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Business Intelligence in Supply Chain Management

A Systematic Literature Review

School of Management
Master's thesis in Strategic
Business Development

Vaasa 2024

UNIVERSITY OF VAASA
School of Management
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Title of the Thesis: Business Intelligence in Supply Chain Management: A Systematic Literature Review
Degree: M. Sc. In Economics and Business Administration
Programme: Strategic Business Development
Supervisor: Rodrigo Rabetino Sabugo
Year: 2024 **Pages:** 119

ABSTRACT:
This study addresses the growing interest of utilizing business intelligence (BI) systems in organizational decision making. Due to recent global crises' and increased competition, the role of supply chain management as an enabler for competitive performance is highlighted. The disruptions brought by COVID-19 and the war in Ukraine to global supply chains also showed their vulnerability to sudden shocks. Simultaneously, technologies such as RFID trackcing enable firms to collect more data from their supply chains. Previous research has conceptualized BI as a dynamic capability, allowing firms to harness data to make them better suited to operate in rapidly changing markets. Despite the potential of BI, there is a lack of understanding of the mechanisms through which this potential can be achieved in practice. Drawing from the dynamic capabilities framework, this study posits that dynamic capabilities operate with organizational capabilities to create new and enhance existing capabilities. Thus, understanding the mechanisms of interaction between BI and organizational capabilities is essential for unlocking the potential value of BI. Thus, this study seeks to answer the research question "How does BI impact organizational capabilities and how does this interaction affect SCM?".

This research question is answered by systematically reviewing 121 studies regarding the use of BI in SCM context. The study has three research objectives. First, to identify the antecedent organizational capabilities required for BI use in SCM context. Second, to understand the mechanisms through which BI interacts with organizational capabilities. And third, identifying the resulting capabilities in practice.

The selection of studies show a significant proportion of studies being quantitative studies focusing on manufacturing organizations. The review finds that utilization of BI in SCM context requires a diverse set of organizational capabilities. These include technical, managerial, integration, and knowledge management capabilities. The findings also show that BI interacts with organizational capabilities by enhancing information processing and sharing capabilities. These result in improved supply chain agility, resilience and innovation capabilities. These findings are discussed in practical context utilizing the SCOR framework from SCM literature. Agility was found to have the most profound impact on most SCOR processes, while the impact of resilience and innovation were focused on fewer SCOR processes. Finally, the study concludes by providing managerial implications and future research opportunities. The study highlights that managers should not consider BI as just a technical tool. The successful utilization of BI requires active effort and commitment from the entire organization and represents a form of organizational change. Future research could address the dominance of quantitative studies on the field, and the impact of artificial intelligence on BI use.

KEYWORDS: Business intelligence, analytics, supply chain management, decision making, organizational capabilities

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1. Introduction

In recent decades, competition has shifted from being between companies to being between supply chains. Increasing global competition, fragmented markets, and customer demands have made the management and development of supply chains a critical strategic issue for businesses (Miller & Liberatore, 2020; Swink et al., 2022; Oliveira et al., 2012; Kiron et al., 2011). Furthermore, companies face the challenge of operating and developing their supply chains in an increasingly dynamic environment. This environment forces supply chains to become more environmentally sustainable, more resilient to disruptions, and more agile to respond to changing customer demands. While growing in importance, supply chains are also increasing in complexity, referring to the number of firms involved (Bag et al., 2022; Gunasekaran et al., 2017; Jeble et al., 2018; Jha et al., 2020; Razaghi & Shokouhyar, 2021). To develop supply chains in an increasingly dynamic environment, SCM literature has highlighted the need for firms to harness data generated throughout the supply chains to enhance decision-making (Bag et al., 2020; Gunasekaran et al., 2017; Patrucco et al., 2023; Xu & Pero, 2023)

As a response to this need, the concept of business intelligence (BI) has received significant attention in the context of supply-chain management (SCM) (Swink et al., 2022; Oliveira et al., 2012; Sangari & Razmi, 2015; Pramanik et al., 2020). BI refers to both technology and process organizations use to improve decision-making based on data (Sherman, 2014). Potential use cases for BI in SCM include logistics and operations optimization, demand management, and forecasting (Maggioni & Ricciardi, 2012; Jafari et al., 2021). Despite the many promised benefits, research has shown many organizations failing to reap benefits from BI, with some companies even showing decreased performance from BI (Torres et al., 2018; Adamala & Cidrin, 2011; Elbashir et al., 2013; Sahay & Ranjan, 2008; Petrini & Pozzebon, 2009; Bargshady et al. 2014; Rezaie et al., 2017). A common reason for this inconsistency has been attributed to organizational factors affecting BI implementation and use (Popovicˇ, Hackney, Coelho, & Jaklicˇ, 2012; Yeoh & Popovič, 2016; Salmasi et al., 2016; Chasalow, 2009; Trieu, 2017;

Larson and Chang, 2016; Vugec et al, 2020; Olbrich et al. 2012; Dawson & Van Belle, 2013). For example, Yeoh et al. (2008) found that organizational factors such as management and organizational commitment were considered more critical to BI implementation than data and technical aspects. In addition, there is ambiguity regarding the mechanisms of how BI contributes to improvements in supply chains. Research has identified that BI often impacts organizational performance indirectly, i.e., through organizational capabilities (Torres et al., 2018; Vugec et al.,2020; Li et al., 2022; Bag & Rahman, 2023; Jafari et al., 2023, p. 1469). Thus, BI is often considered an "enabler" or "mediator" of organizational capabilities, which eventually leads to changes in organizational performance (Larson and Chang, 2016; Vugec et al., 2020). Due to this indirect relationship between BI and organizational performance, understanding the mechanism of how BI influences organizational capabilities is essential for unlocking the full potential of BI in the SCM context (Trieu, 2017; Ranjan, 2008; Salmasi et al., 2016; El-Adaileh & Foster, 2019).

1.1 **Research problem and justification**

Even though the influence of organizational factors on BI is well acknowledged in research, there is ambiguity concerning the causal mechanism between BI and supply-chain outcomes. This is due to the volume of studies conducted, which have adopted various theoretical lenses and focus areas on both BI and the different regions of supply-chain management (Arunachalam et al., 2018; Jafari et al., 2021; Li et al., 2022). As a result, these studies have identified several organizational capabilities and key factors impacting BI. Considering that many of these studies are case studies focusing on specific industries or regions, it is not easy to gain a comprehensive understanding of how the interaction between BI and organizational capabilities leads to different supply-chain outcomes (Swink et al., 2022; Sangari & Razmi, 2014; Oliveira et al., 2012; Li et al., 2022; Jafari et al., 2021; Arunachalam et al., 2017). Thus, previous studies have called for a better understanding of the organizational context as part of BI research (Arunachalam et al., 2018; Talaoui & Kohtamäki, 2020; Paradza & Daramola, 2020; El-

Adaileh & Foster, 2019; Oliveira et al., 2012; Trieu, 2017). Based on this background, this study seeks to answer the following research question:

How does BI impact organizational capabilities, and how does this interaction affect SCM?

The approach to answer the research question is divided into the following research objectives:

- Identifying the required organizational capabilities for using BI in the SCM context
- Understanding the process of how the interaction between BI and organizational capabilities impacts SCM outcomes
- Identifying the supply-chain capabilities companies gain as a result of this process

A systematic review was chosen due to the various methods and theoretical perspectives used to study BI in the SCM context. According to Kitchenham (2004), the significant advantage of SLRs is that "they provide information about the effects of some phenomenon across a wide range of settings and empirical methods" (p.2). Furthermore, the body of knowledge is constantly growing since BI is continuously developing. Thus, SLRs provide the benefit of being updateable by making the research methodology explicit (Briner & Walshe, 2014; Briner & Denyer, 2012; Rousseau et al., 2008).

2. Theoretical Background

2.1 Business intelligence

BI is defined both as a process and a collection of tools and technologies that allow companies to process information from various sources to generate insights and

improve decision-making (Ain et al., 2019; Brijs, 2012; El-Adeileh & Foster, 2019; Elbashir et al., 2013; Kiron et al., 2012; Laursen & Thorlund, 2016). The technical conceptualization focuses on the technology infrastructure required to operate a BI solution, i.e., databases, data warehouses, servers, and reporting software. The process view of BI is more concerned with how the BI infrastructure is used to transform data into insights that can be used for decision-making. "Business analytics," or BA, is often associated with BI. There is no commonly agreed definition of BI; thus, the terms "BI" and "BA" vary. Some authors combine the terms, referred to as "BI&A" (Corte-Real et al., 2014). Others view BA as an advanced form of BI, with BA being future-oriented, i.e., focused on forecasting, while BI focuses on reporting current and past events (Mashingaidze & Backhouse, 2017). This study adopts the view of Corte-Real et al. (2014) and considers BA as part of the broader BI umbrella term (Chen et al., 2012; Brands, 2014; Marjanovic, 2013; Sircar, 2009).

Despite receiving growing attention in academic research and business publications in the last ten years, the roots of BI can be traced to decision-support systems (DSS) of the 1970s (Watson and Marjanovic, 2012; Mashingaidze & Backhouse, 2017). As technology improved, the data generated and stored by companies has increased significantly (Storey et al., 2012). With increased market dynamism, businesses and researchers have begun to see data analysis as a potential source of competitive advantage (Gillon et al., 2014; Mashingaidze & Backhouse, 2017; Talaoui et al., 2020). The core idea is that data analysis enables better decision-making since decisions are based on more comprehensive and accurate information rather than hunches or guesswork (Talaoui et al., 2020).

BI is typically divided into three categories based on the level of analysis provided. These are descriptive, predictive, and prescriptive intelligence. Descriptive intelligence is focused on interpreting past events to identify patterns and trends (Lee & Sharon, 2022). Thus, it resembles the traditional use case of BI by focusing on reporting and storing data from past events. Predictive intelligence focuses on using past data to

predict the probability of future events (Lee & Sharon, 2022). Prescriptive intelligence expands on predictive intelligence by providing recommendations and actions based on potential future events (Lee & Sharon, 2022; Arismendy et al., 2021; Lana et al., 2021).

In their synthesis of BI process research, Talaoui & Kohtamäki (2021) described the BI process as consisting of three phases:

- Intelligence collection
- Intelligence transformation
- Usage

The intelligence collection phase includes collecting data from various sources such as ERP and CRM systems, financial systems, and social media. The diversity of potential data sources highlights the changing nature of data since the volume, variety, and velocity have increased significantly. This means the data is cleaned and formatted correctly in the following transformation phase so that various reporting tools can be used. In the usage phase, the actual value of the data is unlocked as it becomes part of the managerial decision-making process.

Research has highlighted that the use and success of BI are influenced by various contextual factors (Yeoh & Popovic, 2016; Grublješič & Jaklič,2015; Dawson & Van Belle, 2013). These are often categorized based on the “technology-organization-environment" (TOE) framework (Grublješič & Jaklič,2015; Ziaee et al., 2022; Feng & Sheng, 2023; Tung & Chang, 2023).

According to Grublješič & Jaklič (2015), the technological context “describes both the internal and external technologies relevant to the firm, which includes current practices and equipment internal to the firm, as well as the set of available technologies external to the firm" (p. 302). Thus, technological factors include the firm's BI infrastructure and the infrastructure of other supply chain members who share information with the firm.

In addition to technical infrastructure, the capabilities to manage it are also considered part of the technological context. The function of technical capabilities is to ensure data and system quality, i.e., to ensure that data is collected, stored, processed, and shared correctly (Grublješič ja Jaklič; Dawson ja Van Belle, 2013; Rezaie et al., 2017; Wixom & Todd, 2005).

Organizational context includes characteristics of the organization using BI (Grublješič & Jaklič, 2015; Yeoh ja Popovič, 2016; Dawson ja Van Belle, 2013). This includes managerial culture and structure, size, user involvement, business strategy, and vision (Grublješič & Jaklič, 2015; Yeoh ja Popovič, 2016; Dawson ja Van Belle, 2013). Several studies have highlighted the importance of management support in determining the adoption and success of BI (Grublješič &Jaklič, 2015; Yeoh & Popovič, 2016; Dawson & Van Belle, 2013). Management is considered essential in determining the overall function and direction of BI development and ensuring that sufficient resources are allocated (Grublješič & Jaklič, 2015; Yeoh & Popovič, 2016; Rezaie et al., 2017).

Environmental context refers to factors such as industry structure and regulatory environment (Tornatzky & Fleischer, 1990; Grublješič ja Jaklič, 2015). This impacts the type of data collected and used during the BI process. For example, regulation can limit the kind of personal data firms can collect and store.

The technological and managerial conceptualizations of BI, combined with the contextual factors presented via the TOE framework, highlight that BI is a multifaceted concept, and its utilization requires diverse capabilities, such as technical, managerial, and relational (Aljumah, 2022). Orchestration of these capabilities in deploying BI technologies is called “BI capability” (Torres et al., 2018). Thus, BI can also be conceptualized as a specific capability alongside technical and process conceptualizations. Specifically, a second-order capability as it utilizes and orchestrates other capabilities.

2.2 BI as a dynamic capability

Management literature has promoted the concept of dynamic capabilities as a way for organizations to retain their competitive advantage in volatile environments (Teece, 2007; Eisenhardt & Martin, 2000). According to Teece (2007), dynamic capabilities enable the firm to “adapt, integrate, and reconfigure internal and external organizational skills, resources, and functional competencies to match the requirements of a changing environment." (Teece et al., 1997, p. 515). In practice, dynamic capabilities enable the firm to sense opportunities and threats in its environment, seize opportunities, and transform itself regarding resources and capabilities to match the changing environment better (Teece, 2007; Eisenhardt & Martin, 2000). The central concept of dynamic capabilities is the “hierarchy of capabilities”. Thus, dynamic capabilities enhance organizational capabilities, which can be a source of competitive advantage. In other words, dynamic capabilities are not considered the source of competitive advantage; instead, the source is the underlying capabilities they enhance (Eisenhardt & Martin, 2000). Thus, dynamic capabilities enable the organization to adapt by orchestrating other capabilities (Eisenhardt & Martin, 2000; Teece, 1997).

The importance of adaptation is highlighted in dynamic markets. Nowadays, managers are dealing with ever-increasing amounts of data while facing pressure to improve their decision-making in speed and accuracy. Despite abundant data, the ability to use it for decision-making is limited, and it is impossible to process it into insights. As modern markets have become knowledge-intensive, the ability to collect and transform data into actionable insights is integral in enabling the core elements of dynamic capabilities, i.e., sensing, seizing, and changing capabilities.

