

# 35 years of research on business intelligence process: a synthesis of a fragmented literature

Business  
intelligence  
process

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## Abstract

**Purpose** – The business intelligence (BI) research witnessed a proliferation of contributions during the past three decades, yet the knowledge about the interdependencies between the BI process and organizational context is scant. This has resulted in a proliferation of fragmented literature duplicating identical endeavors. Although such pluralism expands the understanding of the idiosyncrasies of BI conceptualizations, attributes and characteristics, it cannot cumulate existing contributions to better advance the BI body of knowledge. In response, this study aims to provide an integrative framework that integrates the interrelationships across the BI process and its organizational context and outlines the covered research areas and the underexplored ones.

**Design/methodology/approach** – This paper reviews 120 articles spanning the course of 35 years of research on BI process, antecedents and outcomes published in top tier ABS ranked journals.

**Findings** – Building on a process framework, this review identifies major patterns and contradictions across eight dimensions, namely, environmental antecedents; organizational antecedents; managerial and individual antecedents; BI process; strategic outcomes; firm performance outcomes; decision-making; and organizational intelligence. Finally, the review pinpoints to gaps in linkages across the BI process, its antecedents and outcomes for future researchers to build upon.

**Practical implications** – This review carries some implications for practitioners and particularly the role they ought to play should they seek actionable intelligence as an outcome of the BI process. Across the studies this review examined, managerial reluctance to open their intelligence practices to close examination was omnipresent. Although their apathy is understandable, due to their frustration regarding the lack of measurability of intelligence constructs, managers manifestly share a significant amount of responsibility in turning out explorative and descriptive studies partly due to their defensive managerial participation. Interestingly, managers would rather keep an ineffective BI unit confidential than open it for assessment in fear of competition or bad publicity. Therefore, this review highlights the value open participation of managers in longitudinal studies could bring to the BI research and by extent the new open intelligence culture across their organizations where knowledge is overt, intelligence is participative, not selective and where double loop learning alongside scholars is



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continuous. Their commitment to open participation and longitudinal studies will help generate new research that better integrates the BI process within its context and fosters new measures for intelligence performance.

**Originality/value** – This study provides an integrative framework that integrates the interrelationships across the BI process and its organizational context and outlines the covered research areas and the underexplored ones. By so doing, the developed framework sets the ground for scholars to further develop insights within each dimension and across their interrelationships.

**Keywords** Business intelligence, Literature review, Synthesis, Process, Antecedents, Outcomes

**Paper type** Literature review

## Introduction

The business intelligence (BI) process research has grown exponentially during the past three decades into a fragmented state drawing from a diverse set of studies with widely different contributions (Talaoui and Kohtamäki, 2020). Although this pluralism is necessary for the BI process research to generate momentum from insightful findings, it can yield a disjointed theoretical progress if it lacks proper literature reviews that uncover what is already known and set a direction for the way ahead (Hart, 1998; Rowe, 2014). Unfortunately, extant reviews of the BI process research still focus on the scheme that BI follows to provide actionable intelligence for organizations to act upon (Jourdan *et al.*, 2008) rather than the context where this process occurs and guide organizations (Bingham and Eisenhardt, 2011; Loock and Hinnen, 2015). For instance, the stock of previous reviews on BI research focused on its attributes and conceptualization (Ekbia *et al.*, 2015), its methodologies and research strategies (Jourdan *et al.*, 2008), its application to operations models (Rodén *et al.*, 2017), its contribution to business value (Trieu, 2017) or decision-making (Mora *et al.*, 2005), its dimensions and taxonomy (Holsapple *et al.*, 2014), its usage (Watson and Wixom, 2007), its field development (Arnott and Pervan, 2005, 2014; Toit, 2015), its attitudes (Rouach and Santi, 2001), its characteristics and applications (Chen *et al.*, 2012; Eom and Kim, 2006; Moro *et al.*, 2015), its technologies and challenges (Shim *et al.*, 2002; Sivaraman *et al.*, 2017) and its trends (Watson, 2009).

To this date, no literature review has examined the BI process and its interrelationships with the organizational context. To address this gap, our paper synthesizes the body of knowledge of the BI process to discern patterns of the interrelated relationships of its characteristics, and its context, i.e. antecedents and outcomes (Hutzschenreuter and Kleindienst, 2006; Rajagopalan *et al.*, 1993; Van De Ven, 1992). We follow other scholars' conceptualization of BI process as an integrative sequence that encompasses the collection, transformation and usage (Chen *et al.*, 2012; Davenport and Paul Barth, 2012; Trieu, 2017) that occurs in an organizational context, exerts an influence upon it and is shaped by its antecedents (Bingham and Eisenhardt, 2011; Loock and Hinnen, 2015).

To capture the BI process within its context, we follow the process framework of Hutzschenreuter and Kleindienst (2006), Rajagopalan *et al.* (1993) and Van De Ven (1992) for it allows to position the BI process within its organizational context and explore their interrelated linkages. In this vein, we purposefully follow Levy and Ellis (2006) and Webster and Watson (2002)'s "effective methodology" of conducting systematic reviews in cross-disciplinary research such as the BI process body of knowledge and adheres to its processual scheme to select 120 articles published in top tier ABS ranked journals that we synthesize and integrate drawing from the process view framework that emphasizes the role of organizational context (Hutzschenreuter and Kleindienst, 2006; Rajagopalan *et al.*, 1993; Fischer *et al.*, 2016; Vaara and Lamberg, 2014). By so doing, we seek to synthesize the

contributions of prior studies on the BI process and its organizational context and pinpoint to gaps in linkages across the BI process, its antecedents and outcomes for future researchers to build upon. The paper begins with a detailed explanation of our systematic method, then presents our synthetic review and concludes with research gaps for further studies.

### Methodology

We follow the systematic review scheme of [Levy and Ellis \(2006\)](#) to offer the BI research in particular and IS field what [Webster and Watson \(2002, p. 14\)](#) refer to as “effective methodological review”. According to [Levy and Ellis \(2006\)](#), an effective review should justify its contribution to a body of knowledge being reviewed, synthesize quality research and present a sound research framework and systematic papers’ selection method. Our choice of [Levy and Ellis \(2006\)](#)’s systematic review scheme is twofold:

- It addresses the peculiar and cross-disciplinary nature of the IS research in general and the BI body of knowledge in particular.
- It follows a process protocol of literature reviews that fits our process perspective of integrating the BI body of knowledge.

Following [Levy and Ellis \(2006\)](#), a high-quality input yields a high-quality output if it adheres to comprehensiveness, quality and relevance inclusion criteria. To ensure comprehensiveness, we go beyond the IT contributions on BI and extend our search scope beyond one database to capture all fruitful work regardless of its inherent discipline ([Levy and Ellis, 2006](#)). We, therefore, use four scientific databases, reputable among scholars of management, marketing and information management fields, namely, ABI/Inform, EBSCO academic search elite, EBSCO business premier, Emerald journals ([Levy and Ellis, 2006](#); [Webster and Watson, 2002](#)). We conducted a pilot search of keywords in the aforementioned databases with two keywords, namely, BI and competitive intelligence. The intention of this trial was to gather all keywords related to both concepts. In total, 26 keywords were deemed appropriate for this review. Boolean operators (“AND” and “OR”) and the asterisk “\*” wildcard were used to concatenate the keywords set to generate multiple query strings that returned 11,745 hits across the four databases from 1985 through 2020 as [Table 1](#) depicts. We selected 1990 as a starting year of our search as it represents the inception of BI ([Chen et al., 2012](#); [Davenport et al., 2001](#)). A first scrutiny of the hits sought the elimination of duplicates shrinking the set of papers to 780 including conference papers, which we excluded because their research rigor is inferior to top journals and are not subjected to a rigorous peer review process ([Culnan, 1978](#); [Levy and Ellis, 2006](#); [Webster and Watson, 2002](#)). Besides, the high quality input criterion [Levy and Ellis \(2006\)](#) and [Webster and Watson \(2002\)](#) impose limits our sample to articles published in high quality peer reviewed journals of a reputable ranking because they are likely to contain the major contributions we ought to deal with to ensure rigor and leading theoretical discussions on BI ([Levy and Ellis, 2006](#); [Vogel, 2012](#); [Webster and Watson, 2002](#)). Therefore, we chose the ABS journal ranking because it offers an extensive cross-disciplinary list that is corroborated by a documented hybrid and iterative ranking process based upon peer reviews, peers’ consensus and citations ([Mingers and Willcocks, 2017](#); [Morris et al., 2009](#)), which, in turn, offers us a credible guide that we can gauge papers against with confidence ([Levy and Ellis, 2006](#); [Morris et al., 2009](#); [Webster and Watson, 2002](#)). This high-quality criterion reduced our sample to 290 articles whose abstracts we read and evaluated against our relevance criterion that, based on the research gap and motivation, deems only articles addressing BI process, antecedents or outcomes relevant to the review at hand. This step reduced the sample to 113

**Table 1.**  
Systematic selection  
process of the articles

	Search strings
	TITLE-ABS-KEY ("business intelligence" OR "business intelligence model*" OR "competitive intelligence" OR "market intelligence" OR "executive information system*" OR "decision support system*" OR "business analytic*" OR "data mining" OR "data*warehous*" OR "online*analytic*processing" OR "extract*transform*load" OR "environment* scanning" OR "customer intelligence" OR "environment* analy*:*" OR "finance* intelligence" OR "structured query language" OR "relational database management system*" OR "data mart" OR "data discovery" OR "dashboard" OR "process mining" OR "complex event processing" OR "prescriptive analytics" OR "predictive analytic*" OR "big data" OR "big data analytic*")
	ABI/INFORM 9,927
	EBSCO ACADEMIC SEARCH ELITE 270
	EBSCO BUSINESS PREMIER 1,192
	EMERALD JOURNALS 356
	Total hits 11,745
	Minus duplicates 780
	ABS top tier journals 290
	Articles addressing BI process, antecedents or outcomes 113
	Backward referencing plus 7
	Final sample 120

articles that contain one or several linkages to the BI process, antecedents or outcomes. To verify the comprehensiveness of our sample and prevent the exclusion of any older and relevant contribution, we conducted a backward search that consists of reviewing the reference lists in our final set of papers to identify any work that our time frame criterion might have excluded and/or that our databases search might not have revealed (Bandara *et al.*, 2015; Levy and Ellis, 2006; Müller and Jensen, 2017; Thennakoon *et al.*, 2018; Webster and Watson, 2002). Our backward search analyzed each title in the reference lists of the 113 articles and identified 7 seminal works published prior to 1990 such as El Sawy (1985) and Ghoshal and Kim (1986), which, in turn, extended our final sample to 120 articles. We gauged the census of this review complete when no new concepts or relationships were identified in the literature set (Levy and Ellis, 2006; Webster and Watson, 2002).

