Additionally, companies will support employees involved in

the project delivery process to develop new sets of advanced analytical skills to understand statistics and align project insights with business decisions.

## Conclusion

This chapter provided insights for business practitioners into how different business intelligence tools can be used throughout the stages of the project delivery process in project-based firms: the pre-project phase, project execution phase, and post-project phase. Business intelligence systems facilitate the intra- and inter-project learning occurring in project-based firms and contribute to both short-term and long-term project management performance. Knowledge sharing tools facilitate the decision-making processes of project managers, sales managers, and service managers; however, such barriers as inadequate IT, lack of motivation, resources, and time can hinder the performance of business units at the individual and organizational levels. The role of projects and the delivery of customized solutions are growing and are changing firms' internal processes and learning mechanisms. Learning organizations are considered to offer advantages that include nurturing a learning mindset, creating, absorbing, and exploiting the knowledge gained from outside or inside the company. In the current context of digitization and the shift toward intelligent technologies, companies should increase their flexibility and continuously innovate in and optimize their internal decision-making processes to remain competitive.

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## Authors' Biography

**Valeriia Boldosova** is a PhD candidate, teaching assistant, and a project researcher in DIMECC S4Fleet project in the Faculty of Business Studies at the University of Vaasa, Finland. Boldosova is responsible for the development of Project Management Intelligence for real-time decision-making in manufacturing firms and integration of Big Data Analytics in Prima Power. With an educational background in strategic management, Boldosova's research interests are industrial service business, digital business transformation, Internet-of-Things, and Industry 4.0 smart factory solutions.

**Esko Petäjä** is an R&D Manager in Prima Power, a leading manufacturing company of laser and sheet metal machinery with factories in Italy, Finland, USA, and China. With over 30 years of experience, Petäjä has been involved in a variety of R&D and strategic business development projects including software and hardware development, knowledge transfer, development of IoT platforms and Big Data Analytics, LMS development, and merger management of two international manufacturing companies. Apart from computer science and business development, Petäjä is a certified UPL/GPL and RC Pilot, a member of Radio Amateur Club, and an active member of GEO (Group on Earth Observations) focusing on satellite meteorology and environmental science.

# Supply Chain Intelligence

**Karita Luokkanen-Rabetino, Arto Rajala, Ilkka Sillanpää and Khuram Shahzad**

## Introduction

Today, business organizations operate in global and dynamic business environments characterized by continuous change, uncertainty, radical advances in technology development, rapidly changing customer needs, and continuously intensifying competition. To be viable and successful, firms need to have accurate strategies in place to respond to these challenges in profitable and competitive ways. For this reason, in

K. Luokkanen-Rabetino (✉) · A. Rajala · I. Sillanpää · K. Shahzad
University of Vaasa, Vaasa, Finland
e-mail: karita.luokkanen-rabetino@uva.fi

A. Rajala
e-mail: arto.rajala@uva.fi

I. Sillanpää
e-mail: ilkka.sillanpaa@hegemonia.fi

K. Shahzad
e-mail: khuram.shahzad@uva.fi


M. Kohtamäki (ed.), *Real-time Strategy and Business Intelligence*,
DOI 10.1007/978-3-319-54846-3_10

this chapter, we address issues related to business intelligence (BI) and supply chain analytics (SCA) as a means to support supply chain management (SCM) and decision-making, in order to enhance a company's business performance in today's volatile environment.

In this context, SCM is a central component in firms' competitive strategies, directly affecting firms' competitive advantage and success (Gunasekaran et al. 2004; Qrunfleh and Tarafdar 2014; Sangari and Razmi 2015; Ireland and Webb 2007). Generally speaking, SCM can be understood as a set of approaches utilized to integrate suppliers, manufacturing, warehouses, and stores so that merchandize is produced and distributed in the right quantities, to the right location, and at the right time, in order to minimize system-wide costs while satisfying service-level requirements (Qrunfleh and Tarafdar 2014) and customer needs. Therefore, SCM ensures that products and services are available when they are needed and consumed, and that they are produced at the right cost and optimal quality levels. For example, Dell's success was powered by a "build to order" approach that enabled it to offer customers a personalized solution while avoiding inventory hold until the order was received. Dell's innovation in SCM fueled its meteoric stock market performance—92% (cumulative appreciation of Dell's stock price during the 1990s). Accordingly, SCM capabilities are both an important competitive advantage and a determinant of a firm's business performance (Tracey et al. 2005).

The importance of SCM has increased remarkably within the last decades. Its role has changed from taking care of tactical operations to a strategic issue. Even traditional manufacturing firms have focused increasingly on their core business processes, outsourcing other non-core processes and activities, which gives rise to a reliance on external resources and services. This has been a growing trend since the 1970s. For example, many manufacturers outsource 70 to 80% of the content of their finished products (Corbett 2004). Consequently, more often than not the supply chains are global and complex, including multiple market players in many different geographical locations and from different cultural backgrounds. In this context, it is easy to agree that firms' ability to satisfy their customers' (rapidly changing) needs, and respond to competitors' strategic movements and the requirement for

quality and efficiency in product and service delivery, depends strongly on their ability to develop and manage their supply chain relationships, activities, and processes (cf. Meixell and Gargeya 2005).

Competitive advantage rarely depends on only a single firm; instead, competition takes place among complex supply chains, and even in larger networks or ecosystems. For this reason, several horizontal alliances have been established to achieve cost efficiency and market effectiveness. Good examples can be found of alliances to deliver cost efficiency in the automotive industry, where companies use the same platforms in manufacturing but still compete fiercely in the customer market (e.g., PSA Group, Citroën and Peugeot, Fiat, and General Motors). Airlines have also formed horizontal alliances to be able to extend their market offering and customer experience to deliver enhanced market effectiveness (e.g., Oneworld, Star Alliance, and SkyTeam). Both types of alliances are based on effective and streamlined supply chain systems (Gulati et al. 2000). This kind of logistics integration has a significant effect on operation performance. Information technology capabilities and information-sharing both have significant effects on logistics integration (Prajogo and Olhager 2012).