Since BI capabilities enable firms to draw insights from data and improve their decision-making, they allow the orchestration of other organizational capabilities (AL-Khatib, 2023; Loshin, 2013; Mikalef and Krogstie, 2020; Woerner and Wixom, 2015). Thus, BI capabilities function like dynamic capabilities since they act as second-order capabilities rather than being valuable. Due to their similar characteristics and objectives in enabling

sensing, seizing, and transforming capabilities, some authors have presented BI as a dynamic capability (Bhatti et al., 2022; Torres et al., 2018; Chen et al., 2015).

2.3 BI in supply chain management

The challenges supply chains face mean they must operate in an increasingly dynamic environment (Sharma et al.,2020; Allahham et al., 2024; Schoenherr & Speier-Pero, 2015; Bhatti et al., 2022). The war in Ukraine, the COVID-19 pandemic, demographic changes in most markets, and rapidly changing customer demands mean that new capabilities are needed from supply chains for them to stay competitive in dynamic markets. The sudden shocks brought by the COVID-19 pandemic and war in Ukraine were significant disruptors to global supply chains, significantly affecting manufacturing, transportation, and distribution of goods and services. As such, supply chain resilience has gained prominence in SCM research as the capability to prepare and recover from disruptions is increasingly essential. Similarly, the rapidly changing customer demands brought by social media and demographic change in many markets have highlighted supply-chain agility as necessary to operate successfully in dynamic markets (Lee et al., 2024; Aldhaheri & Ahmad, 2023). Companies such as Zara and Temu have gained attention due to their agile supply chains, which can quickly respond to changes in market demand by significantly shortening the time it takes for a product to go from design to production. At the same time, environmental concerns have led to new legislation in many countries that significantly impacts manufacturing and transportation of goods. While this may pose a challenge, many firms have realized the potential of “green innovation” in supply chains as a potential source of differentiation. As supply chains have become more complex, if a company wants to develop their supply chain in any of these areas, they must coordinate actions with other members of their supply chain. Thus, supply chain integration and its related capabilities have become an essential topic in SCM literature.

Achieving supply chain resilience, agility, and innovation capabilities requires dynamic capabilities as supply chains must be able to sense changes in market conditions better, seize new opportunities for innovation, and transform their resource base via knowledge sharing and integration with their partners (Tipu and Fantazy, 2023b; Gani et al., 2022; Friedman and Ormiston, 2022; Bertello et al., 2021; AL-Khatib, 2023; Gualandris and Kalchschmidt, 2015; Li et al., 2022). The increasing complexity of supply chain networks and the abundance of data generated means that the capability to generate insights from data and use it to enhance decision-making is playing an ever-increasing role (Al-Khatib, 2023; Loshin, 2013; Mikalef and Krogstie, 2020; Woerner and Wixom, 2015). Thus, BI is recognized as a solution for firms to develop dynamic capabilities in their supply chains to address the challenges posed by increasingly dynamic markets (AL-Khatib, 2023; Souza, 2014; Wamba et al., 2020; Browning et al., 2023; Friedman and Ormiston, 2022).

Regarding sensing capabilities, BI has been studied in the context of supply chain resilience (Park & Singh, 2022; Allahham et al., 2023; Ibenrissoul et al., 2021; Srinivasan & Swink, 2018). Supply chain resilience refers to preventing and recovering from disruptions (Vanpoucke & Ellis, 2020; Xu and Liu, 2024; Chowdhury & Quaddus, 2016). An example of BI use in this area is risk management. With BI, firms can analyze large amounts of data from past events and use it to predict the likelihood of potential disruptions and prepare accordingly. Park & Singh (2022) studied the impact of big data analytics in developing a supply chain risk management tool in their study. They found that big data analytics, together with the company's IT infrastructure, had a crucial role in determining the effectiveness of the risk management tool, enabling better detection of disruptions in the supply chain. Similarly, Bag et al. (2022) studied big data predictive analytics in the South African mining industry. They found that predictive analytics improves supply chain monitoring capabilities, improving visibility and resilience against adverse weather effects.

Regarding seizing capabilities, BI has been studied in the context of supply chain innovation (Afraz et al., 2021; Bhatti et al., 2022; Al-Khatib, 2022; Friedman and Ormiston, 2022). Supply-chain innovation refers to developing new processes and products to deliver novel value to customers (Afraz et al., 2021; Bhatti et al., 2022; Al-Khatib, 2022; Wong and Ngai, 2019). Innovation capability also helps the firm to adapt to competitive pressure and uncertainty (Bertello et al., 2021; AL-Khatib, 2023). In recent years, "green supply chain innovation" has gained attention in SCM literature. It refers to innovations that improve the environmental sustainability of the supply chain (AL-Khatib, 2023; Benzidia et al., 2024). In their study, Bhatti et al. (2022) found that analytics capabilities improve the networking capabilities of manufacturing firms, leading to better supply chain innovation. BI helps companies exploit data generated by customers and suppliers to identify better their requirements and preferences (Lee and Mangalaraj, 2022; Al-Khatib, 2023). These insights can then be used to steer innovation activities.

BI has been studied to transform capabilities in supply chain integration and agility (Sinha & Dhingra, 2022; Zhou, 2022; Kim & Chai, 2017). Supply chain integration refers to the degree of integration between supply chain members (Willis et al., 2016; Khanuja and Jain, 2023), whereas supply chain agility refers to the ability to respond to changes in supply-demand conditions (Aljumah, 2022). This means introducing new products as customer preferences change and adjusting production volumes if supplier conditions change (Martinez-Sanchez and Lahoz-Leo, 2018; AL-Khatib, 2023). Both integration and agility refer to transforming the resource base of the supply chain. With integration, the firm's resource base is more tightly connected to the resources of suppliers and customers. With agility, the resource base of the supply chain can be changed based on external conditions, such as sudden surges in customer demand. This can be the changing of suppliers or components used in the production process if bottlenecks in the supply chain are identified.

As mentioned earlier, the relationship between BI and organizational outcomes is often indirect due to the impact of technological, organizational, and environmental

factors (Hahn, 2020; Kabadurmus, 2020; Wong and Ngai, 2019; AL-Khatib, 2023). This also applies in the SCM context, as multiple studies have found that the relationship between BI and improvements in various SCM areas is either moderated or mediated by numerous factors (Li et al., 2023; Riggs et al., 2023; Xu and Pero, 2023; AL-Khatib, 2023; Allahham et al., 2024; Bag et al., 2023). For example, Tipu and Fantazy (2024) found that knowledge management capabilities mediate the relationship between BI capabilities and sustainable supply chain performance. Similarly, studies have shown that BI can mediate or mediate between various organizational capabilities in the SCM context. In their research, Barbosa et al. (2022) found that BI mediates the relationship between supply chain collaboration and organizational performance by enabling better sharing and exploitation of information between firms.

Considering the importance of supply chains for the competitive performance of firms and the challenges arising from dynamic markets, it is necessary to understand how BI can contribute to developing dynamic capabilities.

3. Methodology

Systematic literature reviews are "the most efficient and high-quality method for identifying and evaluating extensive literature" (Tranfield et al., 2003, p.215). Thus, they are an established research method in management studies (Davies & Crombie, 1998; Tranfield et al.,2003; Sauer & Seuring, 2023; Kraus et al., 2020; Clark et al., 2021; Durach et al., 2017; Koufteros et al., 2018). Despite being an established management research method, no definitive format for conducting a systematic literature review exists. Instead, their design depends on the studied phenomena (Snyder, 2019; Seuring & Gold, 2012; Kraus et al., 2020; Durach et al., 2017). This study adopts the methodology presented by Tranfield et al. (2003), considered the earliest guideline for systematic literature reviews in management studies (Sauer & Seuring, 2023). The research consists of the following five steps:

1. Identification of relevant literature
2. Selection of studies
3. Data extraction
4. Data synthesis

3.1 Identification of relevant literature

According to Tranfield et al. (2003), identifying relevant literature is based on a scoping study to identify keywords and search terms. Once these are identified, an appropriate search string to answer the research question is formed. This stage also includes consideration of the databases used. For this study, the Scopus and Web of Science databases were chosen. This is due to the quality and size of the databases. Currently, Scopus contains articles from 3500 peer-reviewed academic journals (Paradza & Daramola, 2021).

A scoping study was done using the Scopus database to grasp the state of existing research and identify relevant keywords for further search. Keywords for the scoping study were “Business intelligence,” AND “Supply-chain,” AND “Capabilities”. Additionally, earlier systematic reviews on BI research were used to identify synonyms and subsets of BI (Paradza & Daramola, 2021; El-Adaileh & Foster, 2019; Ain et al., 2019). This review revealed inconsistency in the terms “business intelligence” and “business analytics”. Some authors combine the terms, referred to as “BI&A” (Corte-Real et al., 2014). Others view BA as an advanced form of BI, with BA focusing on predicting the future while BI focuses on current and past events (Mashingaidze & Backhouse, 2017). For this study, both terms “Business intelligence” and “Business analytics” were included to ensure studies would not be excluded due to the authors' choice of terminology. Following the scoping study and assessment of keywords, the following keywords were chosen for the search query:

"Business intelligence" OR "Business analytics" OR "Data analytics" OR "Predictive analytics" OR "Prescriptive Analytics" OR "Descriptive Analytics" OR "Decision support system" OR "DSS" OR "Competitive intelligence" AND "Capabilities" OR "Capability" AND "Supply-chain" OR "Logistics" OR "SCM" OR "Transportation"

The search was conducted based on article title, abstract, and keywords. In Scopus, the results were limited to subject areas “Business, management and accounting”, “Decision Sciences” and “Economics, econometrics and finance”. In Web of Science, results were limited to research areas “Business Economics” and “Operations Research & Management Science”. Furthermore, results were filtered to articles written in English. The search returned 347 articles. Of these, 276 were from Scopus and 71 from Web of Science. After removing duplicates, 286 articles were chosen for further analysis.

3.2 Selection of studies

Next, the titles and abstracts of the selected studies were read to determine their relevancy to the research question. First, only studies that had a business or management plan were included. This meant that studies with purely technical focus were excluded. This also excluded several studies where the focus was on areas such as construction management (Aboseif & Hanna, 2003) and air-traffic management (Wang et al., 2019; Sud et al., 2009). Next, the concept of BI had to be clearly defined in the study. Specifically, the study should treat BI as an independent research object rather than a part of a larger concept, i.e., “industry 4.0” or “digital transformation”. This decision was considered necessary to use the study to answer the research objectives. In cases where BI is “bundled” with other concepts, such as “smart manufacturing”, it would be impossible to identify how the research findings apply specifically to BI. Last, an evaluation was made on whether the abstract deals with at least one of the stated research objectives. Thus, the abstract had to mention the use of organizational capabilities and BI, the process of how BI functions within the organization, and the

supply-chain management outcomes BI provides. After applying the selection criteria, 121 studies were chosen for review.

3.3 Data extraction

A data extraction form was used to gather information from the 121 articles identified in the study selection phase. The extraction form included information about the author(s), title, name of the journal, publication year, sample size & method, and description of the industry and region that was the focus of the study.

4. The results of the literature review

After data extraction, the findings of the chosen studies were collected and grouped based on the research objectives. The first category identifies antecedent capabilities for BI implementation from the perspective of organizational capabilities. The second category focuses on how BI and organizational capabilities interact to create SCM outcomes. The third category looks into what capabilities arise from the interaction between organizational capabilities and BI and how they contribute to different SCM processes.

Reviewing the characteristics of the selected studies showed that most were quantitative.

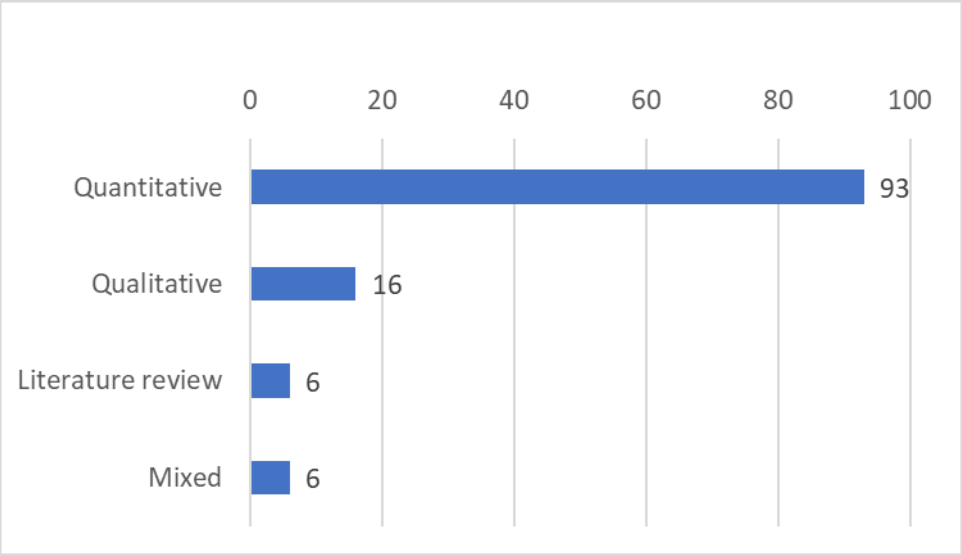

Figure 1. Research methods

Regarding geography, most studies focused on Asia and the Middle-East, with China and India as the most common countries.

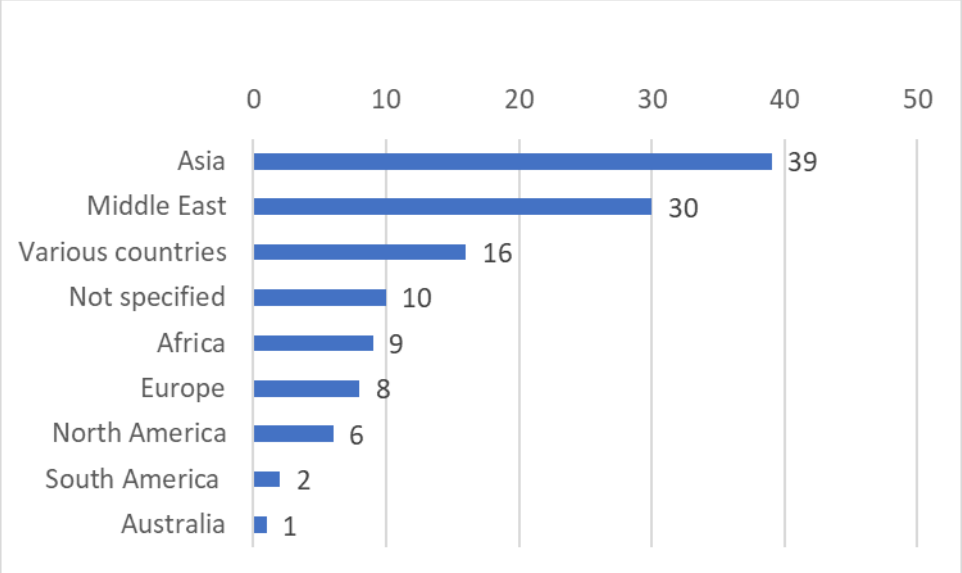

Figure 2. Geographic distribution of studies

Classifying the sampled studies based on industry shows the majority of them being in the context of various manufacturing organizations. This includes industries such as automotive parts, pharmaceuticals, textiles, and food and beverages. The second most common category was studies that included multiple industries. A notable group of

studies was the “NGO/Humanitarian” group. These studies focused on studying the use of BI in humanitarian supply-chains and disaster relief operations.