### A synthetic framework of the business intelligence process

According to Levy and Ellis (2006) and Webster and Watson (2002), a good literature review offers a complete census of its synthesis and follows an analytical framework to structure the body of knowledge it deals with. As a corollary, we followed the process linkage exploring framework of Hutzschenreuter and Kleindienst (2006) and Rajagopalan *et al.* (1993) because it emphasizes the role of organizational context (Vaara and Lamberg, 2014) and the mediating mechanisms that reveal the causality between antecedents and outcomes (Fischer *et al.*, 2016). We coded all articles using a two-digit key (01–120) that we plotted in Table 2 to provide summaries of the studies. Our thorough review of the 120 articles revealed shared patterns along which three streams were discernable, namely, antecedents, BI process and outcomes. In addition, our analysis revealed that each article focused on different interrelationships across the organizational context of the BI process. For the sake of comprehensiveness and in-depth analysis, we marked each article with a linkage code composed of a letter designating the contextual domain [(1) antecedents; (2) BI process; and (3) outcome] and a number that refers to the factor responsible of the relationship between contextual domains:

No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
1	Calof and Wright (2008)	Marketing International business	–	Bibliometric assessment	B-I-B-I	Intelligence collection draws from the environmental scanning and strategic management fields
2	Wright and Calof (2006)	Marketing International business	Canada: technology UK: manufacturing Europe: industrial chemical	Existing studies comparison	B-I-B-I	Three studies measured intelligence collection activity with different measures and different foci, different sample frames and different questions, yet they all attempted to measure the same thing. The result is a set of differences and similarities difficult to generalize
3	Zajac and Bazerman (1991)	Management Organization Strategy	–	Previous empirical findings	B-I-C-III	New business entry failures and acquisition premiums are often the result of biases or blind spots in BI acquisition
4	Ramakrishnan <i>et al.</i> (2012)	Business Information systems	Large firms US BI professionals	Survey	A-I-B-II A-II-B-II	Institutional pressures lead organizations to implement BI analytics for consistency. Organizational transformation requires BI analytics to adopt a comprehensive data collection strategy
5	Singh <i>et al.</i> (2002)	Management Decision support Information systems Management Marketing	North America	Questionnaires	B-III-C-I	BI fulfillment supports operational objectives and the strategy implementation phase
6	Trim and Lee (2008)	Management Organization Strategy	–	Literature review	B-I-C-IV C-IV-C-II	Intelligence acquisition ought to be incorporated into the strategic intelligence effort through a resilience framework
7	Daft <i>et al.</i> (1988)	Management Organization Strategy	50 US manufacturers	50 personal interviews with executives	A-I-B-I C-I-B-I	Executives increase the frequency and scope of scanning in an environment with high uncertainty. CEOs in high performing firms scan more frequently and more broadly than low performing ones
8	Babbar and Rai (1993)	Management	–	–	A-I-B-I A-II-B-I B-I-B-I	New contextual approach: environment: heterogeneous/organizational: prospector. New scanning characteristics: purpose/intent: strategic/orientation: proactive

(continued)

**Table 2.**  
Linkage-exploring  
review matrix

Table 2.

No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
9	Liu and Wang (2008)	Management	Commercial bank	Literature review	B-I-B-I	A mathematical model, for services business, that uses modules for forecasting performance ratios. Its accuracy depends on the quality of collected data
10	Ghosal and Westney (1991)	Management strategy	Three MNC's: general motors/Eastman Kodak/British Petroleum	40-70 semi-structured interviews	B-I-B-I B-I-C-III	A significant gap between information needed and collected. Intelligence collection can benefit the organization in decision-making, sensitization, legitimization and inspiration
11	Gilad and Gilad (1986)	Management	-	-	B-II-B-II	Formal BI support unit at the corporate level- rather than the centralized or the decentralized one- to support BI function at the BU level
12	Bernhardt, 1994	Management	Europe/USA: pharmaceuticals/cleaning	Case examples	B-I-B-I	The collection phase is the first phase of the BI process that feeds planning and direction
13	Ghoshal and Kim (1986)	Management strategy	South Korea A trading company	Case study Survey	B-II-B-II	A formal unit does not guarantee the effectiveness of the business BI system. BI should be a comprehensive system for usable intelligence during decision-making
14	Prescott and Smith (1987)	Business strategy	Sheller-Globe, INC	Field research involving	B-I-B-I	Comprehensive intelligence collection approach is valuable for broad strategic decisions only. A project-based intelligence acquisition is tailored to a specific project, which increases its potential for usable intelligence
15	Abramson <i>et al.</i> (2005)	Business management	Academia	Experiments with MBA's.	B-III-C-II	Access to actionable intelligence disseminated affects primarily prices and profits
16	Fleischer (2008)	Business marketing	-	Literature-based	B-I-B-I	Open sources provide important data but challenges analysts with indexing, internet volatility, languages, sources, volume, Web 2.0 developments
17	McCrohan (1998)	Business marketing	-	-	B-I-C-IV	The integration of intelligence collected and security, deception and psychological operations, permit firms to create an operation gap called commercial information operations (IO) between the firm and its competitor

(continued)

No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
18	Wright <i>et al.</i> (2009)	Business marketing	UK banks	Interviews with 23 executives	B-I-B-I B-I-C-I	UK banks describe intelligence collection as the understanding of the competitive environment and differed in their gathering and the evaluation of intelligence collection No formal intelligence collection unit in the majority of companies. Intelligence collection was valued most by executives reporting activity. Most believed intelligence to support decision-making. CEOs reporting intelligence activity claimed its usefulness in developing and implementing strategies The integration of decision support and knowledge management for business intelligence generation
19	Vedder <i>et al.</i> (1999)	Information systems computing	petrochemical transportation, retail, insurance	Survey	B-I-B-I B-I-C-I B-I-C-III	The greater the BI system maturity, the more positive the impact on information content quality. The greater the BI System maturity, the more positive the impact on information access quality Disparity between intelligence needs and the one reported. Collection involved Internal and external sources
20	Cheng <i>et al.</i> (2009)	Information management Management Business	Cement and electronics	Archival data	B-II-B-II	The web-based data mining provides speed of insight generation, the business models assist the knowledge worker with the structure and focus for sense making Sensing the periphery involves: knowing earlier, managing by wire, dispatching capabilities from the event back
21	Popovic <i>et al.</i> (2012)	Decision support Business	Slovenia, various industries	Survey	A-II-B-II B-II-C-IV C-IV-C-III	Two paths for firms for BI analytics: specialized (firms use BI at the BU level to improve operations) or collaborative (firms use BA broadly to bring the whole organization at the same level of BI sophistication). BI analytics as a decisional paradigm depends on the firm awareness and commitment, and its analytics culture
22	Dishman and Calof (2008)	Management marketing	Canada. Tech-related industries	Survey	B-I-B-I	
23	Heimrichs and Lin (2003)	Information science Business decision support Management	Academia	Survey	B-II-C-III	
24	Haeckel (2004)	Management	-	-	B-I-B-I	
25	Holsapple <i>et al.</i> (2014)	Business Decision support	-	Published views of scholars	A-II-B-III B-III-B-III B-III-C-II	

(continued)

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No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
26	<a href="#">Peyrot et al. (2002)</a>	Business	Maryland and Pennsylvania Industrial wholesalers	Survey	A-I-C-IV A-II-C-IV A-III-C-IV B-I-C-II	The perceived competitiveness of the environment was positively related to intelligence use. A curvilinear relationship between organizational size and intelligence use. Managerial perceptions of intelligence is positively associated with greater intelligence use. Greater effort devoted to obtaining intelligence is associated with greater intelligence use. Intelligence was used mainly for tactical ends
27	<a href="#">Sawyer (1993)</a>	Management Strategy	Nigerian SME manufacturing	Questionnaires to 47 executives	A-I-B-I	The perceived environment uncertainty (PEU) of the task environment is greater than the PEU of the remote environment. The higher PEU, the higher the level of interest in both the remote and task environment sectors. The PEU for both sectors was not a predictor of the frequency of use of internal and personal sources of information
28	<a href="#">Mariadoss et al. (2014)</a>	Management Marketing International business	US-based medical devices company	Online survey	A-III-C-II B-I-C-II	Salesperson product knowledge has a positive impact on salesperson B-IV-gence behaviors. The effect of salesperson product knowledge on salesperson performance is mediated by SCIB, such that the indirect relationship between product knowledge and performance is positive
29	<a href="#">Taylor (1992)</a>	Business	Fortune 1,000 and 500	Mail survey	B-I-B-I	Increased recognition of intelligence importance and lack of know-how of US intelligence users compared to European and Japanese ones
30	<a href="#">Michaeli and Simon (2008)</a>	Marketing Mathematics	Tyrell, Inc vs Alpha, Inc	Case study	B-I-B-I	The use of Bayes' theorem to calculate conditional probability, determines when more information collection is needed and evaluate the validity of warnings
31	<a href="#">Chung et al. (2005)</a>	Information systems Computing	Major search engines	Meta Search	B-II-B-II	BI explorer (BIE) diminishes information overload through its genetic algorithm to cluster websites and its multidimensional scaling algorithm for graphical display of websites

