

# Developing Human Skills for Well-Functioning Business Analytics Capability

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**Abstract:** The ability to support both strategic and operational management with data-informed insight can generate significant benefits for organizations. Industries continue to become increasingly data-driven, and organizations continue to develop their business analytics capability to seize the value potential embedded in data. Consequently, organizations are investing in data and technology resources and, to leverage these investments, also in human and intangible resources, such as technical skills, managerial skills, and data-driven culture. While the integral role of human skills in an organization's business analytics capability is widely acknowledged within the extant research literature, there is much less discussion and evidence on how organizations develop these skills. However, such investigation would help provide organizations with new perspectives on maximizing the business value of their business analytics capability investments. Using 36 semi-structured interviews, this study explores what kind of measures organizations apply to develop the skills of their analytics professionals. Building on the extant business analytics capability literature and the resource-based view of the firm, this study contributes by deepening the current understanding of the development of human skills in building a well-functioning business analytics capability. Our findings show that, besides technical and managerial skills, organizations should also proactively develop the collaboration skills of their analytics professionals. The practical examples of skills development measures described in this study, such as job rotation, mentoring and role overlaps, provide new ideas for analytics professionals and decision-makers to enhance their business analytics capability development.

**Keywords:** Business Analytics, Capability Development, Technical Skills, Managerial Skills, Data-Driven

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## 1. Introduction

Business analytics capability (BAC), defined as an organization's ability to effectively leverage its data, technology, and talent to generate data-driven insight (Kristoffersen et al, 2021) is a widely discussed concept among information systems and management science scholars. Since the first conceptualizations (see, e.g., Cosic et al, 2012; Cosic et al, 2015; Gupta and George, 2016), it has been leveraging the resource-based view (RBV) of the firm (Barney, 1991; Penrose, 1959) to elaborate those resources the organizations should possess and combine to form a well-functioning BAC that helps them create value.

As part of the discourse on human and intangible business analytics (BA) resources, several scholars have been seeking to identify what kind of human resources are essential for forming a successful BAC, as well as what is the role of intangible resources, such as the intensity of organizational learning and data-driven culture. The extant literature on human BA resources has extensively focused on listing various human BA skills (see, e.g., Cosic et al, 2015; Qin et al, 2023) and emphasizing the importance of developing those skills (see, e.g., Shao et al, 2023). While such research has helped scholars and managers to understand the significance of human BA skills when forming BAC, it does not offer many practical examples of how organizations develop their human BA skills.

In this study, we explore what kind of measures organizations apply to develop their human BA skills. First, we describe the current literature on BAC and especially the human BA skills and their development. After this, we introduce our research approach, followed by the empirical findings on the observed measures for human BA skills development. Finally, we discuss how this study relates to the extant literature on human BA skills, and how our findings can support both scholars and organizations to increase their understanding of human BA skills development.

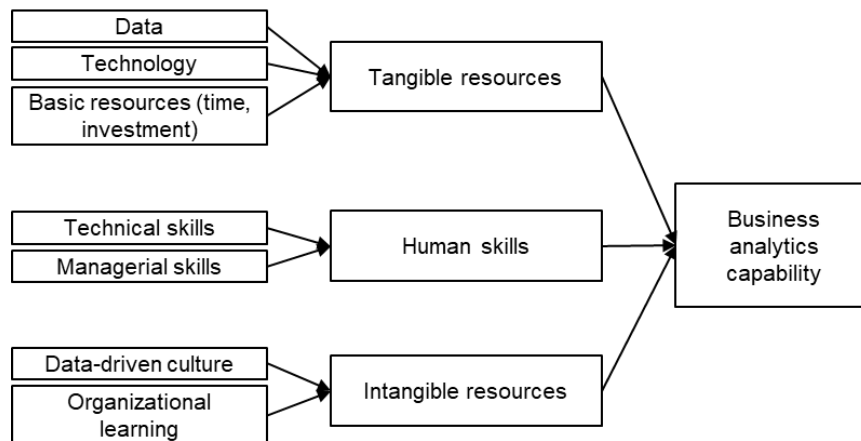
## 2. Theoretical Background

### 2.1 Business Analytics Capability

This study draws on the resource-based view of the firm (RBV), especially its sub-streams of resource combination (Penrose, 1959), complementarity (Harrison et al., 1991), relatedness (Dierickx and Cool, 1989, and co-specialized resources (Lippman and Rumelt 2003), as well as the emerging discussion on BAC (e.g., Cosic et

al. 2015; Gupta and George, 2016). As per the theoretical underpinnings, firm resources could be far more valuable if they are combined and used together instead of in isolation (Penrose, 1959). By combining complementary, related, and co-specialized resources firms can establish capabilities that help them undertake productive activities through simultaneous deployment of their resources (Lockett et al., 2009; Teece et al., 1997).