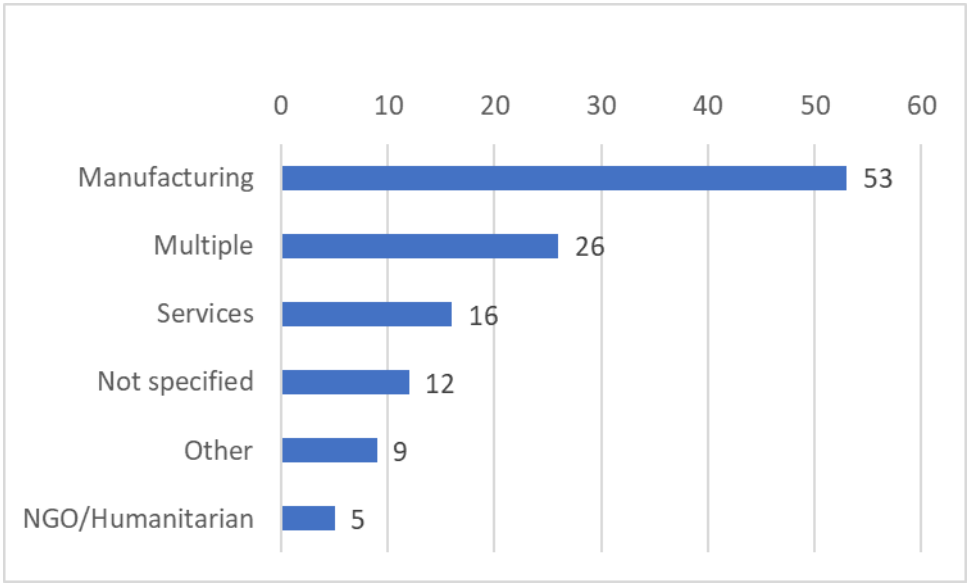

Figure 3. Industries

4.1 Antecedent capabilities for BI use in SCM

4.1.1 Technical capabilities

The role of technical capabilities is to acquire and manage the technical infrastructure to ensure sufficient data quality and quantity is available for BI systems. Technical capabilities were identified as a direct antecedent to the technical implementation of BI but also as a significant determinant of the value that can be gained from data via BI (Bag et al.,2021; Chen et al.,2015). In the technical implementation of BI, technical capabilities are required to acquire the necessary technical resources for BI systems. This includes ensuring the compatibility of existing IT systems with the new BI system (Chen et al.,2015; Allahham et al.,2024; Park & Singh., 2023; Trkman et al.,2010; Swink et al., 2022) and acquiring new resources if necessary (Nisar et al., 2023; Mandal, 2018). Studies such as Mishra et al. (2023), (Patrucco et al., 2023), and Dubey et al. (2019)

highlighted the importance of sufficient technical resources. Thus, the organization needs capabilities to understand and evaluate the technical requirements for BI systems and acquire additional technical resources if necessary. In addition to supporting BI adoption, technical capabilities are essential in moderating BI systems' impact on decision-making. This is because BI often works as an enhancer of existing IT solutions; thus, the insights gained from BI depend on the capabilities of managing current IT infrastructure.

For example, Allahham et al. (2024) showed that BI works with existing technologies to enhance the performance of risk alert technologies. Similarly, Trkman et al. (2010) showed that technological capabilities moderate BI's impact on improving SC performance. Bag et al. (2022) showed that IT infrastructure moderates BI's impact on SC visibility and coordination. The role of technical capabilities is not only limited to the focal firm, but the technical capabilities of other SC members also impact BI's usefulness. Park and Singh (2022) highlighted that BI's impact on enhancing the effectiveness of the disruption alert tool is affected by the IT capabilities of upstream and downstream supply chain partners. In addition to managing and ensuring infrastructure compatibility, technical capabilities refer to personnel's capabilities in using the actual BI system. For example, Swink et al. (2020), Mishra et al. (2023), and Bag et al. (2021) identified the technical skills of personnel in using BI systems as having an impact on BI adoption.

4.1.2 Managerial capabilities

Managerial capabilities include managers' capability to connect BI's technical capabilities to business benefits. This consists of the capability to identify strategic use cases for BI and ensure BI is aligned with the organizational strategy and business processes. With strategic use cases for BI, management is responsible for acquiring and coordinating required resources for BI. Management must also be capable of enacting change management within their organizations to fully utilize the insights from BI.

The role of managerial capabilities in resource acquisition is to ensure clear strategic goals for BI that should guide the resource acquisition process. O'Leary (2011) identified management's role in their BI implementation model, which begins with stating the use case(s) before considering the technical details of the system. Bag et al. (2022) identified that the alignment of BI strategy and initiatives moderates BI's impact on SC visibility. The capability to identify strategic use cases for BI also relates to top management since their role is critical in ensuring resources and organizational commitment to BI use. According to Dehkhodaei et al. (2023), the lack of sufficient knowledge of top management regarding BI can be a barrier to BI implementation. During implementation, project management also needs managerial skills (Jeble et al., 2018). This is to ensure that the project team includes members with the right competences and that the project maintains alignment with business goals. Managerial skills are also connected to managing intangible resources for BI use. These include using communication, relationship-building, and interpersonal skills to build organizational culture and trust supporting BI (Dubey et al., 2019; Jeble et al., 2017; Dubey et al., 2017). During the use phase, managerial capabilities are needed to evaluate the insights provided by BI within the firm's context. According to Dubey et al. (2017) and Jian et al. (2023), managerial skills function to evaluate the relevancy of BI findings for the firm and filter out irrelevant information for decision-making. Thus, managerial skills such as experience and understanding of industry dynamics are an additional layer for data quality alongside technical capabilities.

4.1.3 Integration

Integration capabilities refer to the capability to coordinate action within the supply chain. Multiple studies identified that successful implementation and usage of BI within a supply chain requires coordinated efforts from all members of the chain (Alkhatib, 2023; Feng & Sheng, 2023; Jiang et al., 2024; Liu et al., 2022; Razaghi & Shokouhyar, 2021; Shi et al., 2023). The role of integration capabilities is notable in BI's implementation and usage phases. Bag and Rahman (2023) identified the role of engagement capabilities as an antecedent to BI since the firm must plan and coordinate

the investments for BI with its partners. On the operational level, integration is needed to ensure technical interoperability and information flow between supply chain members. In their study, Swink et al. (2022) found that significant variety between information systems within the supply chain can be a barrier to BI adoption. Specifically, there is a possibility that some members of the chain focus on optimizing their systems only for their operations, leading to reduced optimization of the chain.

4.1.4 Knowledge management

Multiple studies identified knowledge management and organizational learning as antecedents to BI. (Abuzaid et al., 2023; Fantazy & Tipu, 2024; Gunasekaran et al., 2017; Mandal, 2018; Patrucco et al., 2023; Shamout, 2021). Knowledge management also represents how the knowledge gained from BI is stored and managed over time. Compared to managerial capabilities, which focus on the ability of individual managers, knowledge management refers to how the overall organization can utilize the findings from BI. This includes information sharing and integrating new knowledge into existing knowledge within the firm.

4.2 How BI and organizational capabilities interact in SCM

The following section addresses how organizational capabilities and BI interaction lead to SCM outcomes. In the SCM context, organizational capabilities consist of operational supply chain capabilities. These capabilities enable supply chain functions described in the SCOR framework: Plan, source, make, deliver, return, and enable. These capabilities include demand forecasting, inventory management, and distribution network design. The findings showed that BI can assume different roles when interacting with organizational capabilities, and these roles determine the mechanism for interaction. These mechanisms are information processing and information sharing. The information processing mechanism relates primarily to the managerial decision-making process. It includes ways in which greater amounts of information can be gathered and processed into a form that allows it to be used as part of the decision-making process and strategic

steering. Information sharing relates to collaboration between different parts of the firm and with external chain members. It contains ways in which both current and new information move within the supply chain.

Multiple studies showed that BI increases an organization's information processing capabilities via improved visibility, decision-making speed, and accuracy (Ziaee & Sohal, 2023; Bag et al., 2022; Lee et al., 2023; Cadden et al., 2022; Abuzaid et al., 2023). This included better monitoring of current supply-chain operations (Bag et al., 2022), providing access to real-time information (Ziaee & Sohal, 2023), and the ability to access information from more sources (Zhan & Tan, 2020). The effect of these factors is that more information can be used during the decision-making process. Studies such as Liu et al. (2022), Balci and Ali (2024), and Bag et al. (2021) found that data generation and processing capability contribute positively to the decision-making process. Balci and Ali (2024) found that BI allows the firm to collect information related to carbon emissions from their partners and use it in the decision-making process. Specifically, access to larger amounts of information facilitates real-time and more informed decision-making.

Another mechanism by which BI interacts with organizational capabilities is information sharing. Multiple studies showed that BI impacts SCM outcomes via improved collaboration and integration (Barbosa et al., 2022; Dubey et al., 2021; Kerdpitak et al., 2019; Li et al., 2024; Liu et al., 2022). Collaboration includes internal and external collaboration. Internal collaboration refers to collaboration between teams and functional units of a firm. External collaboration relates to collaboration between other organizations in the supply chain, i.e., suppliers and customers. The function of BI in both types of collaboration is to promote information sharing and reduce information asymmetry between parties. This includes improved operational efficiency as information flows more efficiently through the supply chain.

The role of BI in internal integration is to ensure that the data is standardized and can be easily shared across departments (Benzidia et al., 2024; Jha et al., 2020; Liu et al.,

2022; Shamout, 2023; Xu & Pero, 2023). This supports mutual understanding and coordination, increasing operational efficiency (Benzidia et al., 2024; Al-Khatib, 2022). Benzidia et al. (2024) studied the role of BI in hospital supply chains and found that BI helps avoid data fragmentation. The cause for data fragmentation can arise when organizations produce large and complex datasets analyzed by multiple departments with differing priorities and preferences. This can cause issues when the data is used for strategic decision-making since various parts of the organization might not have access to the same data. Liu et al. (2022) made similar findings, showing that BI contributes to standardizing data, which supports shareability and internal integration.

Studies on external integration included supplier and customer integration (Daneshvar Kakhki & Nemati, 2022; Gu et al., 2021; Stekelorum et al., 2021). Supplier integration enables utilizing specific supplier knowledge and monitoring supplier performance (Liu et al., 2022; Balci & Ali, 2024; Alkhatib, 2023). With supplier monitoring, the firm can better understand supplier performance and how it compares to their expectations. When the information flow from the supplier is efficient, the firm can better detect deviations in performance and act. The flow of information also benefits suppliers, as Stekelorum et al. (2021) found that suppliers can utilize BI better to understand the buying firm's expectations regarding product quality. Customer integration refers to gaining a more in-depth understanding of customer needs and integrating these needs into supply chain operations (Feng & Shen, 2023; Lo et al., 2018; Alkhatib, 2023). Daneshvar et al. (2022) found that information sharing by BI helps in aligning the value creation activities of the supply chain members by providing a shared understanding of end customer needs. Alkhatib (2023) found that BI contributes to creating “a mutual flow of information and feedback” between the firm and a customer, enabling the firm to develop its operations based on feedback.

The findings support the notion that BI functions as a dynamic capability concerning existing SCM capabilities by enabling sensing, seizing, and transforming capabilities. The ability to collect more information throughout the supply chain and process it more

efficiently relates to the sensing dimension of dynamic capabilities. Information sharing allows the firm to seize opportunities better as information about market changes and opportunities is transferred more efficiently. The transforming dimension draws from both mechanisms. Enabling supply chain change requires all chain members' coordinated efforts. Having better insight into customer demands and the current performance of the chain helps in setting clear goals and strategies for transforming the supply chain (Wamba et al., 2020; Zhang et al., 2023). These strategic decisions can then be better implemented with improved information sharing. The impact of BI on supplier management can also be seen as a dimension of the transformation dimension. The ability to better evaluate both potential and new suppliers gives better control in managing the capabilities available to the supply chain. With improved supplier management, the firm can better understand the capabilities each supplier brings to the chain and identify areas where capabilities are lacking. By supporting supplier choice, BI also allows more precision in adding new capabilities to the chain in the form of new suppliers.

4.3 SCM outcomes

The following section describes the capabilities gained via the antecedent capabilities and mechanisms described earlier. The findings revealed agility, resilience, and innovation as overarching capabilities that materialize across various SCM processes. To better assess the practical impact of BI, the following section discusses the effect of agility, resilience, and innovation using the SCOR framework presented earlier.

Supply-chain agility was a commonly mentioned outcome of utilizing information processing and sharing mechanisms (Aljumah, 2022; Dubey et al., 2019, 2021, 2022; Mandal, 2018; Manikas et al., 2023; Srimarut & Mekhum, 2020). It refers to the capability of the supply chain to adapt to changes in the shortest possible time (Dubey et al., 2022). It also entails adjusting capabilities to respond to a specific situation (Gunasekaran et al., 2019). The planning process of the SCOR framework refers to “collecting information and resources, anticipating demand and potential gaps, and

identifying appropriate resources to remedy the gaps." (Ziaee et al., 2023, p.1311; ASMC, 2021). The purpose of the planning function is to prepare the supply chain for upcoming events (Xu & Pero, 2023). Given the complexity of global supply chains and dynamic market conditions, BI supports the planning function by providing access to more significant amounts of data that can be used for decision-making, especially in uncertain and complex environments (Xu & Pero, 2023). This gives decision-makers better visibility into market conditions and quicker decision-making speed. Findings by Shi et al. (2023) and Ziaee et al. (2023) found a positive impact of BI on supply and demand visibility, resulting in improved forecasting accuracy. This enables better adjustment of production volumes, resulting in less overproduction and reduced waste (Abuzaid et al., 2023). The planning function also benefits from improved customer insights. Lee et al. (2024) highlighted how the speed and variety of customer data that can be collected contribute to firms' ability to adjust their value proposition.