*(continued)*



No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
32	<a href="#">Lenz and Engledow (1986b)</a>	Management Strategy	-	-	B-I-B-I	A better assessment of the environment would involve the use of a broader set of models appropriate for the environment layer. For general environment (industrial and organizational). For task environment (ecological and era model)
33	<a href="#">Fleischer et al. (2008)</a>	Business Marketing	EAG medium-sized, not-for-profit association	Longitudinal case study	B-I-C-I	The integration of intelligence collection with CRM, DM, MR and the use of a cross-functional team enabled a not-for profit firm to improve its marketing strategies
34	<a href="#">Hughes et al. (2013)</a>	Marketing	B2B logistics	customer and salesperson survey	A-III-B-I B-I-C-II	The greater the salesperson's customer orientation, the greater the amount of intelligence shared by the customer with the salesperson. The greater the information use, the greater the customer perceived value, the greater the share-of-wallet (quantity of sales)
35	<a href="#">Li et al. (2008)</a>	Information management	Taiwan, a major ISP	Questionnaire	B-II-C-II	Decision support with BI technologies help companies identify the degree of usage, time of usage and day of usage of all customers' clusters
36	<a href="#">Zheng et al. (2012)</a>	Business Management	online retail	Academic data	B-I-B-I	LIND model, which uses site centric data performed and the full NBD/Dirichlet model for inferring key competitive measures, with far less data
37	<a href="#">Elofson and Konsynski (1991)</a>	Information systems Computing	Poland	Archival case study	B-I-B-I	The knowledge cash approach guarantees the continuity of the distributed problem-solving process, in the absence of the area specialist
38	<a href="#">March and Hevner (2007)</a>	Decision support Business	-	-	B-II-B-II	The challenges of data warehouses are: the nature of data (structure vs unstructured), data quality and ad hoc queries
39	<a href="#">Chau et al. (2007)</a>	Information management Management	Diversified firms	Evaluation study	B-II-B-II	Redips is effective and precise in extracting in backlink search, content analysis, results visualization

(continued)

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No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
40	Tanev and Bailetti (2008)	Information systems Computing	Quebec small firms	Questionnaire	B-I-C-II	A clear relationship between the collected intelligence firms used and their innovation performance
41	El sawy (1985)	Management Strategy	Silicon Valley SME High Tech	Interviews with 37 CEOs	A-III-B-I	CEOs scan systematically, their information sources (personal and external). CEOs do not delegate their scanning. Their information system is very personal and decoupled from the organizational information system
42	Gilad <i>et al.</i> (1993)	Business Management	Diversified firms	Case studies	B-I-B-I	The evaluation of intelligence collection identifies competitive blind spots
43	Qiu (2008)	Marketing	SCIPs and the American Marketing Association	Online survey	A-III-B-I A-II-B-I	Managers' entrepreneurial attitude orientation has a positive relationship with their frequency and scope of intelligence scanning. Market orientation has a positive relationship with the scope and frequency of managerial scanning for competitive intelligence
44	Chaudhuri <i>et al.</i> (2011)	Information systems Computing	-	-	B-II-B-II	Data warehouse is challenged with the storing and extraction of unstructured data. The OLAP is challenged by multidimensional reporting. The RDBMS is challenged with the increase amount of data. ETL techs are challenged with real time decision-making
45	Ahearne <i>et al.</i> (2013)	Marketing	Fortune 500 media firm	Interviews	A-II-C-IV A-III-C-IV C-IV-C-II	A positive relationship between salesperson intelligence quality and salesperson performance. A positive relationship between district intelligence quality and salesperson performance. District managers' peer-network centrality buffers the negative cross-level moderating effect of district intelligence quality diversity
46	Gordon and Loeb (2001)	Information management	-	-	B-I-C-IV	Intelligence collection defense plan has two parts, the intelligence database with highly confidential information, and another destined for public

*(continued)*

No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
47	Maltz and Kohli (1996)	Marketing	High Tech	Survey	A-I-B-I A-II-B-I A-III-B-I B-I-C-IV	The greater the organizational commitment of a receiver, the greater the dissemination frequency. The greater the inter-functional distance, the lower the dissemination frequency and the greater the dissemination formality. The greater the market dynamism, the greater the dissemination frequency. The greater the dissemination formality the greater the intelligence use by a receiver The task of information gathering is performed at two levels: regional where special unit collects information related to the economic and political climate/ national; subsidiaries where marketing/product managers collect data BI 1.0 and BI 2.0 provided organizations with insights from structured and unstructured data. While these maturing technologies have their challenges, new ones also prevail with the emerging of BI 3.0 The prototype BI 2.0 system for Web 2.0 intelligence proved helpful in assisting decision-makers with adaptive recommendations related to changing business context of mergers and acquisitions The BI prototype built in house, for sales associations discovery outperformed the commercial BI system WEKA. It provided benefits for both the operational and management level General environment changes may be less salient than task environment changes. Size does not differentially affect scanning frequency for organizations with effective systems vs those with ineffective systems. Organizations with effective scanning systems, operating in inflexible technologies, use a wider scope of scanning
48	Lasserre (1993)	Management Strategy	Asia pacific	Survey	B-I-B-I	
49	Chen <i>et al.</i> (2012)	Management Information systems	-	Bibliometric study	B-II-B-II	
50	Lau <i>et al.</i> (2012)	Information systems Computing	China, Forbes 2000 list	Evaluation experiments	B-II-C-III	
51	Cheung and Li (2012)	Knowledge management Information systems	Angus Electronics	Case study	B-II-C-II	
52	Yasai-Ardekani and Nystrom (1996)	Business Management	North American firms listed in the planning forum membership directory	Questionnaires	A-I-B-I A-II-B-I	

(continued)

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No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
53	Moro <i>et al.</i> (2015)	Business Information systems Information science Decision support	–	Literature review	B-II–C-III	BI in banking is used mainly for risk prediction to better support decision-making.
54	Chen <i>et al.</i> (2002)	Information science Decision support	–	Experiment comparison	B-I–B-I	Intelligence spiders diminishes information overload by indexing and analyzing the documents collected from websites that match the interest of the user. Intelligence spiders outperformed Lycos and within-site browsing, in precision, recall and ease of use
55	Lim <i>et al.</i> (1996)	Business Marketing	Ohio Diversified industries	Survey	B-I–C-I	Competitive environmental scanning is an important factor for determining a firm's position at various stages of the internationalization process
56	Peyrot <i>et al.</i> (1996)	Business Marketing	USA Industrial Wholesalers	Survey	B-I–B-I	Field employees were the primary sources of information about customers, suppliers and competitors
57	Kohavi <i>et al.</i> (2002)	Information systems Computing	–	–	B-II–B-II	The business value is the driving force for ongoing improvement of technologies challenges. BI technologies must reduce cycle time from data collection, analyzes, to impartment
58	Lenz and Engledow (1986a)	Management Strategy	USA, Canada Diversified industries	Interviews	B-I–C-II	It is still time for experimentation before the viability of specialized scanning units for introducing environmental information into strategic decision processes can be confirmed
59	May <i>et al.</i> (2000)	Management	Russia	Surveys with 96 executives	A-I–B-I	A mixed pattern of task and general environment sector effects. Russian executives PEU is related to unfamiliar sectors. Source accessibility and sector importance influence the frequency of the scanning of both internal and external sources
60	Wei and Lee (2004)	Information science Decision support	–	Empirical evaluation	B-I–B-I	The NEED technique performs event detection based on event properties extracted from news stories rather than features appearing in news stories, which hinders events categorization

(continued)

No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
61	Jennings and Lumpkin (1992)	Management	The Texas savings and loan (S&L)	Questionnaires and phone interviews	C-I-B-I	Organizations with a differentiation strategy tend to scan for opportunities for growth and customer needs, and organizations with a cost leadership strategy tend to scan for threats and monitor competitors and regulators
62	Leidner <i>et al.</i> (1999)	Management Information systems	Sweden/Mexico Diversified industries	Survey	A-I-B-III B-III-C-III B-III-C-IV	When fulfilled BI is used by CEOs to reinforce the decision-making behaviors valued in their culture. Swedish managers reported enhanced mental models from frequent and long-term use of BI
63	Xu <i>et al.</i> (2011)	Information science Decision support	-	Evaluation experiment	B-I-B-I	The two-level CRF provided better extraction of comparative relations by using the complicated dependencies between relations, entities and words, and the unfixed interdependencies among relations
64	Pawar and Sharda (1997)	Information management Management	-	-	B-I-B-I	A generic guiding framework for online information retrieval: signals are collected through undirected and conditioned viewing and facts are gathered via informal and formal search
65	Christen <i>et al.</i> (2009)	Management Marketing	-	-	A-III-B-I A-II-B-I	It is the limited managerial capacity to analyze data and integrate insights into a decision that leads to imperfect information. The trade-off between a focused and a broad intelligence collection strategy depends to a large extent on the firm's data processing capacity
66	Sheng <i>et al.</i> (2005)	Information systems Computing	-	-	B-I-C-IV	The firm gathered intelligence defensive use would be oriented toward a routine analysis of the system logs activities, elimination of unnecessary conveniences on the firm's URIs, shrink the online information lifetime, make competitors' IAs work longer; Put false information in a firm's own databases; Publish more soft and less hard data; Backup data more frequently

(continued)

Table 2.

Table 2.