In essence, BAC is conceptualized as a multidimensional third-order formative construct, comprising three BA-specific dimensions (i.e., resource categories), including: tangible resources, human resources, and intangible resources (Gupta and George, 2016; Kristoffersen et al, 2021; Mikalef et al, 2020). These dimensions are conceptualized as second-order formative constructs, encompassing seven first-order constructs (Figure 1): tangible resources include data, technology, and financial investments, human resources consist of technical and managerial skills, and data-driven culture and intensity of organizational learning are considered intangible resources, whereas BAC itself is an outcome of an organization-specific combination of these resources (Gupta and George, 2016; Mikalef et al, 2020).



**Figure 1: Business analytics capability as construct of tangible, human and intangible resources (e.g., Gupta and George, 2016)**

The formative nature of BAC indicates that a firm-specific combination of data, technology, basic resources, technical skills, managerial skills, data-driven culture, and organizational learning are required to establish the capability (Gupta and George, 2016). Having a suitable combination of tangible (also called infrastructure), human, and intangible BA resources is touted as a crucial feature for establishing a well-functioning BAC (Mikalef et al, 2020; Morimura and Skagawa, 2023).

## 2.2 Human BA Skills

The role of human resources and especially human BA skills is pronounced in the previous literature. For instance, Fosso Wamba et al (2017) conclude that the expertise of analytics personnel is more important for organizations than analytics infrastructure or analytics management in general, and it should be managed dynamically. Further, Kristoffersen et al (2021) warn firms not to focus too much on tangible resources (i.e., data and infrastructure), as the investments targeted on human talent and data-driven culture are equally important for establishing BAC and reaping business benefits.

Human BA resources are required not only to operate and use BA but also its output. This requires people involved in BA-related activities to possess adequate technical and managerial skills (Gupta and George, 2016; Shamim et al, 2019). Technical BA skills refer to the ability to use BA technology to produce the intended outputs (Gupta and George, 2016; Mikalef et al, 2019), such as skills related to data management and utilization, modeling, and improving the performance of analytical models (Cosic et al, 2012; Srivastava and Dixit, 2023). The technical skills required from the analytics professionals highly depend on the data and technology resources they have at their disposal, but also on the intended use of analytics (Qin et al, 2023; Srivastava and Dixit, 2023). Managerial BA skills are described as a combination of the individual's business acumen and an adequate level of understanding of data and analytics processes, as these help them to understand how BA output is generated and what are those decision-making situations it can be applied in (Carillo, 2017; Mikalef et al, 2019; Shamim et al, 2019; Srivastava and Dixit, 2023). Certain coordination skills, such as resource

management skills (Srivastava and Dixit, 2023) and setting goals and monitoring analytics performance (Cosic et al, 2012) are also required from those who run and develop BA.

Whereas the extant literature seems to agree on the importance of technical BA skills and managerial BA skills as crucial elements of BAC, also skills that facilitate collaboration between business and analytics professionals are important for well-functioning BAC (Carillo, 2017). People leveraging BA should also be endowed with a certain attitude that promotes the collaboration and innovative use of BA (Cosic et al, 2012). Analytics professionals should be able to enhance analytics understanding within the organization, e.g., when they communicate and present their findings to business managers (Carillo, 2017). To be able to collaborate with business managers, analytics professionals should also understand the business they are supporting (Cosic et al, 2012; Ghasemaghaei et al, 2018). For this study, we have combined these skills into one category, describing the collaboration skills needed for operating BAC. A summary of the three categories of human BA skills identified in the extant literature can be found in Table 1.