The sourcing process includes ordering and receiving suppliers' required goods and services (Ziaee et al., 2023; ASCM, 2021). Among the challenges facing the sourcing function of many firms is the growing global scope of sourcing (Razaghi & Shokouhyar, 2021). As sourcing includes a more significant number of suppliers with more excellent global dispersion, managers require more information to choose the correct suppliers accurately. Aljumah (2019) found that BI improves agility in supplier management. With enhanced information sharing, the firm has better visibility of supplier performance and can initiate action earlier if a deviation in performance is seen. These findings were supported by Shafiq et al. (2020), who found that BI improves suppliers' transparency in social and ethical performance.

The making process includes converting raw materials into products and services (ASCM, 2021). The improved planning and sourcing capabilities enhance the agility of the making process and make it more suitable for dynamic environments (Li et al., 2024; Cadden et al., 2022; Wamba et al.,2020). This is because the firm has better access to external information, i.e., customer insights and the performance of their suppliers, via

better monitoring capabilities. This information from both upstream and downstream of the chain can be integrated into the manufacturing process and make it more agile. Li et al. (2024) highlighted that BI helps allocate resources in dynamic environments to better adjust its manufacturing based on customer preferences. Similar findings were made by Cadden et al. (2022), who argued that the contribution of BI to agility comes from the velocity of data, which can feed into the decision-making process, thus helping the adaptation of the production process to changing circumstances.

Furthermore, Wamba et al. (2020) supported this view by showing that environmental dynamism moderates BI's effect on agility. The result of agility in the make process is improved operational and cost performance (Dubey et al., 2019). Improved planning capability enables better adjustment of production levels since the firm has better knowledge of market conditions, including demand levels and customer preferences. Thus, overproduction can be avoided, resulting in lower inventory levels and costs (Alzboun, 2023; Furstenau, 2022). Similarly, with improved sourcing capabilities, the firm has better visibility to the performance of its suppliers. Thus, possible disruptions can be detected better, and sufficient action can be taken to ensure the continuation of production. The effect of optimized production is not only operational and financial but also environmental (Cheng et al., 2021; Dubey et al., 2019; Li et al.,2024). Limiting overproduction and excess inventory leads to reduced waste and production emissions. Li et al. (2024) showed that enhanced collaboration helps incorporate environmental practices into manufacturing.

Resilience was also closely linked to agility. According to Manikas et al. (2022), operational resilience refers to a company’s ability to anticipate, respond, adapt, and eventually recover from sudden shocks” (p.1336). The findings showed that resilience contributes mainly to planning capability. Khan et al. (2022) and Lee et al. (2023) highlighted the link between agility and resilience, showing that BI enhances resilience. In the study by Khan et al. (2023), agility, adaptability, and alignment were conceptualized as specific SCM strategies. Their results showed that BI contributes to all

of the strategies that, in turn, support firms in recovering from disruptions brought on by COVID-19. Lee et al. (2023) found that BI contributes to the flexibility of manufacturing firms' value chain, contributing to supply chain resilience. Studies by Xu & Liu (2023) and Bag et al. (2022) showed how BI contributes to resilience via leadership and strategy making. Xu and Liu (2023) studied the impact of BI on paradoxical leadership in the context of supply chain resilience. Paradoxical leadership refers to the ability of managers to manage conflicting objectives and address shareholders' diverse interests (Xu & Liu, 2023). Typical paradoxical scenarios in SCM include finding a balance between sustainability and cost leadership and between efficiency and flexibility (Xu & Liu, 2023). Paradoxical leadership is connected to SC resilience as it can promote new ways of thinking and creativity, which can be used to solve complex problems that arise during disruptions (Xu & Liu, 2023; Miron-Spektor et al., 2021; Shaheen et al., 2019). Xu & Liu found that BI enhances paradoxical cognition via more informed decision-making. Bag et al. (2022) studied how BI can improve supply chain resilience in the South African mining industry. They found that the enhanced visibility brought by BI enables better adjustment of strategies based on adverse weather conditions.

The third capability is innovation. The most significant impact of innovation capabilities was on the making process, as multiple studies focused on process and product innovation. Findings show that innovation capability stems from both information processing and sharing mechanisms, as BI allows exploration and exploitation of current data to improve current manufacturing processes and create new ways of working (Bahrami et al., 2022; Al-Khatib, 2023). Bag et al. (2020) and Al-Khatib (2022) showed how BI supports the management of the innovation process. Bag et al. (2020) found that managers benefit from improved forecasting capabilities and insights regarding customer requirements since they allow better control of the various processes involved in new product development. Al-Khatib (2022) found that the information processing mechanism of BI contributes to defining green innovation strategies. BI also makes the innovation process more fact-driven, as the process results can be better evaluated (Al-Khatib, 2022).

Most articles in this category focused on sustainability-related innovation, i.e., “green innovation” (AL-Khatib, 2023; Benzidia et al., 2024; Li et al., 2024). Two common sustainability topics included green process and green product innovation. Green process innovation includes improving manufacturing devices, facilities, and processes to reduce negative environmental impacts (Fernando et al., 2019; Al-Shboul, 2024). Green product innovation involves designing environmentally sustainable goods (Singh & El-Kassar, 2019). Studies by Benzidia et al. (2024), Al-Khatib (2023), and Al-Shboul (2024) highlighted the role of information sharing in green innovation. Benzidia et al. (2024) found that BI improves internal integration, which supports the sharing knowledge and ideas about environmental issues. Similar findings were made by Al-Khatib (2023), showing that BI can act as an information-sharing platform for environmental knowledge. Al-Shboul (2024) found that BI contributes to green process innovation, supporting green product innovation. This highlights that the two types of innovation in the SCM context are often closely related.

5. Conclusion

This review studied the use of BI in the SCM context. Considering the significant attention and potential benefits associated with BI, the aim was to understand if these benefits materialize in the SCM context and, if so, what the mechanisms are. The critical part in answering this question was that previous studies had often conceptualized BI as a dynamic capability. This suggested that BI does not produce benefits but through interaction with organizational capabilities. This conceptualization and multiple studies focusing on different industries and countries left ambiguity about the underlying nature of BI in the SCM context.

To answer this question, this study identified the antecedent organizational capabilities, mechanisms through which BI interacts with organizational capabilities, and the

capabilities gained as a result. The antecedent organizational capabilities highlighted that successful implementation and use of BI requires a diverse set of capabilities. Specifically, purely technical capabilities are just one part of the equation. It was also shown that adopting BI represents an organizational change rather than simply implementing a new technical solution. The role of managerial capabilities showed that BI must be integrated into the organization and that managers and upper management have a critical role in enabling and supporting this change. This includes defining the purpose of BI and how it supports the firm's strategic management. Integration capabilities highlighted that enacting change in the SCM context requires alignment of other supply chain members. The complexity of supply chains offers vast amounts of data that companies can use to improve operational efficiency and tailor their value propositions. However, this requires a state where information flows seamlessly from the end customer throughout the supply chain. The members of the chain must be able to coordinate their investments in BI technologies and ensure their operational processes are aligned. Once integration enables the flow of information in the chain, knowledge capabilities become critical in utilizing this information. Knowledge management highlights that utilizing BI requires a different approach to conceptualizing information than traditional reporting systems. Rather than focusing on storing past information, new information should be used as a basis for organizational learning and development. This transforms information into knowledge. This notion highlights that simply using BI as an extension of a traditional reporting tool means preceding the significant benefits of BI. Together, these antecedent capabilities provide the technical infrastructure, organizational culture, and processes so that BI can interact with organizational capabilities.

This study found that BI interacts with organizational capabilities by acting as an information processing and sharing mechanism, supporting the conceptualization of BI as a dynamic capability. This finding shows the critical role of information in operating and developing modern supply chains. Specifically, these mechanisms showed that the quantity of information and challenges in information sharing are significant barriers to

fully utilizing data in the SCM context. BI addresses these challenges by combining suitable technical infrastructure, management practices, and capabilities to treat knowledge as an asset.

Finally, this study identified supply chain agility, resilience, and innovation as the main capabilities firms gain from implementing BI. These capabilities were contrasted with the SCOR framework to assess their practical impact on SCM. The findings showed that agility impacted SCOR processes most, whereas resilience and innovation had a more focused impact on planning and making processes.

Managerial implications

Managerial implications of this study are the multifaceted nature of BI and how it produces value for the firm. The findings showed that BI should not be viewed purely as a technical solution but as a form of organizational change. The variety of antecedent organizational capabilities showed that technical resources and capabilities are only a tiny part of the factors managers must consider when implementing BI. Specifically, factors such as employee motivation, skills, and managers' attitudes toward BI must be considered during implementation and use. Managers must encourage and cultivate a culture of openness and information sharing to ensure BI can be used to generate insights. In addition, BI should not be considered as a replacement for managerial experience. The findings showed that managers have a critical role in using their expertise to evaluate and interpret the findings generated by BI.

Second, managers must understand that BI does not produce value but enhances existing processes and capabilities. The identified mechanisms showed that BI acts primarily as a mediator or moderator between two organizational capabilities. In addition, the relevancy of agility, resilience, and innovation capabilities must be evaluated concerning the firm's strategic goals and the market environment. Thus, BI should not be considered a tool for fixing incorrect processes or creating entirely new organizational capabilities. Since BI can be configured to serve multiple purposes,

managers must define clear use cases and ensure that these support the firm's strategic goals.

Limitations

This study included limitations that must be considered when interpreting the results. The first limitation relates to the sample size. The sample consisted of studies collected from two databases. Although the chosen databases are among the most comprehensive databases in management studies, it could be argued that expanding the search to include more databases could have impacted the results to a degree. However, the study aimed better to understand the interaction between organizational capabilities and BI. Thus, the focus in selecting studies for review was their relevancy to the research goal, rather than focusing simply on the amount of included studies. Furthermore, a choice was made to include only articles focusing on business and management, excluding articles with a more technical focus. Since BI is widely researched in computer science and engineering fields, this automatically excluded many studies from the two databases.

Another limitation is the role of subjective evaluation in choosing studies for the review and classifying them for the integrative framework. Even though the study selection process was conducted systematically and steps documented, the study inherently includes subjective interpretation. Specifically, whether to include a study after reading the abstract involved subjective evaluation from the author. For transparency, the criteria for study selection are described in part 3.2. Lastly, the grouping and classification of studies for the integrative framework also included subjective evaluation by the author. As typical for management studies, many sampled studies included multiple research objectives and findings. The focus in building the integrative framework was identifying the significant findings and relationships between different study constructs. This meant that some findings were considered more relevant than

others. For transparency, the conclusions of each study used to construct the integrative framework are presented in appendix 1.

Future research opportunities

The research methods, the geographical focus of sampled studies, and the rapid development of BI technologies provide opportunities for future research. Reviewed literature showed that most studies were geographically focused on emerging economies in the Middle-east and Asia. Future research could focus on contrasting these findings with those of more developed markets. Since elements such as culture, personal capabilities, and environmental dynamism were identified as contributors to BI use, the research field could benefit from a broader geographical scope of studies. Second, the study sample mainly consisted of quantitative studies. Considering the importance of culture and personal traits, a better understanding of them could be gained by using qualitative methods.

Another exciting area for research could be the growing role of artificial intelligence (AI) in BI systems and how this affects BI use in managerial decision-making. BI systems such as PowerBI have previously been marketed as “self-service” BI, i.e., users can conduct data cleaning, preparation, and report creation using a graphical interface. More of these steps in the BI process can be automated with AI. From a technical standpoint, this represents improved efficiency since user involvement and manual work in the report creation is reduced. However, this could lead to a situation where BI becomes a “black box” where managers are only presented with the outputs generated by AI rather than participating in the various BI steps themselves. Future research could study if the growing level of automation in the BI process impacts how managers perceive and use the outputs. For example, would managers consider the more automated BI less trustworthy since there is less human involvement in the process?

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Appendices

Appendix 1. Characteristics & key findings of selected studies

Number	Author(s)	Title	Type	Country & Industry	Sample size	Findings
1	Xu T.; Liu X.	Achieving manufacturing supply chain resilience: the role of paradoxical leadership and big data analytics capability	Quantitative	China, manufacturing	164 managers	BDA can strengthen SC ambidexterity and resilience. BDA also has a negative moderating effect between managerial paradoxical cognition and SC ambidexterity. I.e., BDA can replace managers' Independent paradoxical mindset in the decision-making process and cause over-reliance on BDA.
2	Feng T.; Sheng H.	Identifying the equifinal configurations of prompting green supply chain integration and subsequent performance outcome	Quantitative	China, manufacturing	317 responses	BDAC does not drive GSCI by itself but via interaction between green HR management and environmental conditions. From SC's perspective, BDAC was the most critical factor in green customer integration.

3	Kholaif M.M.N.H.K.; Xiao M.; Hamdy A.	Covid-19's effect on green supply chains and environmental sustainability; innovative technologies moderation	Quantitative	Egypt, manufacturing SMEs	517 survey responses	BDA decreases uncertainty-anxiety in green supply-chain management by improving decision-making capability via improved data collection and enabling more accurate predictions.
4	Tipu S.A.A.; Fantazy K.	Examining the relationships between big data analytics capability, entrepreneurial orientation and sustainable supply chain performance: moderating role of trust	Quantitative	Pakistan, manufacturing	300 survey responses	The relationship between BDA and sustainable supply chain practices (SSCP) is moderated by trust. When trust is low, an increase in BDAC does not enhance SSCP. Focusing on developing technological capabilities is not enough for BDAC, but establishing an optimal level of trust between SC partners is also necessary.
5	AL-Khatib A.W.	The determinants of export performance in the digital transformation era: empirical evidence from manufacturing firms	Quantitative	Jordan, manufacturing	327 survey responses	The positive relationship between BDAC and export performance is mediated by supply chain innovation.
6	Alzboun N.M.	Big data analytics capabilities and supply chain sustainability: Evidence from the hospitality industry	Quantitative	Jordan, hospitality	450 survey responses	All elements of BDA, including infrastructure flexibility, management, and personnel capabilities, positively impact SC sustainability. The highest impact was infrastructure flexibility,

						followed by personnel and management capabilities having the lowest impact. BDA can contribute to SC sustainability by improving demand forecasting, which improves inventory management and helps reduce waste. BDA contributes to SC sustainability via supplier choice and monitoring. The sustainable performance of suppliers can be better monitored to ensure ethical purchasing. In transportation, BDA can support route planning, reduce emissions, and be more effective in SC.
7	Alsmairat M.A.K.	Big data analytics capabilities, SC innovation, customer readiness, and digital SC performance: the mediation role of SC resilience	Quantitative	Jordan	340 responses	BDAC, directly and indirectly, impacted digital SC performance through SC resilience as a mediator.
8	Seddigh M.R.; Shokouhyar	Approaching towards sustainable supply chain under the spotlight of business intelligence	Quantitative	Iran, pharmaceutical	408 responses	BI capabilities, including infrastructure integration, BI functionality, and BI self-service, strongly affected SC sustainability

	S.; Loghmani F.					and its different aspects. These included vision, the scope of operations, internal roles, and responsibilities. Effects on other dimensions, such as expectations, engagement, and goals, were also positive but weaker. BI's contribution to vision is achieved via better insights into the market, which supports strategic management in production and distribution. BI supports scope by enabling better segmentation of markets and customers through data and capabilities that would not otherwise be available, i.e., customer behavior.
9	Barbosa M.W.; Ladeira M.B.; de Sousa P.R.; de Oliveira M.P.V.	Supply chain collaboration and organizational performance: The effects of big data analytics capabilities, technological dynamism, and competitive intensity	Quantitative	Brazil, retail	323 survey responses	BDA mediates the relationship between collaboration and organizational performance. This relationship is moderated by technological dynamism and competitive intensity.