Managing large and complex supply chains is a challenging task, where intelligence regarding supply chain partners, intrafirm and interfirm functions, processes, and performance levels is an essential asset for decision-makers (Adelman et al. 2002). Information technology (IT) and its many applications have a central role in SCM, and the application of IT has been considered the backbone of the supply chain business structure (Sanders and Premus 2002; Varma and Khan 2014). Particularly in the era of the Internet and digitization, advanced IT systems and SCA are critical tools for firms to support decision-making and facilitate their intentions to achieve competitive advantage (Sahay and Ranjan 2008). For example, a global engine and power solution provider for marine and energy markets addressed the importance to develop big data analytics and applications to scan efficiently their massive internal database to find quickly the most promising suppliers among hundreds of potential ones. Another global manufacturer in lift and elevator industry sector, in turn, highlighted the importance of developing big data analytics enhancing their risk management in

supplier markets based on external data sources. They expect that big data analytics can create intelligence to detect possible risks regarding suppliers' court suites and unethical behavior (e.g., the violence of environmental regulations or the use of child labor). Moreover, several scholars have claimed that organizations have reached a point where they *need* to use effective analytics and tools to support decision-making (e.g., Sangari and Razmi 2015).

Figures describing the development of the SCM-related software market provide evidence for this trend. For example, Gartner estimates that the market for SCM software, maintenance, and services has been growing constantly. It generated a market close to $9 billion in 2013 (including applications for procurement software), showing a 7.4% increase compared to 2012 (Trebilcock 2014). This also includes software solutions such as enterprise resource planning, warehouse management inventory, logistics, and spend management. Moreover, big data analytics, while still in its infancy in the SCM context, is gaining more attention as a potential investment area (e.g., Accenture). However, the extent to which firms rely on these applications varies remarkably.

While SCM-related applications are widely used, firms are still struggling to harness the full potential that analytics and BI systems can provide. We believe that one of the main reasons is a lack of holistic and integrated BI approaches, resulting from the complexity pertaining to SCM. As such, SCM itself is a broad concept, which typically includes many different functions, activities, and processes, and it yields many different decision-making levels (strategic, tactical, and operative). Unfortunately, often these functions and processes operate in silos, with each having their own IT applications (e.g., Gibson et al. 2005). While these applications can produce an enormous amount of data, the different datasets are not integrated or shared between the different functions or processes inside the firm, or between supply chain members. Another important reason inhibiting firms from taking full advantage of SCM-related IT is that the information generated is not tied to the company's strategies and strategic objectives (Prajogo and Olhager 2012). In addition, there is a lack of accurate performance measurements and metrics.

In this chapter, we aim to provide an overall picture of BI and SCA as a means to support SCM and decision-making. In the next section, we

describe the concept of SCM and need for BI. Then, we take a closer look at SCA in different areas of SCM. Following that examination, we construct a holistic framework that illustrates how an integrated, managerially planned BI system can be developed. Finally, we discuss the main competency requirements, as well as the challenges still prohibiting the great majority of firms from building comprehensive BI systems for SCM.

## Supply Chain Management and Business Intelligence Needs

During the last decades, several definitions of SCM have been presented. In these definitions, SCM has been—and still is—regarded as a synonym for logistics, supply, and supply chain control (Sillanpää and Sillanpää 2014). Accordingly, it is seen as the chain linking each element of the manufacturing and supply process, from raw materials to the end user, encompassing several functions and organizational boundaries (Scott and Westbrook 1991; New and Payne 1995). It even includes activities such as sales and operation planning, sourcing, logistics, manufacturing, assembly, transportation, distribution, and post-delivery customer support (Tan 2001, p. 40).

The SCM concept has evolved to include activities such as supply chain integration, coordination, and collaboration activities, as well as supplier development, lean, agility, and "leagile" (lean agile) forms. The Council of Supply Chain Management Professionals defines SCM as

> the planning and management of all activities involved in sourcing and procurement, conversion and all Logistics Management Activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies (Mentzer et al. 2008, 32).

From the strategic viewpoint, definitions of SCM also clearly reflect the connection between SCM and firms' success, presenting SCM as

a system with clear strategic intent (Braziot et al. 2013), which should bring benefits to and competitive advantage for firms. A good illustration of this is Stock and Boyer's approach, which defines SCM as:

> The management of network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction. (Stock and Boyer 2009, 706)

On the basis of the above definitions, it can be stated that successful SCM requires both cross-functional integration inside the company, and coordination of inter-organizational relationships and networks, where marketing must play a critical role (e.g., Tracey et al. 2005; Lambert and Cooper 2000). Following on from Stock and Boyer's definition, the ultimate goal of SCM is to provide value for customers and benefits for the firm (Qrunfleh and Tarafdar 2014). The benefits associated with successful SCM can usually be placed in three broad categories: value creation, efficiency creation, and customer satisfaction (Lambert and Burduroglu 2000; Christopher 2005; Ehrenthal et al. 2014). SCM merges supply chain integration, creating competitive advantage and agility of cooperation between the members and functions in the supply chain. At a more detailed level, researchers have pointed out factors such as increased inventory turnover and revenue, cost reduction, product availability, and decreased order cycle time as the main benefits of successful SCM (Fawcett et al. 2008). Lately, more strategic-level issues, such as supply chain sustainability, agility to respond quickly to external and internal changes to maintain competitive advantage, and collaboration between supply chain members as strategic goals of SCM have increased in importance (e.g., Sangari and Razmi 2015).

In short, we understand SCM as a concept (or management approach) consisting of many different intrafirm and interfirm activities and processes that should be planned, implemented, and managed so as to produce value for the end customer, and provide competitive

advantage and benefits for the firm. However, some scholars have criticized the use of the term *chain* to describe the very complex and even multilayered structure of supply activities and actors. Terms such as "supply network" or "supply system" provide a more up-to-date picture of what we really mean by SCM (e.g., Rice and Caniato 2003).