**Table 1: Summary of the three human BA skill categories described in the extant literature.**

Category	Description	Related literature
Technical BA skills	Ability to use data and analytics technology to produce intended BA outputs	Cosic et al, 2012; Gupta and George, 2016; Mikalef et al, 2019; Qin et al, 2023; Srivastava and Dixit, 2023
Managerial BA skills	Ability to understand how BA output is generated and where it can be applied  Ability to manage BA work and monitor BA performance	Cosic et al, 2012; Gupta and George, 2016; Carillo, 2017; Mikalef et al, 2019; Shamim et al, 2019; Srivastava and Dixit, 2023
Collaboration skills	Communication skills, presentation skills, business understanding, proactive attitude	Cosic et al, 2012; Carillo, 2017; Ghasemaghaei et al, 2018

The extant literature provides various listings of human BA skills that would support organizations in establishing a well-functioning BAC. However, the actual measures that organizations could apply to develop their human BA skills have received significantly less attention. Therefore, it is worthwhile to take a closer look at how organizations develop their human BA skills in practice to ensure a well-functioning BAC.

### 2.3 Developing Human BA Skills

Organizations' growing need to develop their BAC has increased the demand for human BA skills in the job market (Qin et al. 2023). Possessing a set of human BA skills, however, does not alone guarantee that an organization could be able to leverage these skills to establish a well-functioning BAC (Srivastava and Dixit, 2023). Recent studies have continued to emphasize that organizations should pay increasing attention to continuously develop their employees' BA skills to enhance their performance on individual level (Shao et al, 2023) but also to improve data-driven decision making on organizational level (Srivastava and Dixit, 2023). While the extant management literature contains excellent examples of potential measures for skills development in organizations, it has not been examined, how these measures are applied when developing human BA skills.

Learning takes place continuously and on different levels within organizations, and a large share of individual-level skills that are relevant to conducting organization-specific work tasks are learned as part of everyday work practices and interaction at the workplace (see, e.g., Brown and Duguid, 1991; Tynjälä, 2008). It should be acknowledged that the human BA skills introduced in the extant literature are already based on empirical data, and thereby can be considered as a solid representation of skills that are relevant for operating and leveraging BA in practice.

To enhance the learning of individual employees, organizations can support skills development with various measures (Huselid, 1995; Manuti et al. 2015), including, e.g., job rotation, specific training programs, mentoring programs, talent management programs, or communities of practice for knowledge sharing purposes. Each organization differs in what kind of measures they prefer to apply (Tynjälä, 2008). In this study, we address the question of what kind of measures organizations apply to intentionally support and foster their human BA skills development. Next, we explain how we approached such an endeavor in this study.

### 3. Methodology

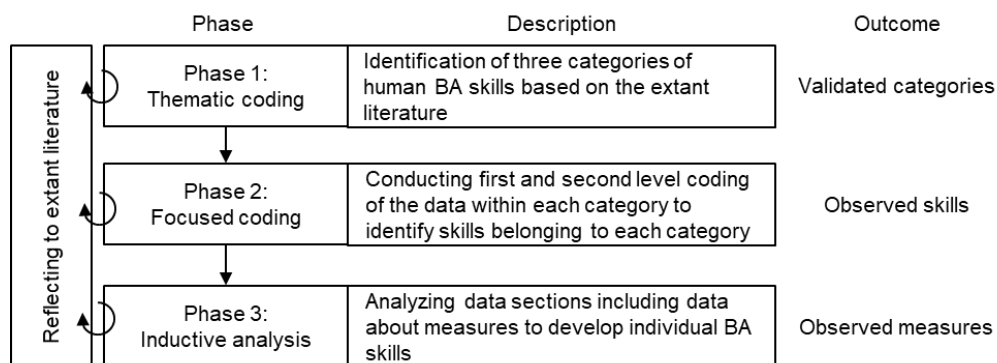
#### 3.1 Data Collection

While the extant literature has mostly focused on identifying the required human BA skills for building a well-functioning BAC, how these skills are developed is a rather unexplored phenomenon. This study pursues to commence this discourse by sharing the observations on measures applied in organizations. To enable collecting novel insight on this topic, we chose to conduct a qualitative inquiry (Timmermans and Tavory, 2012).