						Management capabilities were found to have the greatest influence on BDA dimensions. Integration capabilities are crucial for implementing BDA in the SC context. This includes knowledge and information sharing between SC partners, ensuring data interoperability, and complementing their weak capabilities with strong capabilities from partners.
10	Allahham M.; Sharabati A.-A.A.; Al-Sager M.; Sabra S.; Awartani L.; Khraim A.S.L.	Supply chain risks in the age of big data and artificial intelligence: The role of risk alert tools and managerial apprehensions	Quantitative	Various countries, manufacturing, and services industries	420 survey responses	BDA capabilities and IT infrastructure improve the usefulness of risk alert technologies. Management impressions of BDA moderated this relationship. Organizations should invest in managerial training to address the potential negative impacts of management impressions. Thus, investing in BDA and IT infrastructure is not enough.

11	Park M.; Singh N.P.	Predicting supply chain risks through big data analytics: role of risk alert tool in mitigating business disruption	Quantitative	Various countries, various industries	297 survey responses	BDA knowledge management capability improved the effectiveness of the automated SC disruption alert tool. BDA infrastructure and human capital capabilities did not significantly impact the effectiveness. The impact of BDA on the automated disruption alert tool was moderated by upstream and downstream IT infrastructure. Thus, supply network partners' IT infrastructure capabilities influence the firm's BDA capabilities.
12	Riggs R.; Roldán J.L.; Real J.C.; Felipe C.M.	Opening the black box of big data sustainable value creation: the mediating role of supply chain management capabilities and circular economy practices	Quantitative	EU, various industries	210 survey responses	Big data analytics capabilities impact sustainable performance indirectly through SCM capabilities and circular economy practices. The most critical mediator between BDAC and SP is circular economy practices.
13	Bag S.; Dhamija P.; Luthra S.; Huisingh D.	How big data analytics can help manufacturing companies strengthen supply chain resilience in the context of the COVID-19 pandemic	Quantitative	South Africa, automobile parts manufacturing	224 survey responses	Aligning BDA with SCM goals positively influences purchasing and supply chain management capabilities and supports competitive advantage. This

						requires clarity regarding BDA adoption goals so that managers can focus on orchestrating and developing resources and capabilities that can assist in BDA alignment with SCM goals. BDA-based resources must be integrated with the firm's business plans and procedures for BDA to contribute to sustainable competitive advantage.
14	Khan, S.A.R., Piprani, A.Z. and Yu, Z.	Supply chain analytics and post-pandemic performance: mediating role of triple-A supply chain strategies	Quantitative	Pakistan, textile manufacturing	163 survey responses	Supply chain data analytics significantly contributes to SC agility and adaptability. SCDA alone is not enough to minimize the effects of disruptions on SC. This requires companies to have 3A strategies and alignment of business processes with SC partners.
15	Xu J.; Pero M.E.P.	A resource orchestration perspective of organizational big data analytics adoption: evidence from supply chain planning	Qualitative, multiple case study	Italy, manufacturing	19 interviews	The study examined how resources (individual, technological, organizational) are orchestrated for organizational BDA adoption in the SC planning context. Stages of resource orchestration include

						establishment, development, and leveraging. Results show that individual and organizational resources have a role in each stage, whereas technological resources are crucial in the development and leveraging stages.
16	Munir, M., Jajja, M.S.S. and Chatha, K.A.	Capabilities for enhancing supply chain resilience and responsiveness in the COVID-19 pandemic: exploring the role of improvisation, anticipation, and data analytics capabilities	Quantitative	Pakistan, various industries	206 survey responses	Data analytics capability positively affects anticipation and improvisation. These mediate the relationship between data analytics capability and SC resilience. Organizations' information processing capabilities are enhanced in turbulent and volatile environments since they can better make sense of their environment through more reliable and up-to-date data and analysis techniques. This also helps prepare and mitigate the negative effects of SC disruptions and risks.

17	Tipu S.A.A.; Fantazy K.	Linking big data analytics capability and sustainable supply chain performance: the mediating role of innovativeness, proactiveness, and risk-taking	Quantitative	Pakistan, manufacturing	300 questionnaire responses	The relationship between BDAC and SSCP is mediated by knowledge development, with no direct relationship between BDAC and SSCP. Developing BDAC alone is not enough for SSCP, but the importance of knowledge development must also be acknowledged.
18	Furstenau L.B.; Zani C.; Terra S.X.; Sott M.K.; Choo K.-K.R.; Saurin T.A.	Resilience capabilities of healthcare supply chain and supportive digital technologies	Qualitative	Brazil, healthcare	15 interviews and document analysis	Big data & predictive analytics contributed to anticipating disruptive events and enhancing decision-making related to purchasing and inventory management.
19	Dubey R.; Bryde D.J.; Dwivedi Y.K.; Graham G.; Foropon C.	Impact of artificial intelligence-driven big data analytics culture on agility and resilience in humanitarian supply chain: A practice-based view	Mixed methods, qualitative & cross-sectional survey	International NGOs, disaster relief operations in India & Nepal	17 semi-structured interviews	AI-driven big data analytics culture promotes agility and resilience practices, improving humanitarian SCs' performance. BI enhances relief team responsiveness, effectiveness, and resilience through better insights.

20	Aljumah A.I.	Exploring the nexus among big data analytic capability and organizational performance through mediation of supply chain agility	Quantitative	UAE, Hospitality	302 survey responses	BDA improves SC agility by enabling managers to assess the performance of their suppliers better and take necessary actions in time. SC agility contributes to organizational performance since decision-makers have more information about internal and external stakeholders.
21	Lee V.H.; Foo P.-Y.; Cham T.-H.; Hew T.-S.; Tan G.W.-H.; Ooi K.-B.	Big data analytics capability in building supply chain resilience: the moderating effect of innovation-focused complementary assets	Quantitative	Malaysia, manufacturing	308 survey responses	No significant direct link between BDA and SC resilience was identified. SC resilience cannot be improved by BDA alone, but it requires the entire value chain to have the capability to react and respond to disruptions based on analysis provided by BDA. BDA contributes positively to SC resilience through SC flexibility. This is because BDA speeds up decision-making by providing intelligence reports quicker and with more data than traditional reporting systems. This is especially useful during times of SC disruptions and crises'.

						The impact of BDA on SC flexibility is enhanced by innovation-focused complementary assets related to IT infrastructure and technologies. These support data gathering, processing, and analysis. BDA enables better response to changing market demands via better insights into customer needs, preferences, and satisfaction, enabling better predictions and market analysis. This can be used to improve product development.
22	Li W.; Waris I.; Bhutto M.Y.	Understanding the nexus among big data analytics capabilities, green dynamic capabilities, supply chain agility, and green competitive advantage: the moderating effect of supply chain innovativeness	Quantitative	Pakistan, manufacturing	331 survey responses	BDAC has a significant positive influence on green dynamic capabilities and SC agility. BDAC enhances collaboration across departments, which results in more efficient decision-making processes. With BDAC, managers have better access to data, which enables them to make strategic decisions regarding environmental aspects of the supply chain and support innovation activities within the SC.

						Culturing BDAC culture and acquiring the necessary technologies are necessary to make the most of BDAC.
23	Ziaee M.; Shee H.K.; Sohal A.	Big data analytics in Australian pharmaceutical supply chain	Qualitative	Australia, pharmaceutical	20 Semi-structured interviews	BDAC was most beneficial in planning, delivery, and return processes. In planning, BDA enhances visibility and transparency, which helps predict and aggregate supply and demand via demand monitoring and improves forecasting accuracy. It can provide information about geographical locations and improve route planning, resulting in lower transportation costs and quicker delivery times. In the return process, BDA helps inventory management by minimizing stock wastage. It helps identify near-expiry products and areas with higher demand where they can be sent. It was highlighted that each technology has its characteristics that must be assessed from technological, organizational, and environmental perspectives.

24	Cadden T.; McIvor R.; Cao G.; Treacy R.; Yang Y.; Gupta M.; Onofrei G.	Unlocking supply chain agility and supply chain performance through the development of intangible supply chain analytical capabilities	Quantitative	UK, manufacturing	201 survey responses	Organizational learning is pivotal for suppliers in developing BDAC and enhancing SC agility. Organizational learning in big data had a greater role in enhancing SC agility than purely technical aspects of big data. This is possible because suppliers must learn to leverage big data before building basic zero-level big data capabilities. SC analytical capabilities can improve SC agility by enabling more informed and responsive decision-making in turbulent and competitive environments. This happens by reducing the complexities of processing large volumes and various data. Intangible capabilities such as learning orientation and enhanced collaboration with SC partners via cross-SC analytical teams are necessary to develop SC analytical capabilities. Strategic alignment and integration of the SC is necessary for SC

						partners to develop higher-order BDA capabilities.
25	Jiang Y.; Feng T.; Huang Y.	Antecedent configurations toward supply chain resilience: The joint impact of supply chain integration and big data analytics capability	Qualitative	China, manufacturing	277 survey responses	Both SC integration and BDA capabilities are needed to achieve SC resilience.
26	Benzidia S.; Bentahar O.; Husson J.; Makaoui N.	Big data analytics capability in healthcare operations and supply chain management: the role of green process innovation	Quantitative	France, hospitals	123 survey responses	BDAC was found to impact environmental process integration in the SC positively. BDAC improves internal integration between departments, which supports decision-making related to environmental initiatives. The managerial focus should not be only on technical BDAC aspects related to its implementation but also on identifying the strategic use of BDAC.
27	Bag S.; Rahman M.S.; Srivastava G.; Chan H.-L.; Bryde D.J.	The role of big data and predictive analytics in developing a resilient supply chain network in the South African mining industry against extreme weather events	Qualitative	South Africa, mining industry	Ten interviews & 219 survey responses	BDAC improves SC visibility by enabling better SC monitoring. It enhances the mining industry's dynamic capability be enabling the adjustments of strategies based on adverse weather conditions. The

						alignment of BDAC strategy and initiatives moderates BDAC's impact on SC visibility. SC visibility is dependent on the level of technology infrastructure in the SC. This influences the level of information sharing and SC connectivity. Technical and managerial skills, culture, and organizational learning are antecedents for BDA capabilities.
28	Liu Y.; Fang W.; Feng T.; Gao N.	Bolstering green supply chain integration via big data analytics capability: the moderating role of data-driven decision culture	Quantitative	China, manufacturing	317 survey responses	BDAC is a significant antecedent for green SC integration. BDA managerial and technical capabilities enhance information processing capability, which leads to a higher degree of green SC integration. Data-driven decision culture also has a significant role in this relationship. BDAC helps firms access information about environmental issues by enabling information sharing with customers and

						suppliers, facilitating mutual understanding and collaboration regarding environmental issues. Internal integration is essential for the green integration of customers and suppliers. Internal integration established by BDAC helps the firm develop its environmental strategies, which can be used to integrate customers and suppliers. A data-driven decision culture was found to have a substitution effect on BDAC.
29	Al-Khatib A.W.	Big data analytics capabilities and green supply chain performance: investigating the moderated mediation model for green innovation and technological intensity	Quantitative	Jordan. Food & beverage manufacturing	420 survey responses	A positive relationship between BDAC and green SC performance was identified. This relationship was mediated by green innovation. BDAC can improve sustainable performance at the SC level by providing the members with collaboration tools for sharing environmental knowledge. BDAC contributes to defining the SC's green innovation strategy by providing novel insights.

						BDAC supports sustainable performance by ensuring the early detection and verification of disasters.
30	Bhatti S.H.; Ahmed A.; Ferraris A.; Hirwani Wan Hussain W.M.; Wamba S.F.	Big data analytics capabilities and MSME innovation and performance: A double mediation model of digital platform and network capabilities	Quantitative	Pakistan, manufacturing	221 survey responses	Relationship between BDAC and Supply chain innovation mediated by networking capabilities and digital platform capabilities Digital platform capabilities, i.e., platform integration capabilities, enable knowledge sharing between supply chain members. Network capabilities allow the development and better utilization of internal and external relationships, which can lead to higher rates of innovation and growth opportunities.
31	Kholaif M.M.N.H.K.; Sarwar B.; Xiao M.; Poliak M.; Giovando G.	Post-pandemic opportunities for F&B green supply chains and supply chain viability: the moderate effect of blockchains and big data analytics	Quantitative	Egypt, food & beverage	362 firms/survey responses	BDA moderates the relationship between fear & uncertainty and green SCM practices.BDA reduces uncertainty and fear, improving decision-making during crises by allowing firms to obtain more accurate data and better

						forecasting accuracy, which supports green SCM practices.
32	Bag S.; Rahman M.S.	The role of capabilities in shaping sustainable supply chain flexibility and enhancing circular economy-target performance: an empirical study	Quantitative	India,agriculture & allied industries, electronics & electrical, metals & mining, automobiles	760 survey responses	Engagement capability is an antecedent to data analytics capability. Engagement capability is needed to engage customers with coordination, planning, and investment required to implement data analytics in the supply chain. DAC was found to partially mediate the relationship between ENC and alliance capability by providing a platform for the parties, increasing understanding and coordination between the members. DAC has a positive impact on SSCP via alliance capability. By supporting alliance capability, firms can better access information and coordinate their actions based on sustainable principles.

33	Abuzaid A.N.; Alateeq M.; Baqleh L.; Madadha S.-A.; Haraisa Y.A.	The moderating effect of strategic momentum on the relationship between big data analytics capabilities and lean supply chain practices	Quantitative	Jordan, textile manufacturing	116 survey responses, senior executives	BI has a positive impact on lean supply chain practices and strategic momentum. BI has a positive impact on lean supply chain practices. Better efficiency can be achieved by collecting real-time data across the chain. Predictive analytics allows better forecasting and decision-making regarding production and inventory management, resulting in better efficiency and reduced costs and waste. BI supports strategic momentum by enabling better decision-making and optimization of operations. With BI, development areas within operations can be better identified and investments made more accurately. Also, BI enhances strategic momentum by better understanding the firm's relative market position, as external data on competitors and markets can be analyzed in higher quantities.