In order to manage and monitor the supply chain efficiently and achieve the aforementioned benefits, managers need many types of information and forecasts to support decision-making, ranging from the strategic to the tactical and the operative. Information on (actual and prospective) supply chain members is essential and should include their capacities and capabilities, performance levels, and costs. Information on different intrafirm and interfirm functions and processes (e.g., inbound logistics, manufacturing, outbound logistics, sales and marketing, and customers) is also needed (Chan and Qi 2003a, b). Sometimes the necessary information will be qualitative (e.g., supplier innovativeness, quality, flexibility, visibility, and trust), or it might be quantitative (e.g., cost, resource utilization, and lead time) (Shepherd and Günter 2006; Chan 2003). In addition, several aspects of information are important for measuring performance:

- costs (e.g., prices, logistics, and warehousing);
- lead times and punctuality (order delivery time, inbound punctuality, and outcome punctuality);
- quality (number of reclamations, reclamation costs, etc.); and
- information to develop the supplier base (cost-competitive sourcing, number of suppliers, supplier innovativeness, supplier capabilities, etc.)

When managing a supply chain, it is necessary to measure its performance because "*if you cannot measure it you cannot manage it*" (Picard 2003, 58). Supply chain performance measurement is most relevant when matched to the supply chain operations stages: plan, source, make, deliver, and return. Furthermore, both financial and non-financial metrics should be used alongside quantitative and qualitative measures. As Shepherd states, SCM should be measured at multiple levels (Shepherd and Günter 2006). In practice, this means measuring SCM performance at the operational, tactical, and strategic management

levels (Gunasekaran et al. 2004). It is important to develop more non-financial metrics, owing to their ability to deliver more information than basic financial metrics.

De Toni and Tonchia (2001) present time-based indicators as non-cost indicators, where time can be measured as internal or external time. Gunasekaran et al. (2004) present a great deal of time-based measures. Time is also identified as the next source of competitive advantage (Balsmeier and Voisin 1996; Kessler and Chakrabarti 1996; Mehrjerdi

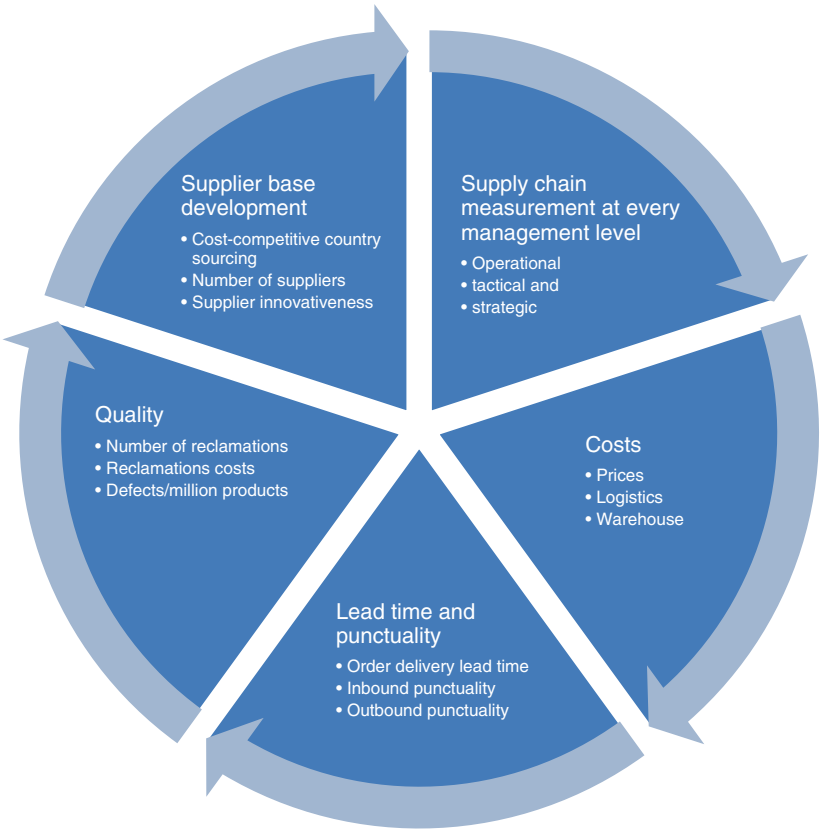


**Fig. 1** Supply chain performance measurement approaches (*Source* Modified from Sillanpää 2015)

2009; Stalk 1988; Vesey 1992). Several scholars also recognize lead time to be a very descriptive indicator when measuring the supply chain.

Figure 1 summarizes the different supply chain performance measurement approaches as costs, lead time and punctuality, quality, supplier base development, and supply chain measurement at every management level (Sillanpää 2015).

Recently, supply chain integration has received a lot of attention, both in academic research and in SCM practice (Prajogo and Olhager 2012). Supply chain integration is involving all its members and functions in order to share and distribute BI across the whole supply chain network, resolve SCM issues, and develop cooperation between actors in the end-to-end supply chain (Tsai et al. 2013). Integrating information into the whole supply chain plays a critical role when developing the supply chain to make it more agile, responsible, and capable of creating competitive advantage. A dominant trend in supply chain integration is to utilize cloud services to track and share all members' contributions to the end-to-end supply chain. The concept of supplier development creates practical operational-level supply chain integration, shares BI, and develops the external supply chain where sales and operations planning, sourcing, manufacturing, and delivery are conducted based on BI information (Sillanpää 2015).

Planning and building BI systems to respond to the abovementioned requirements requires supply chain competence, which can be understood as the ability to provide the supply-chain-related information and knowledge that supports supply chain decision-making at different levels, functions, and processes (Sangari and Razmi 2015). In the remaining parts of this chapter, we discuss analytics in different SCM functions and build an overall framework to illustrate what an integrated Supply Chain Management Business Intelligence (SCMBI) system could look like.