The empirical context of this study was informed by the framing of an ongoing research project that had been established to investigate BA usage and development in large Finland-based organizations. To identify suitable informants, we asked these organizations to name informants they considered capable of providing input on BA usage and development (an approach complying with criterion sampling, see, e.g., Patton, 1990). For data collection, we decided to use semi-structured interviews, as this enabled us to adjust the interview themes depending on the role of the interviewee (Qu and Dumay, 2011). Our data was collected between September 2022 and January 2023, and it consisted of 36 interviews that were transcribed with the help of a third-party service provider.

#### 3.2 Data Analysis

The focus of our data analysis was to identify those measures that organizations have applied to develop their human BA skills. Our analysis proceeded through three phases described in Figure 2.



**Figure 2: Three-phase analysis approach applied in this study.**

Phase 1 had an objective to understand which of the human BA skills observed in previous literature were observable in our data. Hence, we chose to start our analysis by reflecting our data on human BA skills identified in the extant literature in a deductive manner (Fereday and Muir-Cochrane, 2006; Timmermans and Tavory, 2012). This was done as thematic coding, using the three human BA skills categories identified in the extant literature as a starting point (see Table 1).

For Phase 2, we moved into focused coding to further identify the individual skills under each of the three categories we had already used to categorize our data during Phase 1. During this phase, we also continuously returned to extant literature to validate our coding. As a result of the second phase, the structure consisted of three levels of coding (see, e.g., Saldaña, 2013): 1) aggregated third-level codes to describe the categories identified in extant literature (Technical BA skills; Managerial BA skills; and Collaboration skills); 2) thematic second-level codes describing skills within these categories; and 3) focused first-level codes to describe the more granular sub-areas under each skill.

After examining our data from the perspective of human BA skills, we moved on to Phase 3, where we applied a more flexible inductive analysis approach (Timmermans and Tavory, 2012) to identify, what kind of skills development measures we were able to observe from those sections of our data where any of the human BA skills were discussed. Through cross-comparison of our findings, triangulated both between the authors as well as between the data from individual informants (see, e.g., Shenton, 2004) we identified measures that we were able to link to developing specific skills. A summary of these findings is included in Table 2.

Finally, we used our data structure and inductive observations as a basis to form a narrative report of our empirical findings (see, e.g., Krippendorff, 2019) regarding the development of each of the identified categories of human BA skills: technical skills, managerial skills, and collaboration skills.

## **4. Empirical Findings**

### **4.1 Development of Technical BA Skills**

Technical BA skills consist of various skills that are required to leverage an organization's tangible BA resources, such as data and technology (Gupta and George, 2016). According to our informants, the needs for technical BA skills are mostly connected to analytics technologies and tools that the organization has invested in. Examples of such skills identified in our analysis include using various analysis and modeling tools; ensuring analytics output quality; building and maintaining analytics-related tools and services; and – as a skill enabling the other technical BA skills – the ability to identify and apply suitable methods and approaches. Skills related to data management and utilization were emphasized by most of the informants, independent of how they had described the role of other technical BA skills.

Based on our observations, the analytics professionals develop their technical BA skills mainly by attending trainings arranged by external vendors. Analytics professionals also attend analytics-related communities inside and outside organizations to learn from other analysts. Additionally, analytics team managers seem to enable learning at the workplace by offering opportunities for job rotation and to some extent, allowing overlaps in the roles of individual analysts to support peer-to-peer learning. Senior analytics professionals also intentionally get engaged as sparring partners with their more junior colleagues, which we interpreted as a form of workplace mentoring. Our data also indicate that organizations that consider having major gaps in their existing technical BA skills tend to either recruit new analytics professionals with these skills or contract external consultants to temporarily fill in the need for such skills, instead of assuming their existing analytics professionals to develop these skills for themselves.

### **4.2 Development of Managerial BA Skills**

Regarding managerial BA skills, we observed three types of skills that were directly related to BAC. First, analytics professionals are expected to be able to plan, manage, and deliver analytics projects and initiatives. Second, they also need to monitor the value generated through these projects and communicate it to various stakeholders in their organization. Third, our data suggest that individual analysts are often expected to work rather independently, and to organize and manage their own work.