						Strategic momentum helps to leverage the insights gained via BI. With SM, BI insights are transformed into concrete actions. SM moderates the relationship between BI and lean SC practices.
34	Bhatti S.H.; Hussain W.M.H.W.; Khan J.; Sultan S.; Ferraris A.	Exploring data-driven innovation: What's missing in the relationship between big data analytics capabilities and supply chain innovation?	Quantitative	Pakistan, various manufacturing industries, including food & beverage, consumer electronics, automotive, and pharmaceutical.	386, managers working in supply chain-related operations	BI enhances SC innovation directly and indirectly via SC agility and adaptability. Technological uncertainty had a significant positive moderating effect on the direct relationship between BI and SC innovation.
35	Balci, G. and Ali, S.I.	The relationship between information processing capabilities, Net-Zero capability, and supply chain performance	Quantitative	Turkiye, manufacturing	311 survey responses	SC visibility and integration have a significant positive impact on BI. BI positively impacts SC's net zero capability by acting as an information processing capability. This allows better capture and analysis of carbon emissions data from suppliers and enhances decision-making. SC integration is an antecedent since intra and inter-organizational data is needed.

36	Alkhatib, A.W.	Fostering green innovation: the roles of big data analytics capabilities and green supply chain integration	Quantitative	Jordan, food & beverage manufacturing	300 survey responses	BDAC improves all three elements of green integration (internal, customer, supplier) Green internal integration is enhanced by promoting cross-department collaboration and providing new perceptions about environmental issues. Green customer integration is enhanced by a better understanding customer preferences and opinions via BDAC. Green supplier integration is enhanced by better utilization of supplier knowledge of environmental issues and the ability to select the greenest suppliers using BDAC. BDAC also has a positive impact on green innovation. BDAC supports the generation of new information and information sharing within the SC, leading to increased green innovation.

37	Al-Shboul, M.A.	Do reliable big and cloud data analytics capabilities in manufacturing firms' supply chains boost unique comparative advantage? A moderated-mediation model of data-driven competitive sustainability, green product innovation, and green process innovation in the North Africa region	Quantitative	Egypt, Algeria, Tunisia, Morocco	346 survey responses	Green products and green process innovation mediate the relationship between BDAC and comparative advantage.
38	Wei, S., Yin, J. and Chen, W.	How big data analytics use improves supply chain performance: considering the role of supply chain and information system strategies	Quantitative	China	159 questionaire responses	BDA has a direct effect on SC performance. Additionally, SC strategy (lean or agile) mediates this relationship. The choice of information system strategy has a moderating effect on the BDA—SC performance link. With the IS innovator strategy, there is more technical support for BDA.
39	Al-Khatib, A.W. and Ramayah, T.	Big data analytics capabilities and supply chain performance: testing a moderated mediation model using partial least squares approach	Quantitative	Jordan, manufacturing	420 survey responses	BDA positively impacts SC performance; it improves operational efficiency, reduces risks, and enhances innovation. This relationship is mediated by SC innovation. Innovation helps utilize information collected via BDA, thus resulting in more innovation.

40	Manikas, I., Sundarakani, B. and Shehabeldin, M.	Big data utilization and its effect on supply chain resilience in Emirati companies	Quantitative	United Arab Emirates, SCM professionals from various industries	128 survey responses	BDA management capabilities, i.e., planning, coordination, investment, and control, significantly impact SC agility via SC preparedness.
41	Gupta, Y., Khan, F.M., Kumar, A., Luthra, S. and Queiroz, M.M.	Mobilizing big data analytics capabilities to improve performance of tourism supply chains: the moderating role of dynamic capabilities	Quantitative	India, tourism industry	218 questionnaire responses	BDAC enhances operational efficiency by reducing costs related to supplier management and inventory wastage. Dynamic capabilities moderate the relationship between BDAC and improvement in operational efficiency. DC did not mediate between BDAC and environmental or social performance.
42	Dehkhodaei, A., Amiri, B., Farsijani, H. and Raad, A.	Barriers to big data analytics (BDA) implementation in manufacturing supply chains	Mixed, literature review and Delphi method	Iran, manufacturing	12 interviews	The most significant barriers to BDA implementation in manufacturing supply chains were senior managers' lack of sufficient knowledge and the weakness of governance policies.
43	Papanagnou, C., Seiler, A., Spanaki, K., Papadopoulos, T. and Bourlakis, M.	Data-driven digital transformation for emergency situations: The case of the UK retail sector	Quantitative	UK, grocery retail	142 survey responses	Predictive analytics enhances risk management capabilities by increasing the ability to anticipate and respond to supply chain disruptions.

						Big data capabilities are not vital in strengthening retailers' supply chain resilience because retailers lack associated capabilities to respond and act to severe disruptions and emergencies. Retailers rely on their SC partners' resilience capabilities, making them vulnerable. Thus, SC resilience is not directly dependent on the technical BI capabilities of the focal firm but is subject to BI capabilities and level of integration with partners. Technical implementation of BI is not enough to provide resilience for the firm. Management systems and processes are needed to respond to risks and use BI to improve decision-making. Alternative ways of processing large amounts of data should be considered in addition to analytics capabilities. The focus should be finding ways to process ever-increasing amounts of data and how this data and information

						exchange with suppliers could be simplified.
44	Jegan, J., Sonwaney, V., Bryde, D. and Graham, G.	Achieving competitive advantage through technology-driven proactive supply chain risk management: an empirical study	Quantitative	India, Manufacturing, and logistics	218 survey responses	
45	Swink, M., Hu, K. and Zhao, X.	Analytics applications, limitations, and opportunities in restaurant supply chains	Qualitative	China, USA, restaurant industry	16 interviews	Personnel capabilities in BI systems and internally developed legacy systems can act as bottlenecks for BI adoption. Legacy systems can limit the possibilities of integrating data from internal and external sources. User-friendliness of BI systems can also limit their adoptions if systems are not easy to use. A lack of vertical integration can challenge BI adoption since systems can vary between supply chain members. Also, some members prioritize optimizing their operations even if it negatively affects the system as a whole. Thus,

						BI cannot be used to improve the chain's performance.
46	Daneshvar Kakhki, M., Rea, A. and Deiranlou, M.	Data analytics dynamic capabilities for Triple-A supply chains	Quantitative, meta-analytical structural modeling	Various industries	117 published studies	SCI can limit flexibility by limiting agility. This happens by imposing rigidity and higher coordination costs as systems are more integrated, and responding to volatility becomes more costly as a unified response between system members is needed. DAMC can mediate the relationship between SCI and agility. Agile SC leads to large amounts of information and complexity; with DAMC, firms can gain the ability to analyze this information and handle complexity. Thus, they can detect changes quickly and focus decision-making on the most important issues.
47	Fantazy, K. and Tipu, S.A.A.	Linking big data analytics capability and sustainable supply chain performance: mediating role of knowledge development	Quantitative	Pakistan, manufacturing	300 survey responses	Knowledge development mediates the relationship between BI and sustainable SC performance via knowledge acquisition, information

						distribution, shared meaning, and achieved memory dimensions. BI facilitates the sharing of common knowledge within the supply chain; thus, shared meaning is essential for maximizing the value of BI. Knowledge management capabilities are essential alongside technical BI capability to enhance sustainable supply chain performance. Technology is an enabler, but knowledge management is required to identify and capture relevant data via BI.
48	Mishra, R., Gangwar, H. and Sahoo, S.	Role of bigdata analytics in improving drivers of omnichannel retailing for improving logistics experience	Mixed, exploratory sequential mixed method	India, retailing	Five interviews, 158 survey responses	Top management commitment, financial and technological resources, and individual employee skills impact the adoption of BI. BI improves SC performance via enhanced information sharing. It enables the identification of correlations, patterns, and other insights from the SC. For example, BI can be used in distribution network optimization to model

						different scenarios. This requires capabilities that enhance the interpretation of this data so that actions can be taken. BI also improves SC performance via optimizing transportation, which benefits from real-time data access. Cross-functional operations between business and IT personnel with relevant skills, i.e., statistics and programming, are beneficial for achieving business growth from BI. BI substantially impacts warehousing, material handling & packaging by providing decision-makers with better information. This enables more flexible planning in warehouse operations.
49	Li, L., Gong, Y., Wang, Z. and Liu, S.	Big data and big disaster: a mechanism of supply chain risk management in global logistics industry	Mixed, survey, and semi-structured interviews	Global, logistics	323 survey responses, 55 semi-structured interviews	BI and SC integration function as second-order capabilities that help the firm develop first-order capabilities, such as proactive, reactive, and resource configuration capabilities. These first-order capabilities enhance innovation capability and disaster immunity,

						improving SC performance during COVID-19.
50	Shi, H., Feng, T., and Zhu, Z.	The impact of big data analytics capability on green supply chain integration: an organizational information processing theory perspective	Quantitative	China	317 survey responses	BI supports three elements of green SC integration: Supplier, internal, and customer. BI positively impacts supply and demand visibility. For supply, BI enables monitoring of supplier inventory levels and better monitoring of shipments. BI enables better insight into customer buying behavior by combining data from multiple sources for demand. Supply visibility enhances the three elements of GSCI. Demand visibility only enhances internal and customer integration. Supply visibility also mediates the relationship between BI and the three aspects of GSCI. Demand visibility mediates the relationship between BI and internal and customer integration. An oriented culture strengthens BI's relationship with supply and demand visibility.

51	Shreyansh Vikram Singh, Singh, J., Garg, S., Trivedi, S. and Negi, S.	Role of big data analytics and the internet of things in Indian agricultural supply chain	Literature review	India, agriculture		BI supports more efficient farming methods, i.e., precision farming. With insights from data, farming activities can be better optimized to enable better yields from farming. Farmers have better access to market information and climate conditions. BI helps connect the various members of the supply chain.
52	Patrucco A.S.; Marzi G.; Trabucchi D.	The role of absorptive capacity and big data analytics in strategic purchasing and supply chain management decisions	Quantitative	Global, various industries	222 survey responses	Acquisition, assimilation, and transformation capabilities act as antecedents to BI adoption. Firms with mature capabilities are likey to benefit most from potential sensing capabilities brought by BI. BDA strengthens the exploitation capabilities of the com panies as a result of their ability to support strategic purchasing & supply chain management decisions BI needs to be integrated into existing business decision-making processes, and its effectiveness depends on organizational context.

						BI will yield more benefits if the organization itself is flexible and ambidextrous. Such organizations can better use BI to capitalize on opportunities. Also, the level of Various non-technical knowledge management capabilities must be developed before implementing BI, i.e., knowledge discovery, adaptation, and integration. Also, sufficient technical tools and infrastructure are required for BI adoption. This includes ensuring that current IT systems can support BI adoption.
53	Zhang X.; He X.; Du X.; Zhang A.; Dong Y.	Supply chain practices, dynamic capabilities, and performance: The moderating role of big data analytics	Quantitative	China	415 questionnaire responses	Big data analysis positively moderates the relationship between supply chain practices and supply chain performance. BI helps implement SC practices that improve SC performance via information sharing and coordination with SC members. BI also provides better visibility to SC processes, which enhances decision-making and helps to align

						SC development with organizational goals.
54	Nisar Q.A.; Haider S.; Ameer I.; Hussain M.S.; Gill S.S.; Usama A.	Sustainable supply chain management performance in post COVID-19 era in an emerging economy: a big data perspective	Quantitative	Pakistan	374 survey responses	BI enhances sustainable SC performance via green product development and risk management capabilities. These capabilities support innovation and learning capabilities, significantly impacting sustainable SC performance. Achieving sustainable SC performance with BI requires investment in BI management, talent, and technology domains. Together, these domains function as dynamic capabilities to boost sustainable SC performance. A positive relationship between BDA and innovative green product development. With BDA, employee skills and competencies can be better developed, making employees more suited to operate in dynamic and data-rich environments. Also, better employee skills in technology and data-driven culture will enhance

						firm innovativeness, thus resulting in improved green product development. Innovative green product development mediates the relationship between BDA and learning performance, as the completion of the IGPD project results in learning outcomes for the participated employees.
55	Dubey R.; Gunasekaran A.; Childe S.J.; Bryde D.J.; Giannakis M.; Foropon C.; Roubaud D.; Hazen B.T.	Big data analytics and artificial intelligence pathway to operational performance under the effects of entrepreneurial orientation and environmental dynamism: A study of manufacturing organisations	Quantitative	India, manufacturing	256 survey responses	Entrepreneurial orientation within an organization, including proactiveness, risk-taking, and innovativeness, enables exploitation and a more comprehensive exploration of BI capabilities in developing operational performance. The level of environmental dynamism moderates the effect of entrepreneurial orientation on BI exploration and exploitation. In a moderate level of environmental dynamism, EO significantly impacts BI adoption and operational performance.

56	Dubey R.; Gunasekaran A.; Childe S.J.; Fosso Wamba S.; Roubaud D.; Foropon C.	Empirical investigation of data analytics capability and organizational flexibility as complements to supply chain resilience	Quantitative	India, manufacturing	213 survey responses	Data analytics capability has a positive impact on SC resilience and competitive advantage. Organizational flexibility moderates the relationship between data analytics, SC resilience, and CA. DA improves SC resilience via enhanced visibility thanks to data and analysis capabilities. DA improves CA by enabling better organizational performance by allowing the firm to better asses itself and use these insights to position itself in the market and develop capabilities i.,e. low cost, differentiation that supports its competitive position. Organizational flexibility moderates the relationship between DA and SCR and CA as flexible organizations can better act on the insights provided by DA.
57	Dubey R.; Luo Z.; Gunasekaran A.; Akter S.; Hazen B.T.; Douglas M.A.	Big data and predictive analytics in humanitarian supply chains: Enabling visibility and coordination in the presence of swift trust	Quantitative	International, non-government organizations	205 survey responses	BDPA significantly influences SC visibility and coordination, mediated by swift trust. By enhancing visibility, coordination between SC members is improved.

						Swift trust includes contextual factors such as culture, strategic context, firm size, and other organizational factors.
58	Alvarenga M.Z.; de Oliveira M.P.V.; Filho H.Z.; dos Santos W.R.	Analytical supply chains: Are they more resilient? A model's proposition	Literature review			Analytics capability is proposed as a resilience capability founded on the ability to process information more efficiently in the context of organizational decision-making related to risk management.
59	Adaileh M.J.; Alrwashdeh M.; Alzeat H.Z.A.; Almatarneh N.S.	The antecedents of supply chain performance: Business analytics, business process orientation, and information systems support	Quantitative	Saudi-Arabia, manufacturing	373 questionnaire responses	BI has a significant indirect impact on SC performance, mediated by information systems and business process orientation. The relationship between BI and BPO is that effective utilization of BI-generated data requires information processing capabilities. Achieving these may require organizational change, i.e., change management processes or business process reengineering. More mature change management capabilities allow organizations to better act on insights provided by BI.