## Supply-Chain-Related Business Intelligence and Supply Chain Analytics

BI is about producing and providing invaluable information-related input for business needs. It can be viewed as

> a response to current needs in terms of right, quick, and easy access to relevant information through intensive use of information technology (IT) that enables managers to make better informed decisions in a variety of organizational contexts. (Sangari and Razmi 2015, 356–357)

In particular, the development of high-speed Internet connections, the Internet of things, and efficient computing power has opened up new avenues for BI systems and applications. Traditionally, BI has been mainly linked to *descriptive analytics*, which use significant amount of data describing what happened or what is happening. *Predictive analytics* is used to forecast what will be happening in future. These analyses are based on historical and real-time data. On the other hand, *prescriptive analytics* provide recommendations which are derived from descriptive and predictive analytics models using multi-criteria decision-making, optimization, and simulation models (e.g., Wang et al. 2016; Souza 2014). These three categories can be seen as a kind of continuum in which SCA support decision-making in both operational/tactical and strategic levels. The role of BI changes when moving from descriptive to predictive and prescriptive analysis. In the context of supply chain management descriptive, predictive and prescriptive analytics support operative-level decision-making whereas strategic decision-making level utilizes mainly predictive and prescriptive analytics (see Fig. 2).

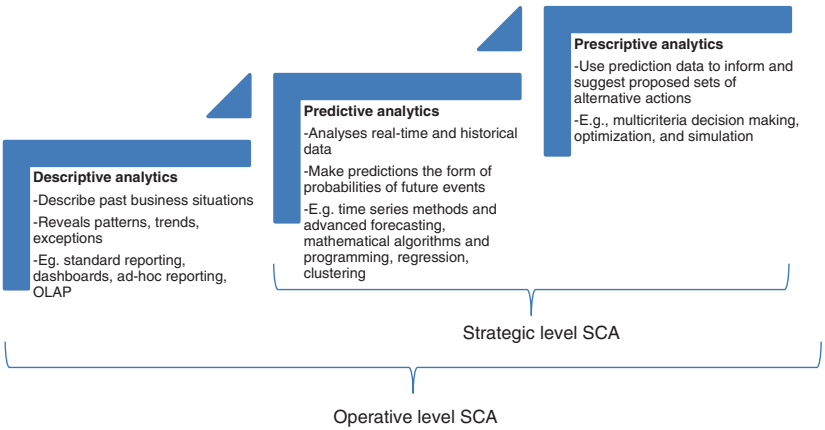


**Fig. 2** Business intelligence analytics continuum in supply chain management (Elaborated by using Wang et al. 2016)

**Table 1** Definitions of SCA (Developed from Rozados and Tjahjono 2014)

| Author(s) | Definition of SCA |
|---|---|
| Bongsung et al. (2014: 4695) | "SCA refers to the use of data and quantitative tools and techniques to improve operational performance, often indicated by such metrics as order fulfillment and flexibility, in supply chain management." |
| Deloitte (2014: 2) | "Analytics tools and techniques harness data from a wide range of internal and external sources to produce breakthrough insights that can help supply chains reduce costs and risk while improving operational agility and service quality." |
| Souza (2014: 595) | "Supply chain analytics focuses on the use of information and analytical tools to make better decisions regarding material flows in the supply chain. Put differently, supply chain analytics focuses on analytical approaches to make decisions that better match supply and demand." |
| Waller and Fawcett (2013: 79) | "SCM data science is the application of quantitative and qualitative methods from a variety of disciplines in combination with SCM theory to solve relevant SCM problems and predict outcomes, taking into account data quality and availability issues." |
| O'Dwyer and Renner (2011: 33) | "Advanced supply chain analytics represents an operational shift away from management models built on responding to data. Advanced supply chain analytics can help supply chain professionals analyze increasingly larger sets of data using proven analytical and mathematical techniques." |
| Sahay and Ranjan (2008: 38) | "Supply chain analytics provides a broad view of an entire supply chain to reveal full product and component." |
| Smith (2000: 6–7) | "Supply chain analytics is the process by which individuals, organizational units, and companies leverage supply chain information through the ability to measure, monitor, forecast and manage supply-chain-related business processes." |

As stated previously, IT and its many applications have an important role in SCM. For example, large companies such as Proctor & Gamble and Walmart have improved operational efficiency through the use of data and analytical IT tools, whereas Tesco has experienced cost savings through SCA (Bongsug et al. 2014). The definitions of SCA (Table 1) illustrate the potential of the BI system for firms. For example, Smith (2000) states that:

> Supply chain analytics is the process by which individuals, organizational units, and companies leverage supply chain information through the ability to measure, monitor, forecast and manage supply-chain-related business processes (Smith 2000: 6–7).

In the same fashion, Pearson (2011) describes the benefits of SCA as:

> "...with predictive analytics, supply chain managers gain a deeper understanding of what is happening upstream and downstream. As a result, they're better able to assess the operational impacts of prospective supply chain decisions" (Pearson 2011: 22).

O'Dwyer and Renner (2011) link the use of SCA to a managerial approach, stating that:

> Advanced supply chain analytics represents an operational shift away from management models built on responding to data. Advanced supply chain analytics can help supply chain professionals analyze increasingly larger sets of data using proven analytical and mathematical techniques (O'Dwyer and Renner 2011: 33).

Next, we will present a short overview of the analytics used in the SCM context. We base our overview on the study by Wang et al. (2016), who conducted an extensive analysis regarding supply chain and big data analytics in the SCM sphere. Following their approach, we describe the use of analytics at different managerial levels (strategic and tactical/operative) based on different SCM functions. Although in the real world these functions may be integrated and overlapping, we present them separately for the sake of clarity.