Senior analytics professionals support their more junior colleagues to help develop their skills and improve their readiness to start managing analytics projects and initiatives and monitoring and communicating the value resulting from these projects and initiatives. However, managerial skills, and especially the self-organizing skills in general do not seem to be supported with other development measures. Instead, we paid attention to some of our informants explaining that certain managerial skills and proactive attitude are used as criteria when selecting new members for the team.

### **4.3 Development of Collaboration Skills**

In contrast to technical and managerial BA skills, collaboration skills are not an established concept within BAC-related literature, yet it has been discussed in earlier research. Our data show that analytics professionals collaborate with various intra-organizational stakeholders, such as business managers and their team members, business controllers, other analysts in their own team and across other teams, as well as information systems professionals. They are also involved in inter-organizational collaboration with external consultants and to some extent fellow analytics professionals from other organizations, such as technology vendors. Based on the extant literature, however, skills that can be linked to collaboration with relevant analytics stakeholders are facilitation and presentation skills, business understanding, and a set of skills that form what we have named a “proactive attitude” (see Table 1).

Based on our data, facilitation, and presentation skills are important in many aspects. Whereas presentation skills often manifest through the ability to document and visualize analytics outcomes, analytics professionals are often also expected to present their output to decision-makers and facilitate the discussion during the presentation. Such activities assume them to be able to adjust the level of details in their presentation according

to the audience, as well as apply a conversational approach that enables their audience to understand how the output has been formed and what it means from decision-making perspective. Our data also suggest that an effective measure for developing these skills is to involve more junior analysts into situations where they can learn such skills by shadowing their more senior colleagues.

We also found a strong indication that facilitation skills are required to establish a longer-term collaboration with different analytics stakeholders. Ability to facilitate continuous collaboration and dialogue seems to help analytics professionals to adjust their work based on the business needs and thereby increase the relevance and value delivered by analytics. Additionally, analytics professionals are expected to share analytics-related knowledge and educate their stakeholders, such as business managers and information systems professionals, on analytics-related matters. While these skills emerged through our analysis, we did not identify any evidence in our data of intentional measures to develop these skills, and unlike facilitation and presentation skills concerning the presentation of analytics output, these facilitation skills are not highlighted within the extant BAC literature.

In addition, business understanding is an enabler of collaboration, especially between analytics professionals and business decision-makers. Understanding the internal and external business logic, such as internal processes or industry and market dynamics, combined with the ability to identify business side needs, helps analytics professionals create analytics models that produce the intended output. Therefore, it is connected to the ability to document and visualize analytics outcomes on shorter term but also to the ability to establish a longer-term collaboration with business stakeholders.

Business understanding develops as part of collaboration between business and analytics, and organizations also expect their analytics professionals to proactively accumulate their business understanding as part of their work. To develop business understanding of their analytics professionals, organizations involve them in business meetings and forums on a permanent basis, allow analytics professionals to move between analytics and business roles as part of career development plans, and offer them opportunities to work with various business stakeholders. We also found some indication that business experience and understanding may be valued when recruiting new analytics professionals.

Lastly, we observed a group of “skills” that can be described as individual characteristics or behaviors expected from analytics professionals. These include, e.g., willingness to learn, ability to think critically and to challenge the status quo, creative mindset, and proactive approach to networking and communication. While these characteristics may not be categorized as skills, they may represent the attitude described by, e.g., Cosic et al (2012), and we decided to include them into this category. What comes to achieving such a proactive attitude, our data suggest that this – similarly to the managerial BA skills – is a criterion when hiring new analytics professionals.

**Table 2: Summary of empirical findings.**

Category	Observed Skills	Observed Measures
Technical BA skills	Managing and utilizing data; Using analysis and modeling tools; Ensuring quality of analytics output; Building and maintaining analytics-related tools and services; Identifying and applying suitable methods and approaches	Participating in externally organized trainings Intra- and inter-organizational analytics communities Job rotation between analytics roles Role overlaps Mentoring Recruitments, temporary hires (consultants)
Managerial BA skills	Planning, managing, and delivering BA-related work and projects; Monitoring and communicating value through analytics; Organizing own work	“Assumed” from new hires Mentoring
Collaboration skills	Facilitation and presentation skills	Job shadowing
	Business understanding	Permanent roles of analytics professionals in business meetings and forums Job rotation between analytics and business roles Offering opportunities to collaborate with various business stakeholders Recruitments
	Proactive attitude	“Assumed” from new hires

## 5. Discussion and Conclusions

Building on the extant literature on the RBV (e.g., Barney, 1991), resource combination as means to achieve competitive advantage (Lockett et al. 2009; Teece et al. 1997), and the emerging BAC (see, e.g., Gupta and George, 2016) and human BA skills (see, e.g., Srivastava and Dixit, 2023) literature, our study goes beyond the state-of art by offering the first glimpse on the measures that organizations apply to develop those skills.