						Information systems are also antecedents for BI, providing the technical infrastructure that collects and stores data. The level of analysis that can be generated with BI depends on the quantity of data dictated by information systems.
60	Dubey R.; Gunasekaran A.; Childe S.J.; Luo Z.; Wamba S.F.; Roubaud D.; Foropon C.	Examining the role of big data and predictive analytics on collaborative performance in context of sustainable consumption and production behaviour	Quantitative	India, auto-components manufacturing	190 questionnaire responses	BI significantly impacts collaborative performance, mediated by organizational compatibility, i.e., alignment of cultures, missions, objectives, procedures, technical capabilities, and resource complementarity. The effect of resource complementarity is that it can reduce opportunistic behavior when reciprocal needs arise. This can enhance the collaboration via BI.
61	Tarei P.K.; Thakkar J.J.; Nag B.	Development of a decision support system for assessing the supply chain risk mitigation strategies: an application in Indian petroleum supply chain	Mixed, systematic review and correspondence analysis	India, petroleum industry		The DSS improves decision-making speed and accuracy by collecting tacit expertise in the organization and producing risk management strategies based on external conditions. Thus, risk management strategies can be generated quickly,

						and knowledge can be utilized more efficiently in the organization. It also enables easier comparison of different strategic options. The DSS addresses subjectivity bias in its recommendations. Thus, its recommendations are more objective than those resulting from traditional decision-making.
62	Arunachalam D.; Kumar N.; Kawalek J.P.	Understanding big data analytics capabilities in supply chain management: Unravelling the issues, challenges and implications for practice	Systematic literature review			Antecedents to BI use in the SCM context include data-driven culture, cloud computing capability and Absorptive Capacity, Data Generation, Data integration and management, advanced analytics, and data visualization capabilities. Understanding one's own BI maturity level supports the adoption of BI. Guidelines for BI implementation include> 1. Begin by building technical infrastructure 2. Establish information-sharing policies and principles with SC members

						3. Develop BI capabilities incrementally, starting from essential reporting functions and moving towards advanced forms of BI such as predictive and prescriptive. 4. Integrating BI with business processes and vision makes BI part of organizational decision-making culture.
63	Bag S.; Pretorius J.H.C.; Gupta S.; Dwivedi Y.K.	Role of institutional pressures and resources in the adoption of big data analytics powered artificial intelligence, sustainable manufacturing practices and circular economy capabilities	Quantitative	South Africa, automotive manufacturing	219 survey responses	Tangible resources and workforce skills support BI adoption, which positively impacts sustainable manufacturing performance (SMP) and circular economy capabilities (CEC). Organizational flexibility and industry dynamism moderated the relationship between BI and CEC.
64	Gu V.C.; Zhou B.; Cao Q.; Adams J.	Exploring the relationship between supplier development, big data analytics capability, and firm performance	Quantitative	China, manufacturing	500 companies	BI capabilities have a positive impact on supplier development and business performance. BI capabilities mediate and moderate the relationship between supplier development and business performance. With BI capabilities, the ability to manage suppliers is

						improved, leading to improved firm performance. BI can support supplier development by providing more in-depth information about suppliers, which enhances decision-making. This includes monitoring supplier information from various sources, i.e., publicly available news or social media, and consolidating supplier information from different parts of the organization. This data can include delivery performance, quality, and spending. With more in-depth information, firms can enhance their ability to choose the right suppliers, optimize their distribution network, and better manage supply risks.
65	Singh N.P.; Singh S.	Building supply chain risk resilience: Role of big data analytics in supply chain disruption mitigation	Quantitative	USA & Europe, various industries	225 survey responses	BI capabilities support the development of SC risk resilience capability by enabling better utilization of resident firm knowledge and enhancing existing IT capabilities. BI allows the firm to better learn from previous disruptions and use this knowledge

						to develop resilience. By supporting IT capabilities, companies have access to larger amounts of data which can be analyzed more effectively. This enables better and earlier risk detection. Thus, BI enhances existing organizational capabilities in developing SC risk resilience.
66	Brinch M.; Gunasekaran A.; Fosso Wamba S.	Firm-level capabilities towards big data value creation	Qualitative, single case study	Global, wind turbine manufacturing		BPM (business process management) and ITBV (IT business value) practices were relevant in gaining value from big data. A lack of BPM maturity will likely limit the value gained from big data since it limits data sharing and leads to limited data available for analytics. This stems from functional silos and a lack of governance procedures. These factors cause inadequate data quality and system standardization, leading to a lack of data. A lack of BPM maturity will likely lead to a low level of big data value creation. This includes confining data within functional silos, not

						sharing data across the organization for analytic purposes, and the lack of governance procedures to secure adequate data quality and system standardization, all of which are critical for big data use.
67	Hallikas J.; Immonen M.; Brax S.	Digitalizing procurement: the impact of data analytics on supply chain performance	Quantitative	Finland, forest industry	101 survey responses	Digital procurement capabilities mediate the relationship between external BI capabilities and SC performance. Internal BI capabilities had a direct effect on SC performance. The suggested cause for this was that external data is not as quickly applicable to operational processes since its often unstructured. Internal data is typically structured and linked to operational processes and systems. Internal BI refers to gathering and using data from internal SC processes, whereas external refers to combining external data from suppliers.
68	Jeble S.; Kumari S.; Venkatesh V.G.; Singh M.	Influence of big data and predictive analytics and social capital on performance of humanitarian supply chain: Developing	Literature review	Global, humanitarian organizations		BI improves humanitarian SCs by enhancing visibility and coordination, making them more responsive, impactful, sustained,

		framework and future research directions				and efficient. This enhances information sharing between various stakeholders and improves coordination. These effects of BI are highlighted when a large and diverse set of stakeholders is involved in the SC operation.
69	Wamba S.F.; Dubey R.; Gunasekaran A.; Akter S.	The performance effects of big data analytics and supply chain ambidexterity: The moderating effect of environmental dynamism	Quantitative	USA, various industries	281 survey responses	BI positively impacts SC agility, adaptability, and cost performance/operational performance. Agility and adaptability are improved by better SC visibility due to BI. Cost/operational performance is improved by making processes more efficient, reducing operating costs, and improving product quality. These effects are contingent upon environmental dynamism, with effects being high with moderate dynamism but weak with low or high dynamism.
70	Dubey R.; Gunasekaran A.; Childe S.J.	Big data analytics capability in supply chain agility: The moderating effect of organizational flexibility	Quantitative	India, automotive components manufacturing	173 questionnaire responses	BI has a significant positive impact on SC agility, moderated by organizational flexibility. Flexible organizations can implement decisions quicker and more

						efficiently and thus can utilize insights gained from BI more effectively.
71	Srimarut T.; Mekhum W.	From supply chain connectivity (SCC) to supply chain agility (SCA), adaptability and alignment: Mediating role of big data analytics capability	Quantitative	Thailand, manufacturing	300 respondents	BI capability enhances SC alignment, agility, and adaptability. Agility is improved by giving management a better understanding of external changes and conditions, allowing them to respond quickly. Adaptability is improved by enhancing collaboration, which helps SC adapt to market requirements. Alignment is improved since management can better assess the distribution of risks and benefits between SC partners. BI enhances information sharing between partners, spreading risk equally and improving alignment. SC connectivity is a determinant of BI since it influences the data available for BI.

72	Dubey R.; Gunasekaran A.; Childe S.J.; Roubaud D.; Fosso Wamba S.; Giannakis M.; Foropon C.	Big data analytics and organizational culture as complements to swift trust and collaborative performance in the humanitarian supply chain	Quantitative	Global, NGOs and military organizations	373 respondents	BI as culture significantly impacts swift trust and collaborative performance in humanitarian SCs. Flexibility-oriented culture within the organization has a significant positive moderating effect on the relationship between BI and collaborative performance.
73	Zhan Y.; Tan K.H.	An analytic infrastructure for harvesting big data to enhance supply chain performance	Qualitative, single case study	China, athletic goods manufacturing		The proposed BI infrastructure addresses competence sets required for specific decision problems. Competence sets consist of ideas, knowledge, information, and skills for a decision problem. The proposed infrastructure enables managers to integrate information from various sources to understand the decision problem better. It also allows a better understanding of current firm competences and offers support in expanding these competences.
74	Yu W.; Zhao G.; Liu Q.; Song Y.	Role of big data analytics capability in developing integrated hospital supply chains and operational flexibility: An organizational	Quantitative	China, healthcare	105 respondents	BI significantly impacts three dimensions of hospital SC integration: Internal, hospital-patient, and hospital supplier.

		information processing theory perspective				BI improves internal integration by transforming unstructured data into structure, which enhances information sharing across departments. Hospital-patient integration is improved by better patient health monitoring since data can be collected via various devices, enhancing diagnosis, medication, and treatment. BI improves supplier integration by enhancing collaboration between hospitals and suppliers. As hospitals can better collect and analyze data, they can better forecast required levels of inventory. This enables better collaboration with key suppliers as they can better monitor and deliver according to hospital requirements.
75	Dubey R.; Gunasekaran A.; Childe S.J.; Papadopoulo	Can big data and predictive analytics improve social and environmental sustainability?	Quantitative	India, manufacturing	205 respondents	BI has a significant positive impact on supply chains' social and environmental performance. Organizational culture orientation,

	s T.; Luo Z.; Wamba S.F.; Roubaud D.					i.e., control or flexibility, had no moderating effect. However, data-driven decision-making, organizational learning, and technical and management skills were identified as antecedents to BI adoption. BI helps address information asymmetry in SCs that results from poor visibility. It also improves coordination among SC partners, resulting in better sustainability.
76	Dubey R.; Bryde D.J.; Foropon C.; Tiwari M.; Dwivedi Y.; Schiffling S.	An investigation of information alignment and collaboration as complements to supply chain agility in humanitarian supply chain	Quantitative	Various countries, humanitarian organizations	613 respondents	With intergroup leadership, BI supports collaborative relationships and SC agility.
77	Bag S.; Luthra S.; Mangla S.K.; Kazancoglu Y.	Leveraging big data analytics capabilities in making reverse logistics decisions and improving remanufacturing performance	Quantitative	South Africa, manufacturing	232 respondents	BI can enhance strategic and tactical reverse logistics decisionmaking and improve remanufacturing performance. Data generation capabilities enhance strategic decision-making, whereas tactical decision-making is enhanced by data integration and management capabilities. Advanced

						analytics capabilities, data visualization capabilities, and data-driven culture positively impacted both strategic and tactical decision-making.
78	Bag S.; Wood L.C.; Xu L.; Dhamija P.; Kayikci Y.	Big data analytics as an operational excellence approach to enhance sustainable supply chain performance	Quantitative	South Africa, mining	520 respondents	The study views BI from two perspectives. BI management capability, i.e., effective management of BI and its implementation as the organizational process by leadership and BI talent capability, the abilities of employees to use BI technology. Results show that BI management capability significantly impacts innovative green product development, supporting sustainable SC performance via innovation and learning capability. In practice, BI offers management a better ability to control the complex processes of developing new products through better forecasting and insight into customer requirements. The results showed a weaker but more positive impact of BI talent capability on employee development, supporting

						sustainable SC performance via innovation and learning capability. However, it was highlighted that BI management capability had a much stronger impact on innovation and learning capability than talent capability.
79	Kerdpitak C.; Somjai S.; Aeknarajindawat N.; Thongrawd C.	Collaborative performance and swift trust in tourism industry of Thailand: Role of big data analytics capability and external supply chain management	Quantitative	Thailand, manufacturing	287 respondents	BI enhances collaborative performance and swift trust in supply chains via information processing capabilities, making data more readily available and shareable. The relationship between BI, ST, and CP is mediated by external supply chain management, referring to SC operations outside the firm.
80	AlNuaimi B.K.; Khan M.; Ajmal M.M.	The role of big data analytics capabilities in greening e-procurement: A higher order PLS-SEM analysis	Quantitative	United Arab Emirates, various industries	216 respondents	Results show that e-procurement has positive effects on BI capabilities. Firms with mature e-procurement functions can gain more from BI as the e-procurement system provides BI with a higher volume and quality of data to generate insights, resulting in better decision-making and organizational performance. Also,

						BI mediates the relationship between e-procurement and environmental performance. BI can provide additional functions missing from traditional e-procurement systems that help monitor and control the environmental impact of procurement decisions.
81	Stekelorum R.; Laguir I.; Lai K.-H.; Gupta S.; Kumar A.	Responsible governance mechanisms and the role of suppliers' ambidexterity and big data predictive analytics capabilities in circular economy practices improvements	Quantitative	France, manufacturing	202 respondents	Supplier's BI capabilities improve the buying firms' circular economy practices. Suppliers can use BI to better meet buyer expectations via better decisionmaking regarding product quality and materials. Thus, the buyer receives better quality products and can better manage the product's lifecycle. The governance mechanism (supplier selection or development) impacts suppliers' supply-chain ambidexterity, affecting the supplier's BI capabilities. Supplier development positively impacted the development of the supplier's BI capabilities via SC ambidexterity, whereas supplier selection had no such effect.

82	Daneshvar Kakhki M.; Nemati H.R.	Value-based view of firms enabled by data analytics: aligning suppliers for customer value creation	Quantitative	USA, various industries	198 respondents	BI has both direct and indirect positive effects on firm performance. It directly improves SC integration, planning/forecasting, and SC reconfiguration by providing insights into new development opportunities. It indirectly improves performance by enhancing strategic supplier partnerships via learning and improved decision-making capabilities. BI also impacts performance indirectly via customer-centric focus orientation, enabling better insight into customer needs and demands, which can then be used to coordinate value creation in SC activities.
83	Jeble S.; Dubey R.; Childe S.J.; Papadopoulos T.; Roubaud D.; Prakash A.	Impact of big data and predictive analytics capability on supply chain sustainability	Quantitative	India, manufacturing	205 respondents	BI positively impacts the environmental, social, and economic performance of supply chains.