## Strategic Level

At the strategic level, the main issues relate to questions regarding whether the supply chain includes the right partners in the right locations to deliver everything that is necessary to provide the correct cost and quality levels. Strategic-level BI refers mainly to activities related to

strategic sourcing, supply chain network design, and product development. Strategic SCA is able to develop information which helps managers and decision-makers to understand better changing marketing conditions, identify and assess supply chain risks, and leverage supply chain capabilities in order to formulate cutting edge, implementable supply chain strategies, thereby improving supply chain flexibility and profitability (Wang et al. 2016: 101).

Organizations need to capitalize on the importance of supplier integration in business operations, particularly in the new product development process (Handfield and Nichols 2002). Further, customer and supplier integration in the supply network significantly enhances value creation. This also supports what Vargo and Lusch (2004) called a service dominant logic, where customers and providers together create value.

**Strategic sourcing** aims to create value for the firm by leveraging external resources and capabilities: in other words, outsourcing business processes and activities. As a general-level goal, strategic sourcing targets performance-enhancing opportunities, to enable cost reductions and/or value creation by finding suppliers and partners with distinctive capabilities and innovation ability (Monczka and Markham 2007; Wang et al. 2016). This is in line with what Russell and Thukral (2003, p. 325) point out when focusing on the total cost of ownership, including both qualitative and quantitative processes or service improvements, strategic sourcing can facilitate better internal and external service, thereby increasing revenue. Applications can produce information for strategy sourcing alignment (e.g., analyzing supplier spend profiles based on history and future estimations, procurement processes, and estimating future demand). In addition, it can feed sourcing strategy optimization (including, e.g., supply market trend analysis, cost modeling, risk management, and contracting terms) and produce valuable information for supplier selection and evaluation based on their optimal value offering, and by benchmarking them against industry best practice and market prices (e.g., lead times against industry norms, quality level, cost-saving initiatives, and supplier pricing against the market), and setting performance targets. (Wang et al. 2016)

**Supply network design** determines the physical configuration and infrastructure of the supply chain. In today's fiercely competitive markets, designing competitive supply chain network design is the inalienable requisite of having successful supply chains (Farahani et al. 2014, 94). Key decisions are made on the number, location, and size of manufacturing plants and warehouses, and the assignment of retail outlets to warehouses, etc. Network analysis software can provide valuable information for managers and decision-makers regarding the number and location of warehouses, cross-dock facilities, return depots, and production facilities for the entire globe that minimize total warehousing, freight, and inventory costs. Analytics can provide information regarding, for example, fixed and operational costs (warehouse location), traffic network design, and reshoring decisions (Davis-Sramek et al. 2010; Wang et al. 2016). However, several cases indicate that the competitive aspect of supply networks has become a critical issue, regarding how they should be designed. As Farahani et al. (2014) pointed out, it seems that competitive supply chains are the leading entities of today and future markets. According to them, competitiveness should be considered in all stages of designing new supply chains. Designing the physical network structure of a chain is called supply chain network design. Because the structure of a supply chain has a great effect on its overall performance, resilience, costs, and competitiveness, supply chain network design is considered to be one of the most important stages of designing a new chain, which impacts all of its future tactical and operational decisions.

**Product design and development** plays a key role in company success, where information regarding suppliers' capacities and innovativeness, as well as the cost, quality, and lead times of different components, is essential. The aim of SCA in this context is to help increase the competitiveness of firms' products. SCA is able to produce information regarding, for example (Wang et al. 2016):

- quality and reliability prediction standards;
- data on the expected performance of supplied components;

- what-if scenario analysis regarding product design and development costs; and
- real-time data from internal processes or suppliers to monitor and analyze the substance of supplied components.

## Tactical and Operational Levels

Regarding tactical and operative levels, there is little research addressing the supply chain planning problem of integrating procurement, production, and distribution planning activities into a "fuzzy" environment (Peidro et al. 2010). SCA offers tools for analyzing and measuring supply performance in demand planning, procurement, production, inventory, and logistics. SCA is useful at the tactical and operative level to improve an organization's operational efficiency, measure supply chain performance, reduce process variability, and implement the best possible supply chain strategies. These improvements are achieved through seamless interconnected operations between supply chain processes, from the suppliers of raw materials to end consumers (Wang et al. 2016: 101; Davis-Sramek et al. 2010). Decentralized tactical supply chain models are of particular interest in uncertain environments. In particular, the decentralized approach is suitable for companies where the elements of the supply chain belong to different companies and do not share internal information (e.g., Peidro et al. 2010).

Operational-level metrics require data that are relevant to low-level management, and metrics that are relevant to routine business practice (Gunasekaran et al. 2004). Furthermore, Peidro et al. (2010) suggest that especially in uncertain environments, the so-called fuzzy linear programming models are superior to the traditional deterministic methods for handling situations where accurate data is ill-known or is not available for operative and tactical supply chain planning.

**Demand planning** is an activity undertaken to manage processes and operations to meet demand—and variations in such demand—to ensure customer satisfaction, and to minimize warehousing and

inventory costs. It is essential for supply chain operations planning as a whole, which includes resource allocation and capacity planning. SCA can be extremely useful as a provider of demand forecasts and capacity planning by utilizing descriptive, predictive, and prescriptive analysis (e.g., time-series approaches, short-term and intermediate-range forecasting, and one-period forecast) (Wang et al. 2016).

**Procurement** consists of activities such as finding, acquiring, and buying goods, services, or works from an external source. Procurement typically generates a large amount of data from various sources and applications, such as monetary spendings, supplier performance assessments, and negotiations. SCA can help decision-making by providing analysis for many important business issues such as supply risk management and supplier performance management. The information needed is related to, for example, price, quality, delivery time, location, and negotiation (Wang et al. 2016).