No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
67	Brownlie (1994)	Marketing	–	–	B-I-B-I	Environmental scanning should have a broader role where it actively participates in the environment, rather than merely collect data about it in a passive fashion The PSU of the task environment is greater than the remote environment. Executives are pragmatic and focus on the factors important to daily operations
68	Ebrahimi (2000)	Management	Hong Kong, service/manufacturing	A survey to 55 executives	A-I-B-I	Meeting enterprises requirements' (MER) is the most concerned criteria that senior experts evaluate in the BI system, followed by 'meeting user's needs' (MUN) After the environmental shift the majority of TMT widened their focus and heightened the depth of environmental scanning. The more the TMT experienced turnover, the more the changes in its environmental scanning. The heterogeneity has a moderating role on TMT turnover and scanning. The output orientation had a positive effect on environmental scanning frequency and scope
69	Lin <i>et al.</i> (2009)	Industrial engineering Management International Business	–	Case study	B-II-B-II	
70	Cho (2006)		30 airline companies	Archival sources	A-III-B-I	
71	Elenkov (1997)	Management Strategy	Bulgaria/single business manufacturing/sales	141 interviews with executives	A-I-B-I	The strength of the relationship between perceptions of strategic uncertainty and environmental scanning behaviors depends on the combined effect of the environmental constraints and decision-making approach Scanning activities encompassed the societal level, the firm level, the functional level, the people level. No scanning involved consumers Desire for upward mobility, the effective role of recognition and motivation positively influence salespeople's willingness to share marketing intelligence from the field
72	Fabbe-Costes <i>et al.</i> (2014)	Operations Management Management	France	Interviews and focus group	B-I-B-I	
73	Le Bon and Merunka (2006)	Management Marketing	Consumer goods, industrial and services	Questionnaires	A-II-B-I A-III-B-I	

(continued)

No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
74	Viaene and Bunder (2011)	Management	Diversified industries	Interviews and questionnaire	B-II-B-II	BI project managers tackle their assigned projects in a sequential order encompassing room for change and trial and error, continuous learning and partnerships The path from the use of business analytics to organizational performance is complex. It involves three phases, namely, data to insight, insight to decision and decision to value The mining of the web for actionable knowledge involves BI technologies for web-based content acquisition (information retrieval and information extraction) and knowledge creation (discovered knowledge filtering and the retaining of the actionable one)
75	Sharma <i>et al.</i> (2014)	Business Information systems	–	Literature review	B-II-C-II	Organizations should be ambidextrous in intelligence collection, capable of building two cultures, namely, one for sensing the periphery and one core business-oriented
76	Srivastava and Coole, (2003)	Computer science Engineering	–	Case study	B-II-B-II	Operational efficiency (internal environment) and market (external environment) were crucial for all executives in the study. Intelligence collection should provide a comprehensive view of the internal and external environment, not only focus on the external environment
77	Brown (2004)	Computer science Management	–	–	B-I-B-I	The more frequent and longer BI support use, the faster the problem identification speed, the decision-making speed and the extent of analysis
78	Walters <i>et al.</i> (2003)	Management Marketing Information systems	USA Manufacturing	Questionnaires	A-I-B-I	BI support improves information flow down to subordinates and up to executives. BI support be implemented for all business users, with a customized interface and system capabilities to support the executives' specific needs
79	Leidner and Elam (1993)	Information systems Business	USA Diversified industries	Survey	B-III-C-III	
80	Volonino <i>et al.</i> (1995)	Information systems Management	–	–	B-III-B-III	

(continued)

Table 2.

Table 2.

No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
81	Ahituva <i>et al.</i> (1998)	Information systems Management	Israel Diversified industries	Interviews with 40 CEOs	C-II-B-I	Firms succeeding better with new products will show a greater correlation between strategic uncertainty and frequency of scanning of the technological, economic and socio-cultural sectors. Successful firms will exhibit more frequent formal scanning in the task environment than do less successful firms
82	Belcher and Watson (1993)	Information systems Management	USA Conoco	Statistical analysis and interviews	B-III-B-III B-III-C-II B-III-C-III B-III-B-III	There is no single way to evaluate BI support system. BI support improved productivity, and its benefits were found to exceed the system's costs
83	Watson <i>et al.</i> (1991)	Information systems Management	USA Diversified industries	Questionnaire	B-III-B-III	BI support is executive-oriented, developed with a minor cost benefit analysis in an iterative process
84	Jones and Mcleod (1986)	Business Decision support	USA Diversified industries	Interview and questionnaire	A-III-B-I	When engaged in improvement projects, the executives preferred inputs from internal sources and verbal messages. When allocating resources, the executives preferred to use internal information regardless of the form
85	Elbashir <i>et al.</i> (2011)	Business Accounting	Australia 612 clients of BI software vendor	Survey	A-II-B-III A-III-B-III	The increased levels of operational-level absorptive capacity enhance the levels of BI assimilation. The increased levels of TMT absorptive capacity enhance the operational-level absorptive capacity. The increased levels of TMT's absorptive capacity enhance the organizations' BI assimilation
86	Slater and Narver (2000)	Business Marketing	Electronics	Questionnaires/ literature review/ interviews	B-I-C-II	The market focused intelligence generation is positively related to superior sales growth. Intelligence Generated from repetitive experience was positively related to customer satisfaction. Intelligence generated through collaboration was positively related to superior quality. Intelligence generated through experimentation was positively related to new product development success

(continued)



No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
87	Boyd and Fulk (1996)	Management	USA: diversified industries	Survey	A-I-B-I	Strategic importance was the primary determinant of scanning. Scanning declined as the environment was perceived to be more complex. Perceived variability interacted with importance to positively affect scanning. The more frequent and the longer the manager's use of BI support, the faster the speed of problem identification, the greater the enhancement to his/her mental model the greater the extent of analysis and the speed of the decision-making process. The more frequent the manager's use of BI support, the greater the perceived information availability. The BI analytics capability model enhances firm performance. Analytics capability-business strategy alignment has a significant moderating impact on the BI analytics-firm performance
88	Leidner and Elam (1995)	Information systems Business	USA: companies developing EIS	Survey 26 phone interviews six on-site interviews	B-III-C-III B-III-C-IV	
89	Akter <i>et al.</i> (2016)	Management Business Operations management	US: business analytics	Two Delphi studies with 61 analytics practitioners, consultants and academics	B-III-C-II	
90	Arnott <i>et al.</i> (2017)	Information technology Business	Australia: Government Insurance China: Insurance and online retailer	Secondary case analysis of 8 BI systems 142 Semi-structured interviewed across 4 company cases	B-III-C-II	Enterprise BI systems are effective support for Type 2 decisions (operational and management control)
91	Audzeyeva and Hudson (2016)	Information systems Business	UK: retail bank	Semi-structured interviews	B-III-C-I A-II-B-III	An organization's ability to extract strategic BI benefits is influenced by its deep structure (core beliefs, organizational structures, control systems and distribution of power)
92	Aversa <i>et al.</i> (2018)	Information systems Business	UAE: formula 1	Semi-structured interviews 52 media documents	A-III-B-III B-III-C-I	Three interrelated sources of strategic failure for decision-makers using BI support, namely, the situated nature and affordances of decision-making; the distributed nature of cognition in decision-making; and the performativity of the BI support

(continued)

Table 2.

Table 2.

No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
93	<a href="#">Bordeleau et al. (2020)</a>	Information systems Operations management	Canada: Telecommunications, Electronic components	Multiple case study Interviews four cases	A-II-B-III B-III-C-II	Enterprises resources and BI capabilities are not sufficient to predict business value. They need to be combined with organizational learning and ambidextrous organizational culture
94	<a href="#">Brichni et al. (2017)</a>	Software engineering Design science	France: STMicroelectronics	Interview/ questionnaire BI/Business experts and users	B-III-B-III	BI4BI system is based on BI systems' data and BI users' feedbacks. This system provides better BI evaluation criteria, level of automation and continuous processing by relying on two complementary solutions (a system-based solution and a user-based solution)
95	<a href="#">Chen et al. (2015)</a>	Information systems Operations management	US; product-centric firms	Survey of 161 managers	B-III-C-I A-I-B-III	Organizational-level BI analytics usage affects organizational value creation. Environmental dynamism moderates the BDA usage influence on value creation. Technological factors directly influence organizational BDA usage while organizational and environmental factors indirectly influence it
96	<a href="#">Constantinou et al. (2019)</a>	Decision support Information systems	Northern Europe: large bank	43 semi-structured interviews IT and business units	B-III-C-III A-III-B-III	Decision-makers use four techniques to communicate and share intuitive judgments during organizational decision-making that build on the BI output. Senior managers are prone to use intuitive judgments when these are at odds with quantitative information from the BI system
97	<a href="#">Córte-Real et al. (2017)</a>	Business Strategy	Europe: 500 firms Dun and Bradstreet database	Survey, 175 IT/ business executives	B-III-C-IV	BI analytics applications can allow an effective internal and external knowledge management, which can help firms to create organizational agility. BI analytics can support organizational knowledge management, allowing the creation/enhancement of dynamic capabilities

*(continued)*

No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
98	Córté-Real <i>et al.</i> (2019)	Business Strategy	Europe: Industry, Academic, Consultant software vendor	Delphi study, semi-structured interviews, 22 participants, 175 respondents	A-I-B-III A-II-B-III B-III-C-I	Dynamic capabilities and strategic business/IT alignment positively contribute to the BI analytics value. The strategic role of BI analytics has no significant influence on the BI analytics sustained value. Environmental volatility negatively influences BI analytics value creation. BI analytics can create significant value in business processes if supported by a good level of data quality.
99	Córté-Real <i>et al.</i> (2020)	Business Strategy	US and Europe: manufacturing, retail trade	Survey of 618 firms	B-III-C-II	Business value is generated from BI assets via two parallel mechanisms, operational and strategic. Organizations may become ambidextrous in their BI capabilities in the same way they can become ambidextrous in their approach to organizational learning.
100	Fink <i>et al.</i> (2017)	Industrial engineering Management	Israel: manufacturing, services	Interviews three cases	B-III-C-II B-III-C-IV	Business value is generated from BI assets via two parallel mechanisms, operational and strategic. Organizations may become ambidextrous in their BI capabilities in the same way they can become ambidextrous in their approach to organizational learning.
101	Ghasemaghaei and Calic (2020)	Business	US: services, utilities, financial	Survey of 239 managers	B-III-C-II	Data variety and velocity positively enhance firm innovation performance, and finds no impact of data volume on firm performance.
102	Grover <i>et al.</i> (2018)	Information systems Management	Ebay, CancerLinQ, Walmart, DeutscheBank, UPS	Application to use cases	A-II-B-III B-III-C-II	Increasing BI analytics infrastructure investments in the quality and quantity of data and analytical skills enhances BI capabilities, which, in turn, enables organizations to determine value targets mediated by value creation mechanisms. Contextual factors moderates the relationships between BI capabilities, value targets and mechanisms.
103	Gupta and George (2016)	Information systems Operations management	Computers, financial services, internet, communications	Survey of 232 big data Analytics managers and 108 CIOs	B-III-C-II	BI analytics capability that is measured and tested to showcase a linkage to superior firm performance.

(continued)

Table 2.

Table 2.