84	Wang C.; Zhang Q.; Zhang W.	Corporate social responsibility, Green supply chain management and firm performance: The moderating role of big-data analytics capability	Quantitative	China, manufacturing	260 respondents	BI positively moderates the relationship between external corporate social responsibility and green supply chain management. It enables a better understanding of external stakeholders' needs and helps implement green supply chain practices.
85	Mishra B.P.; Biswal B.B.; Behera A.K.; Das H.C.	Effect of big data analytics on improvement of corporate social/green performance	Quantitative	India, manufacturing	310 respondents	Knowledge-sharing culture and talent capability are important antecedents for BI. BI supports sustainability by reducing information asymmetry and increasing coordination within and with partners.
86	Dubey R.; Gunasekaran A.; Childe S.J.; Blome C.; Papadopoulos T.	Big Data and Predictive Analytics and Manufacturing Performance: Integrating Institutional Theory, Resource-Based View and Big Data Culture	Quantitative	India, manufacturing	195 respondents	Institutional pressures (coercive, normative, mimetic) have a significant positive impact on the selection of tangible and human resources, which then have a significant positive impact on building BDA capability.

87	Bag S.; Gupta S.; Choi T.; Kumar A.	Roles of Innovation Leadership on Using Big Data Analytics to Establish Resilient Healthcare Supply Chains to Combat the COVID-19 Pandemic: A Multimethodological Study	Mixed, quantitative survey and semi-structured qualitative questionnaire and thematic analysis	South Africa, healthcare	190 respondents	BDA enhances healthcare SC responsiveness and innovation. These relationships are significantly moderated by innovation leadership. SC responses and innovation are significant contributors to SC resilience. BI enables better organizational alignment with market needs and requirements by allowing a better understanding of customer requirements via access to larger datasets and trend analysis and accelerating R&D processes by powering new technologies such as 3D printing. Barriers to BI adoption include employee skills in using BI technologies and lack of sufficient IT infrastructure and governance (i.e., cybersecurity protocols).
88	Shokouhyar S.; Seddigh M.R.; Panahifar F.	Impact of big data analytics capabilities on supply chain sustainability: A case study of Iran	Quantitative	Iran, pharmaceutical	188 respondents	BI positively impacts supply chain sustainability by allowing decision-makers access to and combining large amounts of data regarding social, environmental, and

						economic factors. This can guide the development of the supply chain based on clear sustainability objectives. BI contributed to the vision, engagement, and internal dimensions of sustainability. Vision refers to establishing a clear vision and objectives for sustainably developing the supply chain. Engagement refers to working with other supply chain members, including communicating sustainability expectations to them and assessing their sustainability performance. Internal refers to the ability to assign a senior executive or group to lead the sustainable development of the supply chain.
89	Singh S.K.; El-Kassar A.-N.	Role of big data analytics in developing sustainable capabilities	Quantitative	Saudi Arabia, UAE, Egypt, Lebanon	215 respondents	Corporate commitment influences BI assimilation through acceptance and routinization. With acceptance, stakeholders show appreciation for the benefits offered by BI. Routinization includes the governance and integration of BI with organizational processes. BI

						assimilation enhances the firm's sustainable performance.
90	Sheng H.; Feng T.; Chen L.; Chu D.	Responding to market turbulence by big data analytics and mass customization capability	Quantitative	China, various industries	277 respondents	BI enhances the mass customization ability of the supply chain by improving SC agility via technical, managerial, and data-driven decision-making culture dimensions. Of the three dimensions, market turbulence only moderates the relationship between managerial and SC agility. Thus, managerial skills in BDAC will become more important as market turbulence increases.
91	Razaghi S.; Shokouhyar S.	Impacts of big data analytics management capabilities and supply chain integration on global sourcing: a survey on firm performance	Quantitative, multiple case study	Iran, manufacturing	158 respondents	BI has a direct positive effect on global sourcing and indirectly via enhancing integration among SC processes, which enhances global sourcing. BI also improves firm performance by enhancing management's visibility and efficiency in reacting to change.

92	Shamout M.D.	The nexus between supply chain analytics, innovation, and robustness capability: Does firm age matter?	Quantitative	UAE, various industries	213 respondents	BI positively affects SC robustness, mediated by SC innovation capabilities. A positive link between BI and SC innovation was also found. Firm age did not impact any relationships.
93	Jha A.K.; Agi M.A.N.; Ngai E.W.T.	A note on big data analytics capability development in the supply chain	Qualitative	France and India, various industries	14 interviews	Technical capacity, competitive landscape, and intra-firm dynamics significantly affect BI development and use.
94	Mandal S.	Exploring the influence of big data analytics management capabilities on sustainable tourism supply chain performance: the moderating role of technology orientation	Quantitative	India, tourism industry	212 respondents	BI management capabilities, planning, coordination, and control enhance the sustainability of tourism SCs. The effect is enhanced by technology orientation, referring to the ability of firms to embrace and integrate new technologies as part of their operations. The impact of BI investment capability on sustainability was insignificant, showing that mere IT infrastructure investments are not enough to achieve SC sustainability.
95	Bamel N.; Bamel U.	Big data analytics based enablers of supply chain capabilities and firm competitiveness: a fuzzy-TISM approach	Quantitative	Various countries, logistics, and SCM	22 respondents	IT infrastructure, leadership commitment, employee skills, and financial support for BI are enablers for supply chain capabilities.

						Leadership commitment and IT infrastructure were considered as driving variables, i.e., key variables determining employee skills and financial support development.
96	Fernando Y.; Chidambaram R.R.M.; Wahyuni-TD I.S.	The impact of Big Data analytics and data security practices on service supply chain performance	Quantitative	Malaysia, service industry	145 respondents	BI positively impacts service SC innovation capabilities, impacting service SC performance via improved flexibility, responsiveness, reliability, and customer service. In addition, BI had a direct positive impact on the service above SC areas, except for responsiveness.
97	Mandal S.	An examination of the importance of big data analytics in supply chain agility development: A dynamic capability perspective	Quantitative	India, various industries	651 respondents	BI technology management knowledge, BI business knowledge, and BI relational knowledge are key enablers of SC agility. Additionally, BI technology management knowledge is an antecedent of BI technical knowledge and BI business knowledge.
98	Edwin Cheng T.C.; Kamble S.S.; Belhadi A.; Ndubisi N.O.; Lai K.-	Linkages between big data analytics, circular economy, sustainable supply chain flexibility, and sustainable performance in manufacturing firms	Quantitative	India, manufacturing	320 organizations	The relationship between BI and sustainable SC performance is not direct but mediated by circular economy practices and SC flexibility.BI enhances circular

	H.; Kharat M.G.					economy practices, enhancing SC flexibility and improving SC sustainability.
99	Shafiq A.; Ahmed M.U.; Mahmoodi F.	Impact of supply chain analytics and customer pressure for ethical conduct on socially responsible practices and performance: An exploratory study	Quantitative	USA, manufacturing	254 respondents	BI, together with customer pressure for ethical conduct, improves suppliers' financial and social performance. Social practices: By increasing efficiency, BI allows firms to release resources that can be aimed at employee-focused social practices
100	Chae B.K.; Olson D.; Sheu C.	The impact of supply chain analytics on operational performance: A resource-based view	Quantitative	Various countries, manufacturing	537 respondents	SC analytics comprises data management capability, IT-based planning, and performance management resources. Data management capability is a key antecedent for organizational BI capability. It includes the IT infrastructure for data capture, storage, and retrieval. Data management capability and IT-based planning resources are considered technical resources that indirectly impact operational performance by enhancing BI's performance management aspect.

						Performance management enables analytical decision-making regarding SC operations.
101	Tan K.H.; Zhan Y.; Ji G.; Ye F.; Chang C.	Harvesting big data to enhance supply chain innovation capabilities: An analytic infrastructure based on deduction graph	Quantitative, single case study	China, manufacturing		The study presents an analytic infrastructure model. The benefits of the model included the ability to better understand management problems by combining data from multiple sources and providing a visual decision-making path for managers. It also provided an understanding of the competence set(s) required for solving the problem.
102	Gunasekaran A.; Papadopoulos T.; Dubey R.; Wamba S.F.; Childe S.J.; Hazen B.; Akter S.	Big data and predictive analytics for supply chain and organizational performance	Quantitative	India, manufacturing, technology, consulting, e-commerce	205 respondents	Top management commitment is a key enabler for BI assimilation as they are responsible for acquiring and orchestrating required resources for BI assimilation. Specifically, top management manages the bundling of connectivity and information sharing, which act as antecedents of organizational resources for BI assimilation.

						BI assimilation improves organizational performance via efficiencies in SC operations and a better ability to respond to environmental changes.
103	Trkman P.; McCormack K.; De Oliveira M.P.V.; Ladeira M.B.	The impact of business analytics on supply chain performance	Quantitative	Various countries, various industries	310 companies	BI improves SC performance in plan, source, and make functions, with information systems support moderating the effect. Results show a limited impact of BI on the delivery area. Possibly since the delivery function is often outsourced and is the last stage of the decision process. Furthermore, business process orientation had no significant moderating effect on the relationship between BI and SC functions.
104	Chen D.Q.; Preston D.S.; Swink M.	How the use of big data analytics affects value creation in supply chain management	Quantitative	USA.various industries	161 respondents	The study focused on how BI impacts value creation in SCM and what are the antecedents for BI usage. Findings show that the relationship between BI and value creation is directly influenced by technological factors and indirectly by organizational and environmental factors via top

						management support. BI use improves business performance by improving asset productivity. The top management has a key role in steering BI's strategic development within the firm based on their interpretations of business requirements and external changes. The top management's role is to advocate for BI use across various departments and establish clear protocols for BI use.
105	Neaga I.; Liu S.; Xu L.; Chen H.; Hao Y.	Cloud-enabled big data business platform for logistics services: A research and development agenda	Qualitative, theoretical	Logistics providers		BI can help re-design logistics processes by improving data sharing between various stakeholders.
106	Swink M.; Robinson Jr. E.P.	Complexity factors and intuition-based methods for facility network design	Single case study, qualitative	USA, logistics experts, and MBA students		The proposed DSS improved decision quality by providing more detailed information on possible options (incremental improvements). This leads to lower perceived problem complexity and better decision-making.

107	O'Leary D.E.	BUILDING AND EVOLVING DATA WAREHOUSING AND BUSINESS INTELLIGENCE ARTEFACTS: THE CASE OF SYSCO	Single case study, qualitative	USA, food distribution		The paper describes a BI implementation process consisting of 4 phases: "Understand business pains", "Identify candidate analytical measures", "Assess capabilities gap", and "Agree on content."
108	Sangari M.S.; Razmi J.	Business intelligence competence, agile capabilities, and agile performance in the supply chain: An empirical study	Quantitative	Iran, automotive manufacturing	184 respondents	BI competence supports agile SC via alertness capabilities as it provides relevant information and knowledge about the SC and business environment. BI also supports responsiveness by supporting the decision-making process via more data, making decisions more information-driven and thus better.
109	Behl A.; Gaur J.; Pereira V.; Yadav R.; Laker B.	Role of big data analytics capabilities to improve sustainable competitive advantage of MSME service firms during COVID-19 – A multi-theoretical approach	Quantitative	India, service sector	497 respondents	BI improves coordination and swift trust among supply chain members. Improved coordination reduces supply chain risks, which improves sustainable competitive advantage.
110	AL-Khatib A.	The impact of big data analytics capabilities on green supply chain performance: is green supply chain innovation the missing link?	Quantitative	Jordan, manufacturing	303 respondents	BI supports green SC performance directly and indirectly via green innovation (radical and incremental). Insights gained with BI enable environmentally friendly

						manufacturing processes and support the generation of new knowledge, leading to a higher degree of green innovation.
111	Ji G.; Yu M.; Tan K.H.; Kumar A.; Gupta S.	Decision optimization in cooperation innovation: the impact of big data analytics capability and cooperative modes	Quantitative, theoretical			BI supports collaborative innovation.
112	Khanuja, A. and Jain, R.K.	The conceptual framework on integrated flexibility: an evolution to data-driven supply chain management	Qualitative, theoretical			Knowledge management, quality management, and BI influence the relationship between SC performance, flexibility, and integration.
113	Shamout, M.D.	A configural model of analytics capabilities, ambidexterity, co-opetition, and firm performance in the supply chain context	Quantitative	UAE, food manufacturing	151, respondents	BI works in combination with ambidexterity to improve SC performance via exploration and exploitation capabilities.
114	Gorman M.F.; Clarke J.-P.; de Koster R.; Hewitt M.; Roy D.; Zhang M.	Emerging practices and research issues for big data analytics in freight transportation	Qualitative	Theoretical		BI supports operational performance by enhancing decision-making via more accurate data.

115	Hamdani F.-E.; Quintero I.A.Q.; Enjolras M.; Camargo M.; Monticolo D.; Lelong C.	Agile supply chain analytic approach: a case study combining agile and CRISP-DM in an end-to-end supply chain	Qualitative, single case study			BI facilitates a better understanding of problems related to SCM processes.
116	Stahl C.; Stein N.; Flath C.M.	Analytics Applications in Fashion Supply Chain Management - A Review of Literature and Practice	Systematic literature review			Top management support is highly important for BI implementation and usage in the fashion industry SCs. Top management support is needed to ensure adequate resources are reserved for BI and that clear strategic use cases for BI are defined. Also, customer centricity should be a guideline for choosing the correct analytics solution. Thus, clear analytics requirements are needed to choose the correct solution.
117	Rialti R.; Marzi G.; Ciappei C.; Busso D.	Big data and dynamic capabilities: a bibliometric analysis and systematic literature review	Systematic literature review			BI implementation and effects on SC performance were identified as a "cluster" in the research. In implementation, the suitability of BI for managerial decision-making

						depends on the quality of data available, and personnel should be educated about the system's potential benefits and trained to use it. Effects of BI on SC performance include sustainability via reduced waste and increased organizational agility as problems and changes in external conditions can be identified more effectively. BI also supports SC innovation via information sharing and collaboration with partners.
118	Yu, W., Wong, C. Y., Chavez, R., & Jacobs, M. A.	Integrating big data analytics into supply chain finance: The roles of information processing and data-driven culture	Quantitative	China, manufacturing	307 respondents	By improving information processing capability, BI enhances the management of financial information flows within the supply chain.
119	Chae, B. (Kevin), & Olson, D. L.	Business Analytics for Supply Chain: A Dynamic-Capabilities Framework	Qualitative, Theoretical			BI conceptualized as a dynamic capability consisting of data management, analytical supply chain process, and supply chain performance management capabilities.

120	Luay Jum'a, Dominik Zimon, & Madzík, P.	Impact of big data technological and personal capabilities on sustainable performance on Jordanian manufacturing companies: the mediating role of innovation.	Quantitative	Jordan, manufacturing	207 responses	BI capabilities of personel have significant positive effect on SC innovation capabilities.
121	Oliveira, M. P. V. de, McCormack, K., & Trkman, P.	Business analytics in supply chains – The contingent effect of business process maturity.	Quantitative	Various countries, various industries	788 companies	BI can be beneficial for all companies regardless of their maturity level in SCOR processes.However, BI can be more beneficial for firms with more mature SCOR processes.