Procurement systems allow comparisons between suppliers for example (Davis-Sramek 2010), and assist decision-makers by providing information regarding:

- quality problems and material availability
- risk identification by monitoring public and private data
- quality evaluation
- delivery guarantees and time lines
- spend analysis, etc. (Wang et al. 2016)

**Production** is one of the central functions in manufacturing firms. It consists of many interlinked processes and activities that must be monitored and analyzed properly to deliver efficiency, cost savings, and, ultimately, customer satisfaction. Important indicators are, for example:

- the percentage of defects
- cost per operation hour
- capacity utilization
- the Human Resource Productivity Index (Wang et al. 2016)

SCA can enhance the understanding of production costs, production capacity levels, resource allocation for multiple production lines

(demand fluctuation), and material waste identification. Advanced planning and scheduling systems can help manage processes by producing schedules for what to make, where, when, and how to make it, while taking into account material availability, plant capacity, and other business objectives (Davis-Sramek 2010; Wang et al. 2016). This is especially important when parts of the manufacturing processes are decentralized or outsourced to other companies.

**Inventory management** is commonly understood as "the practice of overseeing and controlling the ordering, storage, and use of components that a company uses in the production of the items that it sells" (e.g., http://www.investopedia.com/terms/i/inventory-management.asp). Systems such as vendor-managed inventory systems and enterprise resource planning (ERP) collect, process, and report various data to increase efficiency, create cost savings, and improve performance related to inventory. Managers need information regarding demand based on historical data and forecasts, replenishment lead times, desired service levels, holdings costs, and the fixed costs of placing a replacement order. Supply chain inventory analytics produces information regarding inventory performance improvements, accurate inventory needs predictions, and cost reductions, so providing a holistic view at the inventory levels across the whole supply chain. Furthermore, analytic inventory software can create information on optimal safety levels and reorder points at various facilities, in order to maximize profitability (Wang et al. 2016; Davis-Sramek 2010).

**Logistics and delivery** create much of the data when shippers, logistic service providers, and carriers manage their operations. Here, predictive analytical tools in particular are important to assist the design of flexible logistics operations, and to optimize the routing of goods, vehicles, and crews (Wang et al. 2016).

## Toward Integrated Supply Chain Business Intelligence Systems

Even though many kinds of software applications and analytical tools are available, most firms are still far from harnessing the full potential of BI systems and SCA. A major reason for that is the lack of integration

between BI and other systems in the firm. Integration involves linking various systems and their applications or data together, either physically or functionally, so that value can be created above and beyond that provided by each individual system. While much of the discussion of integration in BI focuses specifically on data integration and its associated tools, the integration of both related systems and data stores presents a significant challenge in many sectors (Işık et al. 2013). Sahay and Ranjan (2008, 43) have also argued that "…the cost of deploying of a large data warehouse to support BI system is still high for many organizations."

The abovementioned problem becomes clear in at least three aspects. First, applications often operate in function-based silos where interaction and coordination between the different functions, processes, and supply chain partners remain weak or nonexistent. This may create inefficiencies through overlapping or even duplicated data collection and analyses. It can also lead to a situation where the information located in one place does not reach the decision-maker in the other place, a party who could benefit exactly that information. For example, strategic sourcing, procurement, and production activities can all benefit from spend and cost analysis, lead-time information, and suppliers' performance and quality-related information. Demand planning, production, warehousing, and logistics are very closely linked to each other, and the close coordination and interaction between them can increase flexibility and efficiency and create cost savings. Therefore, the challenge is: (1) to integrate information from many different sources and databases and (2) to provide proper user access for decision-makers at the different organizational levels and units (Işık et al. 2013; Sahay and Ranjan 2008; Varma and Khan 2014; Swafford et al. 2008; Siddiqui et al. 2013).

Second, a common problem relates to the quality of data: The metrics and performance measurements are not clearly defined, and, even more importantly, they are not linked to companies' strategies and objectives (Yeoh et al. 2008). As a consequence, it is difficult to measure and evaluate the performance of different functions and processes. Basically, the previous literature contends that there are two main, but partly overlapping, purposes for measuring BI: to evaluate whether BI is worthy of investment, and to help in the management of BI processes. Moreover, due to the lack of a holistic approach to SCM and weak

integration, it is nearly impossible to evaluate the total performance of the entire supply chain. So, it seems to be important to develop a kind of balanced performance measurement approach to BI, to link BI creation to the strategies and objectives, and link those to key performance indicators when necessary (Lönnqvist and Pirttimäki 2008).

Third, despite the tempting value proposal that big data analytics provides, and SCM managers' positive attitudes toward it (Ramakrishnan et al. 2012), firms have been extremely conservative about, and careful of, what is entailed in building big data-enabled BI systems (e.g., Sanders 2016; Accenture 2014). One reason for this may lie in the fact that building such systems takes time, requires resources and commitment, as well as coordination effort. However, the market is evolving, and BI software providers are gaining a foothold though their development efforts. In addition, at the moment the most advanced most companies are building their proof-of-concepts in order to gain competitive advantage over their less advanced counterparts, and some leading-edge companies, such as Walmart, eBay, and Progressive, have even reported benefits in their use of big data (Sanders 2016; Olszak and Ziemba 2006; Gessner and Volonino 2005).

Bearing in mind the abovementioned challenges, we constructed an integrative framework (Fig. 3) to illustrate how the integrated SCMBI system could be developed from the managerial viewpoint.

The very core idea of the framework is that the managerial understanding **at different SCM levels and functions** defines what kind of information is needed, what kind of data should be collected and analyzed, and what kind of results the analytics should produce. Managers required to measure performance should have a clear understanding of the relevant metrics and of how data relates to the strategic, tactical, and operative levels of objectives.

In addition, managers should have a clear understanding of which functions and processes are interlinked (**cross-functional and cross-level**), the extent to which they can benefit from the same information, what kind of collaboration and coordination (intra and interfirm) is needed, and what kind of BI requirements they possess. In order to reach that level of understanding, managers in different roles and positions need to communicate and interact in order to create an understanding regarding the need for cross-functional and cross-level information.