No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
104	Hallin <i>et al.</i> (2017)	Industrial economics Management Decision support	Scandinavia: hotels	Survey of 626 front-line personnel 3 cases	A-III-B-I B-I-C-III	An index formed through the systematic collection of frontline sensing evaluates firm capabilities and their adaptation to environmental change and offers reliable predictive information for strategic decisions An intelligence collection system for firms to generate competitive intelligence over time from restricted data and finds that timely recovery of disaggregated information at product-firm-market level assists the firm in superior resource allocation Three strategic orientations (customer, entrepreneurial, technology) and one aspect of organizational culture (developmental) are important contributors to the development of BI capability BI disrupts the process of board level decision-making across three areas (cognitive capabilities, board cohesion, responsibility/control within senior teams)
105	Kumar <i>et al.</i> (2020)	Operations management Business	US: Multimedia industry	1 case (internal firm data, commercial market data and secondary data)	B-I-B-I B-I-C-II	BI analytics capability enables firms to generate insight that can help strengthen their dynamic capabilities, which, in turn, positively impact incremental and radical innovation capabilities. In high environmental heterogeneity, the impact of BI analytics capability on dynamic capabilities and, in sequence, incremental innovation capability is enhanced
106	Lin and Kunnathur (2019)	Manufacturing management Information management Marketing Business Strategy	Manufacturing, operations, IT industry	Survey of 251 managers	A-II-B-III	BI analytics capability along with organizational readiness and design factors facilitate better utilization of BI analytics in manufacturing decision-making, and thus, enhance high value business performance
107	Merendino <i>et al.</i> (2018)	Information systems Management Computer science	UK: manufacturing, services	Semi-structured interviews with 20 directors Survey data from 175 CIOs and IT managers	B-III-C-III	BI analytics capability enables firms to generate insight that can help strengthen their dynamic capabilities, which, in turn, positively impact incremental and radical innovation capabilities. In high environmental heterogeneity, the impact of BI analytics capability on dynamic capabilities and, in sequence, incremental innovation capability is enhanced
108	Mikalaf <i>et al.</i> (2019)	Information systems Management Computer science	Greece: Bank and Financials, consumer Goods . . .	Survey data from 175 CIOs and IT managers	A-I-B-III B-III-C-II B-III-C-I	BI analytics capability along with organizational readiness and design factors facilitate better utilization of BI analytics in manufacturing decision-making, and thus, enhance high value business performance
109	Popović <i>et al.</i> (2018)	Information systems Management	Construction, pharmaceuticals, home appliances	Multi-case design, 3 cases semi-structured interviews	B-III-C-II B-III-C-III	BI analytics capability along with organizational readiness and design factors facilitate better utilization of BI analytics in manufacturing decision-making, and thus, enhance high value business performance

(continued)

No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
110	<a href="#">Pryor et al. (2019)</a>	Management Strategy	US: financial services, agriculture, energy production, health care, property management, software development, transportation	Surveys of 358 executives, 17 firms	A-III-B-I B-I-C-II	Top executives' goal orientations affect their firms' environmental scanning. Top executives who exhibit higher learning goal orientations or higher performance prove goal orientations might engage in more environmental scanning than top executives who avoid goal orientations. Firm environmental scanning is positively related to firm performance
111	<a href="#">Robinson and Simmons (2017)</a>	Management Strategy	Global: oil and gas, offshore services, financial services, defense	7 cases Semi-structured interviews corporate or business unit strategy	B-I-B-I A-II-B-I	The quality of the information source is less important in explaining information source use. Organizations rely on internal reporting on the environment, compiled using multiple channels
112	<a href="#">Seddon et al. (2017)</a>	Information systems Computing	BA vendors	Assessment method 100 customer success stories	B-III-C-II	A two parts success model of BI analytics to create business value (a process and a variance model)
113	<a href="#">Urbinati et al. (2019)</a>	Industrial engineering Management	Italy: big data industry	Multi-case study analysis: nine cases	A-II-B-III B-III-C-I	Provider companies create and capture value from BI by two main BI innovation service strategies (use case-driven, process-driven), which differ from each other because of three reasons (the management of data, the use of the technology, the characteristics of the analytic solution)
114	<a href="#">Vidgen et al. (2017)</a>	Information systems Business	UK: mobile telecoms, broadcasting transportation	Mixed methods approach (Delphi study/interviews) 3 cases	B-III-B-III B-III-C-II	31 key challenges in building BI analytics capabilities and 21 corresponding recommendations to create BI into business value
115	<a href="#">Wamba et al. (2017)</a>	Business Information technology	China: IT and analytics	Online survey to 297 IT managers and analytics specialists	A-III-B-III B-III-C-II	The value of the entanglement conceptualization of the hierarchical BI analytics capability model, and the mediating role of dynamics capabilities process on enhancing firm performance

(continued)

**Table 2.**

No.	Author(s)	Discipline	Industry firm characteristic region	Sample size method	Linkage(s)	Key findings
116	Wang <i>et al.</i> (2018)	Information management Management	US, Canada, Australia, China, India, the Netherlands: Health care	Analysis of 33 cases descriptions	A-III-B-III B-III-B-III B-III-C-II	BI analytics capabilities are linked to IT-enabled transformation practices and to benefits and business values. Four BI analytics capabilities (analytical capability, decision support capability, traceability and predictive capability) and three path-to-value chains (from analytical capability to IT infrastructure benefits, from decision support capability to operational benefits, from traceability to IT infrastructure benefits) Three factors contribute to the persistence of the use of intelligence collection practice (keeping it opaque to avoid the negative effects of stigmatization, constructing 'usefulness to justify its ongoing use by leveraging accepted beliefs and invoking fear of unilateral abandonment and adapting it by developing multiple versions to increase its zone of acceptability) BI systems trigger a performative outcome in relation to organizational knowing through two practices (the ability to initiate problem articulation and dialogue and data selection) Changes in strategic priorities through financial reconfiguration following environment instability. Intelligence collection budgeting in a period of instability favors reinforcing the vigilant learner position Tensions that arise from the conflicting task requirements and that pose a challenge for effective BI analytics support and provide insights into tactics for managing these tensions and achieving ambidexterity
117	Reimmoeller and Ansari (2016)	Management Strategy	US: 41 industries	Archival data, semi-structured interviews	A-II-B-I B-I-B-I	
118	Shollo and Galliers (2015)	Operations management Information management Management Strategy	Scandinavia: Finance	Illustrative case study 16 interviews	B-III-C-IV	
119	Opait <i>et al.</i> (2016)	Management Strategy	Romania: IT solutions	1 case, statistical analysis of CI budgeting	A-I-B-I B-I-B-I	
120	Kowalczyk and Buxmann (2015)	Information systems Management Decision support	Telecom, media, finance, logistics	Multiple case study (11 cases) Semi-structured interviews	A-II-B-III B-III-B-III B-III-C-IV	

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- (1) *Antecedents*. Similar to biological organisms, firms' actions are often constrained by their external environments (Brownlie, 1994). This implies that organizations should constantly monitor their respective environments to ensure the detection of plausible alterations susceptible of jeopardizing their competitive advantage. Their BI processes are, hence, influenced by *environmental factors* (A-I) such as uncertainty (Hubert and Daft, 1987), complexity (Child, 1972), rate of change (Daft *et al.*, 1988), importance (Aaker, 1983; Pfeffer and Salancik, 1978), culture (Leidner *et al.*, 1999) and competitive pressures (Zhu and Kraemer, 2005). Further influence on the BI process can be attributed to the *organizational context* (A-II). This may include organizational factors such as size (Yasai-Ardekani and Nystrom, 1996), institutional isomorphism (DiMaggio and Powell, 1983), core technologies (Thompson, 1967), structural flux (Maltz and Kohli, 1996), market orientation (Narver and Slater, 1990) and IT sophistication (Armstrong and Sambamurthy, 1999). Finally, *managerial and individual attitudes* (A-III) affects the BI process through managerial heterogeneity (Cho, 2006), experience (Thomas *et al.*, 1991), managerial attitude (Qiu, 2008; Pryor *et al.*, 2019), absorptive capacity (Elbashir *et al.*, 2011) and decision roles (Mintzberg, 1973).
  - (2) *BI process*. While alterations in the aforementioned antecedents are believed to impact the BI process, characteristics of this latter are also crucial for understanding the different patterns of the BI process literature. At the outset, *the intelligence collection phase* (B-I) is pictured as the first link between a firm and its environment, whereby it can comprehend the happenings and remain vigilant to changes (Hambrick, 1981; Lönngqvist and Pirttimäki, 2006; Turban *et al.*, 2010). Traditionally, the collection phase was fed through open and human sources. However, with the advent of the internet, it faced the challenge of information overload (Chen *et al.*, 2002). The abundance of data created a lack of executives' attention, and called for a more tailored *intelligence transformation phase* (B-II) to support managerial action (Fabbe-Costes *et al.*, 2014; Christen *et al.*, 2009). In response, the BI analysts used computerized decision support systems to prepare the requested intelligence for executives (Leidner and Elam, 1993). Such decision aids stimulated, eventually, the design of the executive information system with the purpose of retrieving the information related to internal operations and the business environment (Turban and Schaeffer, 1987; Turban *et al.*, 2010). A further scrutiny of the *transformation phase* (B-II) reveals that both structured and unstructured data are extracted from operational and external sources, then prepared and loaded into the data warehouse, for a later clustering into Data Marts. This process is usually performed through the extract-transform-load (ETL) application. On the one hand, the data warehouse usually deploys a relational database management system (RDBMS) to store data and rapidly execute queries across a wide range of data. On the other hand, the data warehouse is corroborated by an online analytic processing (OLAP) server in charge of filtering, and drawing thorough analysis (slicing and dicing, drill down. . .) of the data, which, in turn, is communicated to the user interface (dashboards, spreadsheets. . .) that yields the way to the *Usage phase* (B-III) (Chaudhuri *et al.*, 2011; Sen and Sinha, 2005; Singh *et al.*, 2002). This last phase of the BI process offers the required capability to conduct predictive analysis, streamline intelligence content and ensure an effective practice of the BI process and its alignment across organizational culture, analytical capabilities and the human capital propensity for BI (Holsapple *et al.*, 2014; Viaene and Bunder, 2011; Chaudhuri *et al.*, 2011; Sen and Sinha, 2005; Singh *et al.*, 2002).