Our study contributes to extant research in three ways. First, it helps validate the suggested scope of technical BA skills and managerial BA skills already outlined in the extant literature (see, e.g., Gupta and George, 2016; Mikalef et al, 2019; Srivastava and Dixit, 2023). Our analysis shows that the existing high-level descriptions of the technical and managerial BA skills form a solid basis for examining BA skills in organizations and can be applied deductively in qualitative data analysis. On more detailed level, the technical BA skills also seem to vary between organizations, depending on the data and technology resources as well as the intended scope of BA in each organization (Qin et al, 2023; Srivastava and Dixit, 2023). For organizations that aim to develop and improve their BAC, this indicates that they are likely to achieve good results by aligning their BA strategy and technical BA skills, instead of following, e.g., industry trends in terms of talent acquisition.

Second, it combines the various collaboration skills mentioned by, e.g., Cosic et al. (2012), Carillo (2017), and Ghasemaghaei et al (2018), and extends this skill category with additional findings on facilitation skills that promote longer-term collaboration and education of analytics stakeholders, as well as a proactive attitude that represents the individual characteristics expected from analytics professionals. While the human BA skills discussed by our informants were mostly consistent with those human BA skills recognized in the extant literature, collaboration skills received significantly more attention from the informants than the technical and managerial BA skills. Therefore, while our study encourages organizations to continue developing their human BA skills with a wide scope, it highlights the key role of collaboration skills in a well-established BAC and points out the facilitation skills and a proactive attitude as potential new focus areas that could help organizations reap more benefits from their BAC.

Third, it goes beyond the extant BA literature by introducing a set of measures applied in organizations to achieve and develop human BA skills, providing BA scholars and practitioners with a new layer of actionable knowledge on the top of BAC frameworks. Based on our findings, organizations hire analytics professionals mainly when they need to add completely new technical BA skills. As part of the recruitment process, organizations also evaluate candidates based on their collaboration skills, such as business understanding and attitude. Organizations may also fill in the skill gap temporarily by using consultants. Human BA skills are also developed using several measures, such as enabling job rotation within analytics and between analytics and business, offering opportunities for job shadowing, mentoring and peer-to-peer learning, involving analysts in business meetings and forums, and allowing analytics professionals to attend specific (mainly external) trainings to develop their technical BA skills.

The observations made during this study also generated some future research ideas. The extant research already includes manifestations about how business managers should be interested in learning about analytics processes and the potential benefits of using BA to support their decision-making (Carillo et al, 2019; Chen and Nath 2018; Peterson et al, 2023), and thereby understanding the BA skills required from business managers, as well as how to develop them would increase understanding on how to establish a well-functioning BAC. Also, the significance of organizational learning as a crucial element of BAC indicates the dynamic nature of this capability, and organizations should nurture their organizational learning culture to continuously develop their human BA resources and skills (Mikalef et al, 2019; Shao et al, 2023). Thereby, understanding organizational learning mechanisms (see, e.g., Argyris and Schön, 1996) and applying them to identify innovative mechanisms for human BA skills development might help organizations to create a BAC that enables them to achieve competitive advantage.

Simultaneously, the limitations of this study should not be ignored. While the number of interviews forming the empirical data of this study can be considered to provide an adequate basis for conducting a qualitative analysis (Saldaña et al, 2011), our data is collected among large Finland-based organizations and is thereby geographically and contextually limited. We have also aimed at reporting our analysis approach in a transparent manner. However, we also see that further examination of the topic within other contexts (e.g., different geographies, different company sizes) and conducted by other scholars would further support forming an understanding of potential measures for developing human BA skills in organizations.

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