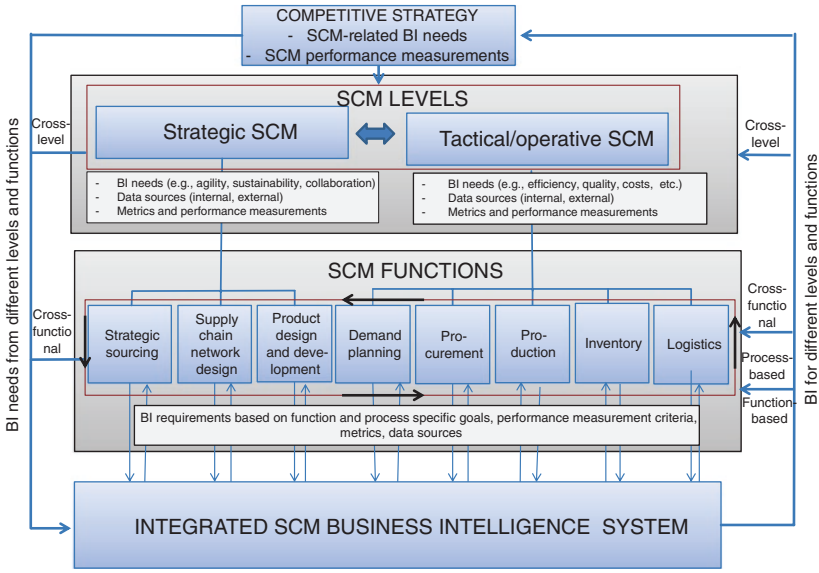


**Fig. 3** A framework for an integrated SCM business intelligence system

The information must serve as a building block for **integrated SCMBI system** development that through technical IT solutions produces intelligence for managerial needs to support SCM at different managerial levels. It is important to ensure BI incorporates and integrates the information for the entire supply chain.

In summary, we provide a list of basic questions to propel research toward the development of integrated SCMBI systems.

- What kind of information is required at different levels, functions, and processes (e.g., quantitative/qualitative, behavioral/numeric)?
- What is the format of the data (function-based, process-based, cross-functional, cross-level, etc.)?
- Which functions or processes are intertwined, and what is the share or benefit from the same data and analytics?
- Where is the data bank or storage located (internal vs. external data sources)?

- What kinds of results should the analytics produce in order to enhance decision-making and performance monitoring (e.g., performance data related to processes and/or outcome, decision-making based on descriptive, predictive, and prospective analytics)?
- How are the BI data linked and connected to the strategic goals and objectives of the company? Do they allow performance monitoring and key performance indicator assessment?

## Competence as a Building Block for Successful Business Intelligence Systems

### Supply Chain Management Challenges and Requirements

Developing an integrative BI approach for SCM is not a simple task. The preceding sections have stressed the role of business managers and their needs as a basic foundation for supply chain BI system development. However, managerial competence alone is not enough to succeed; supply chain BI is a multidimensional concept, where different competence areas have to be developed and managed in a complementary manner.

As proposed by Sangari and Razmi (2015), supply chain BI competence consists of managerial, technical, and cultural competences, which together enable the development of a well-functioning BI system (see Fig. 4).

Managerial competence is needed to ensure the effectiveness and efficiency of the supply chain BI process. Since the creation of an SCMBI system is an involved and resource-demanding process requiring top management involvement and commitment, this can be considered a critical success factor in the development of an SCMBI system.

Technical competence, in turn, is key to ensuring that firms have correct and effective technologies, tools, and software applications to support the BI process (Sangari and Razmi 2015). For this purpose, an effective supply chain BI system incorporates widespread analytical

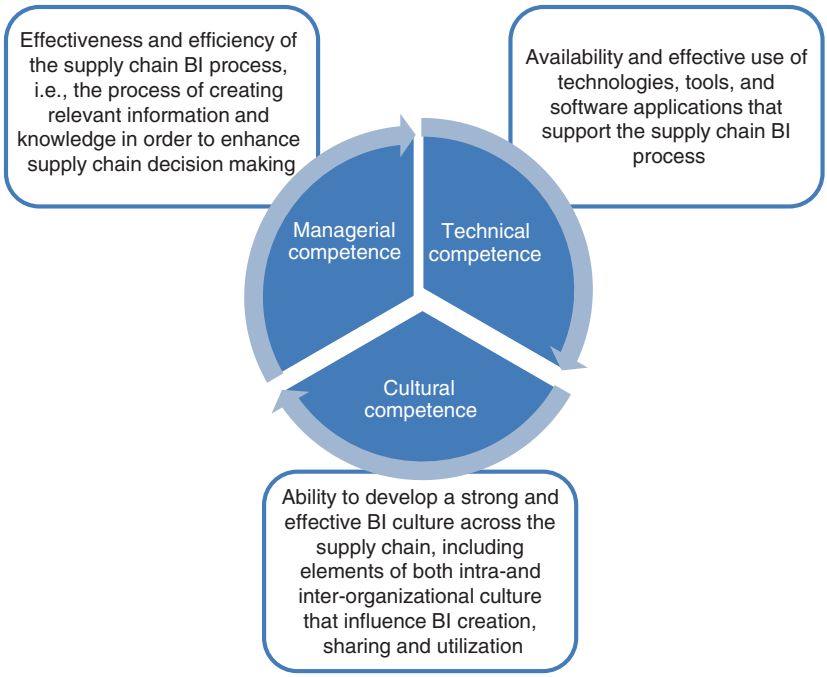


**Fig. 4** Dimensions of supply chain business intelligence competence (*Source* Adapted from Sangari and Razmi 2015)

applications in combining, evaluating, and accessing huge sets of information (Adelman et al. 2002). People need to access the necessary information and have an efficient data management tool to monitor performance at different levels, functions, and processes. Moreover, firms need IT competence, which can be understood as an "extent to which a firm is knowledgeable about and effectively utilizes IT to manage information within the firm," to support supply chain integration and flexibilities (Ngai et al. 2011, 235, 245).