- (3) *Outcomes*. The BI process was found related to certain outcomes (C): of a *strategic order* (C-I) such as strategic management process (Hofer, 1978) and managerial representations of competitive advantage (Porac and Thomas, 1990); *at a firm performance level* (C-II) such as share of wallet (Zeithaml, 1988), customer perceived value (Hughes et al., 2013), product development (Lynn, 1998) and superior sales growth (Slater and Narver, 2000); *related to decision-making* (C-III) including decision-making speed (Leidner and Elam, 1995), problem identification speed (Leidner and Elam, 1995) and extent of analysis (Miller and Friesen, 1980); and *under the umbrella of organizational intelligence* (C-IV) encompassing perceived intelligence quality (Popovič et al., 2012), perceived information availability (Leidner and Elam, 1995), intelligence use (Maltz and Kohli, 1996), receiver's trust (Moorman et al., 1992) and insight generation speed (Heinrichs and Lim, 2003).

After plotting the linkages of each study in Table 2, we sought to allow for a visual display of the linkages explored, and the ones overlooked, therefore we juxtaposed the elements of the BI process (BI-II-III), antecedents (AI-II-III) and outcomes (CI-II-III) in a review matrix, exhibited in Figure 1, where rows represent the independent variables, and columns represent the dependent variables, and each coded study (01–120) is allocated into its appropriate linkage cell. Finally, we synthesized and depicted the aforementioned interrelationships in the form of an integrative framework we present in Figure 2. The framework displays three clusters of antecedents (A), namely, environmental factors (A-I), organizational factors (A-II) and managerial and individual attitudes (A-III); three characteristics of the BI process (B), namely, collection (B-I), transformation (B-II), usage (B-III); and four sets of outcomes (C), namely, strategic (C-I), firm performance (C-II), decision-making (C-III) and organizational intelligence (C-IV).

	B-I	B-II	B-III	C-I	C-II	C-III	C-IV
A-I	87,27,07,52, 71,59,68,08, 47,119, 78	04,	62, 95,108, 98				26,47
A-II	08,52,111, 43, 47,65,117	04,85,21,	25, 91, 95, 98, 102,106, 120, 113, 93,				45,26,47
A-III	41,08,70,110, 84 34,43,73,65, 104,	85,	92, 96, 116, 115,				45,26,47, 21
B-I	37,72,77,32,67,24, 64, 60,08,111,09, 63,30,36, 19, 48, 16,14,10,18,22,02, 01,54,12,29, 56, 42,86,105,117,119			55, 33,19, 18	110, 86,28, 10, 18,26,19, 40, 34,06, 105	58, 03,10,19, 104	66,17, 47 46
B-II		20,49,39,31,76,57,38, 44, 74,13, 11, 69,		35	51,75,	50,53,23,	21,51,
B-III			25,83,80,82,94,114 , 116, 120	05,82, 91, 95, 108, 113,92, 98	15,82, 89, 90, 99, 100, 101, 102, 103, 109, 112, 114, 116, 115, 25, 93, 108	62,79, 82, 96, 88,107, 109	62,88, 97,100, 120, 118,
C-I	61, 52						
C-II	07,81						
C-III							
C-IV					45		47
	A-I: Environmental Factors C-I: Strategic Outcomes	A-II: Organizational Factors C-II: Firm performance	A-III: Managers/ Individual Factors C-III: Decision Making	B-I: Collection C-IV: Organizational Intelligence	B-II: Transformation	B-III: Usage	

Figure 1.  
Linkage-exploring  
review matrix



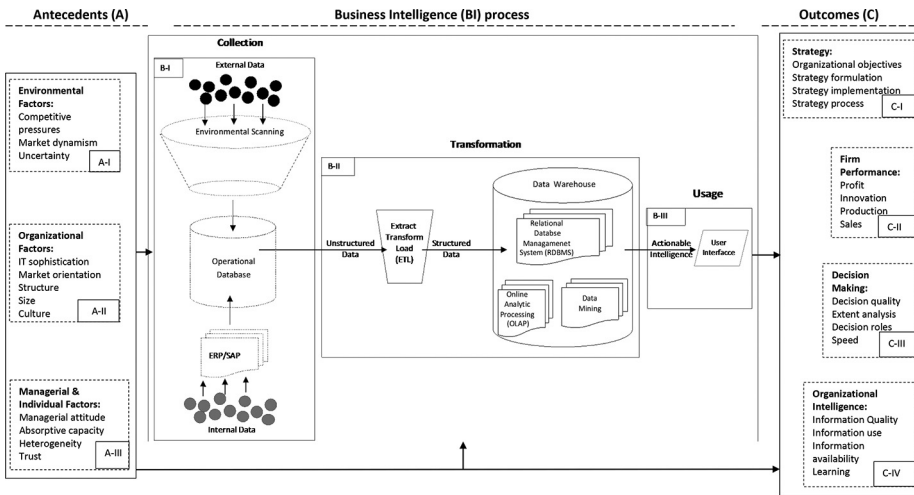


Figure 2. BI process: an integrative framework

Research within the framework falls into four categories, namely, the first one explores the influence of the antecedents on the BI process (A-I-II-III – B-I-II-III); the second explores the BI phases separately, describing the state of affairs and prescribing optimal processes (B-I-II-III); the third set of studies examines the linkages between the BI process and its ensuing outcomes (B-I-II-III – C-I-II-III-IV); and the fourth set of studies examines the moderating role of antecedents on the relationship between the BI process and outcomes (A-I-II-III – B-I-II-III – C-I-II-III-IV).

### Literature synthesis

#### *Stream 1: the influence of antecedents on the BI process (links A-I-II-III – B-I-II-III)*

The environmental influence on the BI process motivated multiple studies that shaped the first cluster of this stream, although the nature of this linkage is still equivocal. This is due to inconsistent views of environmental heterogeneity and uncertainty, and the partial accounts of the BI process. These treatments, rooted in management, bifurcate into two strands. First, a constellation of studies that focus on the frequency and scope of BI collection (Boyd and Fulk, 1996; Daft *et al.*, 1988; Ebrahimi, 2000; Elenkov, 1997; Maltz and Kohli, 1996; May *et al.*, 2000; Sawyer, 1993). Their findings are at best exploratory and piecemeal as they adopt a “one rule fits all” approach to different environmental layers (e.g. political, customer, direct and remote) let alone country-level contexts (e.g. developed vs developing). By so doing, they overlook the peculiarities of developing economies where other informal pressures and singularities (cultural, institutional and cognitive) moderate the relationship between the environment and BI collection. The second thread of studies examine executives’ goal orientations (Pryor *et al.*, 2019), strategic priorities (Opait *et al.*, 2016) quality of information source (El Sawy, 1985; Jones and McLeod, 1986; Robinson and Simmons, 2017), experience and educational background (Cho, 2006), entrepreneurial attitude (Qiu, 2008), intuitive judgments (Constantiou *et al.*, 2019) and boundary spanners’ intelligence effort (Le Bon and Merunka, 2006; Mariadoss *et al.*, 2014), customer orientation (Hughes *et al.*, 2013). Unfortunately, these studies overlook to consider the collection activity as a formal unit within the organization, and explore the informal BI collection and source selection of boundary spanners and executives despite previous evidence of their bounded rationality (Cyert and March, 1963). Besides, we still know little about the

upper management's cognitive and managerial characteristics, which implicitly determine their BI collection, not to mention the need to verify, which leadership approach serves best this activity. Credit is given to [Elbashir et al. \(2011\)](#), being the only scholars of this stream who examined the influence of the absorptive capacity of managers on BI assimilation. Similar studies must follow this line to explore the influence of absorptive capacity on the entirety of the BI process. To this date, all we know, in this context, is the positive influence of the absorptive capacity of managers on organizations' BI assimilation ([Elbashir et al., 2011](#)). Further, studies examining boundary spanners collecting and gathering of intelligence like their engagement to their desire for upward mobility and recognition. Therefore, boundary spanners' involvement in BI collection is a variable of managerial stimulation, and hence, more studies are needed to examine the moderating effect of management appraisal on the linkage between BI collection and boundary spanners' scope and frequency of BI collection.

The significant focus of management scholars on the environment and the managerial and individual factors as the primary antecedents of the BI process came at the expense of overlooking the organizational factors susceptible of influencing the BI process. Conversely, studies, rooted in marketing and decision support, shed light on the ability of the organizational context to alter the BI process, particularly the collection phase and its linkage to decentralized organizational culture ([Babbar and Rai, 1993](#)), size and core technologies ([Yasai-Ardekani and Nystrom, 1996](#)), inter-functional distance and structural flux ([Maltz and Kohli, 1996](#)), organizational market orientation ([Qiu, 2008](#)), resource scarcity ([Christen et al., 2009](#)), institutional isomorphism ([Ramakrishnan et al., 2012](#)), analytical culture ([Holsapple et al., 2014](#); [Popovič et al., 2012](#)); IT infrastructure ([Elbashir et al., 2011](#)), organizational culture ([Leidner and Elam, 1995, 1999](#)) and organizational beliefs ([Reinmoeller and Ansari, 2016](#)). Although harmonious in its uniformity, this line of research was limited to the BI collection phase except for two studies that extended their focus to BI support and its linkage to organizational orientation and culture ([Lin and Kunnathur, 2019](#)) and organizational tensions ([Kowalczyk and Buxmann, 2015](#)).

#### *Stream 2: the business intelligence process (links B-I-II-III)*

The review of the literature illustrates a shared conceptual meaning, across marketing and management scholars, regarding the nature of BI collection as an activity that seeks to proactively monitor a dynamic environment and that ends once data has been collected ([Babbar and Rai, 1993](#); [Bernhardt, 1994](#); [Calof and Wright, 2008](#); [Slater and Narver, 2000](#)). Unfortunately, the literature within this stream was considerably explorative of the BI collection activities and practices ([Taylor, 1992](#); [Vedder et al., 1999](#); [Dishman and Calof, 2008](#); [Wright et al., 2009](#)). While some marketing scholars emphasized the use of Bayes' theorem to determine when more collection becomes cost ([Michaeli and Simon, 2008](#)), other explored information sources companies use ([Fleisher et al., 2008](#); [Lasserre, 1993](#); [Peyrot et al., 1996](#)) or developed indices to evaluate the adaptability of firm capabilities to BI collection of boundary spanners ([Hallin et al., 2017](#)) or to collect BI from disaggregated data ([Kumar et al., 2020](#)). While a stream of scholars examined trust in BI collection quality ([Robinson and Simmons, 2017](#)), others investigated the type and source of the collected intelligence ([Peyrot et al., 1996](#)) or the capabilities to decode each type of intelligence be it soft ([Lasserre, 1993](#)) or web-based ([Fleisher, 2008](#); [Pawar and Sharda, 1997](#)). On the other hand, an apparent discussion within this stream involves the collection approach, i.e. the comprehensive vs the project-based model. A priori, the comprehensive mode seems a better fit to broad strategic decisions, while the ad-hoc approach is more project-oriented. The narrowed focus of the project-based approach is believed to generate more accurate intelligence compared to the holistic model ([Prescott and Smith, 1987](#)). Nonetheless, this

paradox shifts the debate to the culture and the core business of organizations. For some scholars, organizations might choose to participate in the environment rather than passively observing it (Brownlie, 1994). By so doing, the underpinning motive of such an activity swings from BI collection to sense giving (Gioia and Chittipeddi, 1991), from informing to influencing, from a mere passive to proactive BI collection (Brownlie, 1994). Other scholars suggest that ambidexterity arises as a reasonable option whereby the firm can develop two cultures, namely, one for sensing peripheral patterns; the other is core business-oriented (Brown, 2004; O'Reilly and Tushman, 2002; Ghosal and Westney, 1991; Gilad *et al.*, 1993).