In this context, it is important to emphasize that technical competence should ensure that BI users have easy and user-friendly interfaces to access that information. It is important to ensure that collaboration between BI users and IT professionals is emphasized and also that

companies invest in training, educating, and bringing together the right people to use those systems and interact with one another (Fawcett et al. 2008).

Cultural competence is the third important capability necessary to develop a strong BI culture across the supply chain. Cultural competence is based on beliefs, subjective norms, practices, traditions, and values shared among supply chain firms. Inconsistencies in organizational norms and values can negatively affect the information system, as well as decision-making processes.

In this line of argumentation, we want to emphasize that while SCMBI is enabled by modern information technology, its success is also strongly founded on people (Fawcett et al. 2008) and firms' behavior. Scholars and practitioners in the SCM field agree that transparency and trust are the key issues supporting a successful relationship between firms and people (e.g., Liu et al. 2009, 2010). Often, firms may be reluctant to share information with their supply chain partners due to uncertainty and the risk of opportunistic behavior. However, integrating information flow throughout the supply chain results in co-value creation, by bringing parties together to facilitate information-sharing. Information flow integration also establishes a functional competence that enables suppliers, manufacturers, and customers to work together effectively to boost operational and process performance (Cepeda and Vera 2007; Fabbe-Costes and Jahre 2008). Finally, bilateral expectations of information exchange—the beliefs partners hold on what constitutes excellent communication and timely information-sharing—appear to be a useful safeguard against buyer–supplier conflict (Heide and John 1992).

Trust, transparency, openness, and a cooperative atmosphere are significant and effective factors in sharing information and developing and sustaining a long-term relationship (e.g., Liu et al. 2009, 2010). It is important that firms invest in integration processes for their supply networks, in order to access the right information, at the right time, from the right people. However, there are implementation and validation challenges regarding integrating large groups of organizations into

effective networks. For example, small- and medium-sized enterprises may face issues due to a lack of resources, while multinational enterprises need to consider time and cost constraints.

These very operational challenges can be tackled by taking supply chain partners on board through creating confidence levels and giving them a sense of ownership. However, this should be done by considering that firms need to be able to react in agile and flexible ways to market volatilities and dynamisms. Modern IT can play an important role in balancing tensions between supplier network integration and/coordination, and having the agility to respond to market changes (White et al. 2005; Swafford et al. 2008). In more general level, also Wang et al. (2016) have recognized the challenges regarding taking into account the social, organizational, and technological implications of SCA adoption. However, they state that despite these challenges, it is important to leverage the *"organizational capacity for extending SCA across the organization and supply chain in order to create holistic business analytics since it will result in benefits across organizational levels, and ultimately, competitive advantage"* (Wang et al. 2016, 106).

## Conclusion

This chapter has provided an overview of BI and its analytics in the SCM sphere. We hope that our review of current SCA and the integrated SCMBI system framework developed helps to clarify the complexity embedded in SCM. We also hope that our framework and the discussion about SCMBI competences encourages practitioners to be open-minded regarding the potential opportunities of SCMBI system and prompts those practitioners to take the first steps toward establishing more efficient and integrated BI systems. Finally, we end by repeating the notion stated by Wang et al. (2016) that new challenges stem from the need to constantly improve and update the methodologies and techniques for SCA, as well as to understand the underlying organizational culture and politics that play an important role when selecting business strategies, and subsequently determining and deploying methodologies and techniques to be employed by SCA.

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## Authors' Biography

**Karita Luokkanen-Rabetino** works as an Assistant Professor at University of Vaasa in a research group called "Networked Value Systems." Her research interest focuses on firms' strategic adaptation in dynamic business environments, explorative and exploitative innovations, and business intelligence. Previously, Luokkanen-Rabetino has worked as a business consultant at Atos (Spain, Barcelona), focusing on IT-related innovations.

**Arto Rajala** is a Professor of marketing at University of Vaasa (Finland). He earned his doctoral degree in Marketing from the Aalto University, School of Business (former Helsinki School of Economics). Rajala's current research interests include innovation management, customer value creation, business-to-business service development, business networks, and energy transition management. He has published his research, e.g., in Industrial Marketing Management, Journal of Business Research, Entrepreneurship Theory and Practice, International Journal of Technology Management, and International Journal of Revenue Management, and Technology Innovation Management Review.

**Ilkka Sillanpaa** Ph.D. (eng.), Ph.D. (econ.) is presently the CEO and entrepreneur at business consulting company Hegemonia ltd, which is specializing management consulting for small- and medium-size companies, accelerator for startup companies and research cooperation with universities. He was Global Category Manager at Konecranes, a company specializing in lifting equipment and services globally. Prior to this, until June 2011, Dr. Sillanpaa was a Senior Sourcing Manager, Global Sourcing at Rautaruukki Oyj, a supplier of steel and metal-based systems. Dr. Dr. Sillanpaa holds Ph.D. (eng.) degree in industrial engineering and management from the University of Oulu, Finland, and Ph.D. (econ.) degree in management from the University of Vaasa, Finland.

He is Assistant Professor and Postdoctoral Researcher in the Department of Management at University of Vaasa, Finland, and Visiting scholar at Corvinus University of Budapest, Hungary. He has published several international academic journal and conference articles related to supply chain management and strategic management.

**Khuram Shahzad** is a Doctoral Researcher in Department of Production at University of Vaasa. He holds M.Sc. degree in economics and business administration from University of Vaasa. Previously, he has worked as Project Researcher for "Suuri Yrittäjätutkimus Collector & Companies 2015" at University of Vaasa. His broad research interest includes supply chain management, transaction cost economics, business networks and value systems, and corporate social responsibility. He has published several international academic journal and conference articles related to supply chain management, strategic management, operational strategies, and maintenance resource coordination. His Ph.D. study focuses on successfully managing buyer–supplier relationships in supply chain.

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M. Kohtamäki (eds.), *Real-time Strategy and Business Intelligence*,
DOI 10.1007/978-3-319-54846-3