Conversely, literature with scaffolding in information systems and decision support, fueled by the desire of bridging the gap between the business user and BI transformation and usage, criticized the firms' focus on collection over analysis despite the challenge of information overload and gave significant attention to testing in-house acquisition techniques of BI collection to curb the exorbitant price of third-party sources by proposing Limited Information NBD/Dirichlet (LIND) models to infer key competitive measures based on site-centric data (Zheng *et al.*, 2012) or two level conditional random fields (CRF) models to extract comparative relation features from entities and words (Xu *et al.*, 2011) or event detection (NEED) applications that perform events detection based on properties extracted from news stories (Wei and Lee, 2004) or proposed 80/20 rule-based models for reduction of cycle time (Kohavi *et al.*, 2002; Liu and Wang, 2008) or suggested data slicing and dicing technologies, which index and analyze documents collected from websites matching users' interest (Chen *et al.*, 2002) or grant rapid access displays of data (Walters *et al.*, 2003). One commonality within this research stream is the evaluation of the proposed tool against the commercial engines (Chen *et al.*, 2002; Zheng *et al.*, 2012; Xu *et al.*, 2011).

The coming of the WEB 2.0, digitization, the internet of things and Big Data further challenged the BI process by technical issues in regard to (a) the time consuming process of transforming and storing structured and unstructured data into the data warehouse, (b) the lack of techniques capable of, simultaneously, alleviating data heterogeneity and integrating slice, dice, roll-up and drill-down dimensions for data evaluation, (c) the multidimensional view of data through OLAP, which needs continuous performance improvement; (d) the rising volume of data, which challenges the capacity of the RDBMSs to query and store data, (e) the pressure on ETL to filter, cluster and integrate current operational data, for real time decision-making support and (d) detect hidden patterns in terabytes of data (Chaudhuri *et al.*, 2011). This ushered most empirical studies in this stream to shift their attention to what Chen *et al.* (2012) refer to as BI 3.0 or mobile BI and accordingly update BI technologies and develop new applications that can detect patterns in terabytes of data, diminish further information overload, and merge structured with unstructured data (Chen *et al.*, 2012; Srivastava and Cooley, 2003; Chung *et al.*, 2005; Chau *et al.*, 2007; Cheng *et al.*, 2009; Lin *et al.*, 2009) or decipher frameworks for evaluation BI process based on users' feedback (Brichni *et al.*, 2017) or modeling its best practice approach for less challenges (Vidgen *et al.*, 2017; Wang *et al.*, 2018a; 2018b). However, this might not be enough to ensure an effective usage of BI as this latter hinges on the alignment across organizational culture, analytical capabilities and the human capital propensity for BI (Holsapple *et al.*, 2014; Viaene and Bunder, 2011). No empirical studies have yet to investigate this triadic relationship and its moderating variables for better BI usage.

### *Stream 3: the influence of the business intelligence process on outcomes (links B-I-II-III – C-I-II-III-IV)*

Drawing from marketing research, scholars explored the influence of BI collection and managerial representation of competitive advantage (Qiu, 2008), managerial belief in

formulating and implementing strategies (Vedder *et al.*, 1999) improvement of marketing strategies (Fleisher *et al.*, 2008). Other scholars suggested that BI collection translates to share of wallet and profit margin (Hughes *et al.*, 2013) and sales performance (Mariadoss *et al.*, 2014), product innovation and competitive pricing strategies (Trim and Lee, 2008), price optimization, expanding product lines and service improvements (Peyrot *et al.*, 1996), superior sales growth, customer satisfaction (Slater and Narver, 2000), innovation (Tanev and Bailetti, 2008) and profitability and revenues increase (Wright *et al.*, 2009). Although these studies might pinpoint to the relationship between BI collection and strategic outcomes, the question of whether or not this step of the BI process contributes to strategy formulation or implementation remains ambiguous.

Furthermore, the available evidence, drawing from management, demonstrates two stocks of research: one that indicates a clear relation between BI support and productivity enhancement, and information distribution cost savings (Belcher and Watson, 1993), price competition (Abramson *et al.*, 2005), firm performance (Aker *et al.*, 2016; Gupta and George, 2016), business value (Côte-Real *et al.*, 2020; Seddon *et al.*, 2016; Wang *et al.*, 2018a; 2018b), innovation (Ghasemaghahi and Calic, 2020); another that suggests BI support adds value to the organizational intelligence in at least two interrelated ways, namely, workforce learning (Cheung and Li, 2012), information access quality (Popović *et al.*, 2012), data security (Gordon and Loeb, 2001; McCrohan, 1998; Sheng *et al.*, 2005; Vedder *et al.*, 1999) and intelligence use (Maltz and Kohli, 1996) and organizational knowledge management (Côte-Real *et al.*, 2017; Shollo and Galliers, 2015).

The research strand, rooted in information systems, was limited to providing benchmarks of their BI support technologies to which they ascribe a linkage to the decision-making process. Scholars presented their prototypes and evaluated their success for mergers and acquisitions (Lau *et al.*, 2012), and banking and financial decisions (Moro *et al.*, 2015). Besides, information systems scholars had a penchant for solving tactical issues because of their straightforward evaluation or to scholars' approach to BI, as a set of separate technologies rather than a holistic decisional paradigm. Therefore, their contributions integrate BI technologies such as data warehouse and data mining into BI support and address its ability to improve firm performance indicators. Studies examined and demonstrated the positive impact of BI support on crafting personalized customer strategies (Li *et al.*, 2008), decision-making (Aversa *et al.*, 2018), strengthen innovation capability (Mikalef *et al.*, 2019), business value (Sharma *et al.*, 2014), identify sales ordering patterns (Cheung and Li, 2012), business model insight (Heinrichs and Lim, 2003). Research, herein, seems obsessed with solving tactical issues because of their straightforward evaluation or to scholars' approach to BI as a set of separate technologies rather than a holistic decisional paradigm.

Studies rooted in decision support empirically examined the linkage between BI support and the speed of problem identification, decision-making speed and the extent of analysis (Leidner *et al.*, 1999; Leidner and Elam, 1993; Leidner and Elam, 1995; Belcher and Watson, 1993; Arnott *et al.*, 2017). Still little is known about how BI collection influences decision-making. While it is true that explorative studies reveal the utility of BI collection for organizational decision-making (Ghosal and Westney, 1991; Vedder *et al.*, 1999), no empirical evidence has yet examined this belief. The outcome of BI collection on decision-making might be, as well negative than positive, at least for competitor analysis blind spots in the case of capacity expansion, new business entry and acquisition (Zajac and Bazerman, 1991). One might keep wonder about the contexts and the extent to which BI can bring value to the decision-making if scholars' attention does not shift from explorative, inductive

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studies to more cross functional longitudinal ones to further delve into the relation between BI and the decision-making process.

*Stream 4: the moderating effects of antecedents on the relationship between the business intelligence process and outcomes (links A-I-II-III – B-I-II-III–C-I-II-III-IV)*

This stream of research is threefold, namely, research at the individual level, organizational level and environment level. At the individual level, scholars, with scaffolding in marketing research, investigated the moderating role of boundary spanners adaptive skills on BI collection sales performance outcomes (Hughes *et al.*, 2013; Mariadoss *et al.*, 2014; Ahearne *et al.*, 2013), the moderating role of the relationship between intelligence officers and strategists on boosting product innovation and generating competitive pricing strategies (Trim and Lee, 2008), the moderating effect of the relationship between district managers centrality and district BI quality diversity on salespersons' performance (Ahearne *et al.*, 2013). Unfortunately, studies rooted in management and information systems or decision support overlooked the moderating role of antecedents at the individual level on the relationship between BI process and outcomes.

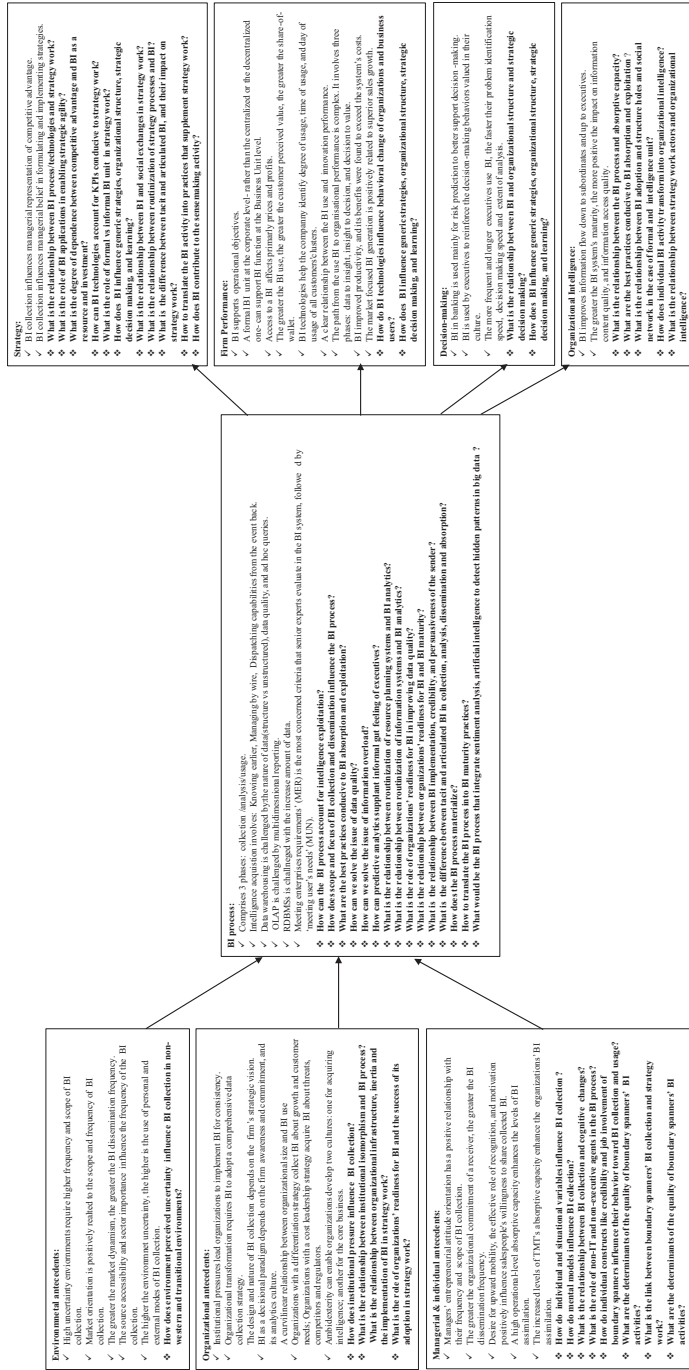
At the organizational level, management scholars explored the moderating role of the alignment between business strategy and IT on the relationship between BI usage and business value (Côrte-Real *et al.*, 2019; Urbinati *et al.*, 2019), the moderating role of the relationship between the alignment of business strategy and BI analytics on BI usage and firm performance (Akter *et al.*, 2016), the moderating role of deep organizational structure on the relationship between BI usage and strategy outcomes (Audzeyeva and Hudson, 2015), the moderating role of organizational learning and ambidextrous organizational culture on the relationship between BI usage and business value (Bordeleau *et al.*, 2020) and BI usage and organizational learning (Fink *et al.*, 2016) and the mediating role of dynamic capabilities on the relationship of BI usage and firm performance (Wamba *et al.*, 2017). In like fashion, marketing scholars investigated the moderating effects of the relationships between organizational antecedents such as structural flux and perceived intelligence quality on BI usage (Maltz and Kohli, 1996), the curvilinear relationship between organizational size and BI use, as well as between marketing departments size and BI usage (Peyrot *et al.*, 2002). On the other hand, decision support scholars shed light on the moderating role of decision-making culture on the relation between the BI content quality and the BI usage (Popovič *et al.*, 2012), the moderating role of the relationship between organizational readiness and design factors on the relationship between BI usage and business value (Popovič *et al.*, 2012) and the moderating role of the information system BI infrastructure investment on the relationship between BI usage and value targets (Grover *et al.*, 2018).

At the environmental level, marketing scholars showcased the moderating role of the relationship between perceived competitiveness of the environment and the perceived value of BI quality on BI usage and organizational outcomes (Maltz and Kohli, 1996; Peyrot *et al.*, 2002). On the other hand, one study, rooted in information systems, explored the moderating role of the environment dynamism on the influence of the BI usage on value creation (Chen *et al.*, 2015).

### Future research

35 years of BI process research seemed fragmented and scattered around similar areas, with scant initiatives to weave strands of lookalike contributions into one unifying paradigm. Research spawned a considerable number of articles partly prescriptive, partly explorative, revealing discrepancies between theory and practice across the BI process, antecedents and outcomes. Figure 3 displays the covered and underexplored areas in each of the

**Figure 3.**  
Synthesis of the  
covered and  
remaining areas of  
the literature



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mentioned streams. Antecedents exploring studies focused on the supply side of the market to formulate viable strategies for an existing industry. These contributions unanimously adopted an outside-in perspective, examining the external environmental influence on the frequency and mode of BI collection. They adopted the same structuralist approach to different business environments and neglected the influence of cultural factors and institutional pressures on the BI process. Another limitation of this stream is the exclusiveness of collection activity to executives, rather than the organization as a whole, following a top-down approach in an apparent discontinuity from the literature on bounded rationality that grants executives limited capacity to fathom the dynamism of the environment.

The significant focus on the environment as the primary antecedent of BI collection marginalized discussions on organizational factors susceptible of influencing the BI process. For instance, the ramifications of one single event on the BI use of multinational corporations in different settings. In this vein, managerial heterogeneity seems a potential frontier for research through which scholars shall compare heterogeneous teams to homogeneous groups of executives' vis-a-vis their uncertainty perception and use of the BI process. Additionally, researchers still need to investigate, which structure represents an environment ripe for effective BI use: organic or mechanistic structure. Similarly, the causation link between strategic orientation and BI process is still vague, despite some studies suggest a one-way association from strategic orientation to BI collection. Moreover, contrary to the trend line of recommendation positing the BI process at the outset of the decision-making or the strategic management process, the authors of the article at hand personally encountered situations, in monopolistic economies, where the BI process was regarded more as legitimacy tools that solidify an already taken decisional or strategic choice. As a corollary, it might be crucial to incorporate the singularity of the decision-making process in developing countries, when hypothesizing coming empirical studies. Another trend line across studies examining BI use is the focus on the receiver's trust in regard to the intelligence sender. Nonetheless, this latter's willingness to share intelligence was treated as a given, while it is far from being the case. Particularly, in developing countries where information is shared among individuals pertaining to the same interest groups. It becomes, hence, evident to account for the sender's trust and influence on the BI dissemination and use, in future research.

In addition, cognitive factors of managers and boundary spanners were rarely on the scholars' agenda. After all, the environmental uncertainty is a matter of interpretation, which, in turn, is framed by intrinsic factors rooted in the person's background. More studies, in this respect, should incorporate elements such as age, gender and personality traits. Moreover, the rationale behind decision-makers' BI collection behavior still appears ambiguous, for there seems to be no evidence regarding the value it adds to their mental models. Another overlooked matter by scholars, caught in an everlasting development of new ways of codifying structured and unstructured data, is the ability of the BI process to acquire and communicate tacit knowledge. Another gap worth mentioning is the scarcity of studies comparing BI practices of multinational corporations in the western world to emerging countries, in a world where anything might happen any second, where new technologies disrupt the status quo of businesses, economies and political regimes. The Covid-19 epidemic, political upheavals or data privacy issues present an opportunity for researchers to examine the linkage between the BI process and strategic agility let alone employees' and organizations' privacy and readiness for disruption.

Finally, a myriad of research methods was adopted by scholars, to delve into issues related to the BI process phases ranging from bibliometric studies, surveys and case studies. Some were conceptual papers, whereas others field tested their hypotheses or settled for laboratory experiments. Except for qualitative exploration examining linkage between

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BI transformation to decision-making success, benchmarking data mining or data warehousing applications against commercial products marked most BI transformation studies, let alone the quantitative exploratory and conceptual articles representing a common trend across studies tackling BI collection. The absence of comparative studies urges researchers to invest time and money probing differences across industries, not in an exploratory superficial manner, but more as a longitudinal thorough analysis depicting whether or not the industry type is a contributing factor to the BI process. Longitudinal studies were, surprisingly, absent, notwithstanding their presence in multiple scholars' future directions. Another advantage longitudinal studies shall have is related to the evaluation of prototypes and technologies in an accurate manner, encompassing the residual value of such applications on the organizational learning. Longitudinal studies might also enable scholars to tap into cognitive changes prior and after BI collection and usage and track front line managers intelligence use as they assume high level positions. With that said, studies shall alter to a more dynamic view of the environment capable of capturing all the various interactions among its constantly shifting elements.

### **Practical implications**

Nowadays, confidential strategies and tactics are swiftly replicated; the sustainability of the competitive advantage is no longer a result of a secret recipe. Managers shall recognize that room for intuition is shrinking as the need for a rational predictability is rising. Therefore, it seems wiser and beneficial for managers to tear down their walls, and engage in double loop learning with scholars, should they want a better real time decision-making and strategic agility. This review carries some implications for practitioners and particularly the role they ought to play should they seek actionable intelligence as an outcome of the BI process. Across the studies this review examined, managerial reluctance to open their intelligence practices to close examination was omnipresent. Although their apathy is understandable, due to their frustration regarding the lack of measurability of intelligence constructs, managers manifestly share a significant amount of responsibility in turning out explorative and descriptive studies partly due to their defensive managerial participation. Interestingly, managers would rather keep an ineffective BI unit confidential than open it for assessment in fear of competition or bad publicity. Therefore, this review highlights the value open participation of managers in longitudinal studies could bring to the BI research and by extent the new open intelligence culture across their organizations where knowledge is overt, intelligence is participative, not selective and where double loop learning alongside scholars is continuous. Their commitment to open participation and longitudinal studies will help generate new research that better integrates the BI process within its context and fosters new measures for intelligence performance.

### **Conclusion**

Although far from completeness, this systematic review strived to synthesize the BI process body of knowledge via an integrative process framework that pinpoints to areas of redundancies and research gaps where scholars' attention should be directed. It is hoped that this article will encourage researchers to change perspective and adopt a more comprehensive view of the BI process aimed at contributing to its organizational context and focus its attention on the interrelationships across the BI process, antecedents and outcomes. Drawing from [Levy and Ellis \(2006\)](#) and [Webster and Watson \(2002\)](#), we sought comprehensiveness from four databases and quality from the ABS ranking list. Therefore, this paper excludes conference papers and book chapters. A caveat regarding the 26 keywords of this study is worth mentioning, as there might surely be some articles that the query strings failed to retrieve; let alone in-press- publications, not yet available when



the database search took place. Notwithstanding, a backward search of references allowed the verification of this review's comprehensiveness, gauged near completion when no new concepts were identified in the literature set (Webster and Watson, 2002). However, the material upon which this scrutiny is based epitomizes an open invitation for other researchers, to compare and test whether or not the results herein stand up to close examination. After all, this is the ultimate way to expand and enrich the body of knowledge probing BI process research.

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