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**Article**

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# Realising value from big data analytics: The process of affordance actualisation

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## ABSTRACT

Recent developments in big data analytics (BDA) enable financial institutions to optimize their decision-making processes. However, many BDA projects fail due to a lack of understanding of the value related to the realisation process. Guided by affordance actualisation theory, this article uses a critical realist case study approach to examine BDA affordance actualisation in a Malaysian-owned regional bank. Data collection involved an online survey, semi-structured interviews, and archival reviews. Using four BDA affordances specific to the banking industry, along with contextual mechanisms shaping organisational actions, interactions, and structures, our study highlights the importance of the process of building BDA capabilities to realise BDA value. By highlighting the iterative and dynamic nature of the affordance actualisation process, this research extends theoretical insights into how organisations build BDA capabilities to realise value. This multi-layered research provides practitioners in banking and other sectors with actionable insights to enhance BDA implementation and realise its potential value.

## 1. Introduction

Megatrends such as rapidly changing technology, globalisation, wider social change and exogenous events such as the COVID-19 pandemic have caused disruption to how businesses operate (Ernst & Young, 2020). Disruption leads to businesses investing in cutting-edge technologies, with big data analytics (BDA) being a priority (PWC, 2017). An increasing investment in BDA (Needham, 2021) reflects its strategic importance. However, 85 % of BDA projects do not fully realise their potential (Heudecker, 2017) and only one in five analytic insights deliver expected business outcomes (White, 2019).

The big data era has enhanced decision-making (Appelbaum et al., 2017; Moffitt & Vasarhelyi, 2013) and enables organisations to capture business activities even before their transactional records register them (Vasarhelyi et al., 2015). The implication of BDA on auditing, managerial accounting and financial reporting is acknowledged by practitioners and researchers alike (Appelbaum et al., 2017; Moffitt & Vasarhelyi, 2013; Vasarhelyi et al., 2015). Accounting information systems (AIS) practitioners acknowledge the need to incorporate BDA in AIS (Vasarhelyi et al., 2015), especially for digital transformation (Liu et al., 2022).

However, the extant BDA literature is dominated by generalised and multi-industry survey studies mostly concentrating on the manufacturing industry (Mikalef et al., 2019b; Torres et al., 2018; Wamba et al., 2017). As BDA strategy, implementation and performance benefits vary by context due to unique structures and tasks (Orlikowski & Iacono, 2001), BDA outcomes will be unique in different industries (e.g., entertainment, financial, automotive) with different business processes, regulations, norms and routines (Barroso & Laborda, 2022; Krishnamoorthi & Mathew, 2018). An investigation of BDA potentials and values in different industries, particularly service industries, within different organisational cultures and governance standards will enrich the current understanding of BDA business value (Abbasi et al., 2016; Mikalef et al., 2019).

To address these gaps and build on prior research, this study seeks to answer the following research questions:

1. How do BDA affordances emerge in the banking industry, and what contextual factors influence their actualisation?
2. What actions do organisational actors undertake to actualise BDA affordances, and how do these actions shape outcomes?

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The banking industry is a major contributor to the \$215 billion BDA investment (Needham, 2021). We examine how the large BDA investment is translated into business value in this industry and within the fertile Malaysian context (PWC, 2016b). Our study illustrates that while affordance in itself is a mechanism providing various potentials, its value realisation is dependent on other contextual factors.

## 2. Theoretical background

### 2.1. Big data analytics and business value

We define big data analytics (BDA) as techniques and processes that extract insights from 5Vs of data- volume, velocity, variety, veracity, and value- to create business value and competitive advantage (Gandomi & Haider, 2015; Kwon et al., 2014). This definition highlights the critical role of organisational resources including actors, structure and technology in leveraging BDA effectively (Wamba et al., 2017). BDA techniques create opportunities to increase business value by enabling real-time decisions and actions (Manyika et al., 2011); therefore, its implementation must be managed effectively. Scholars posit the importance of other organisational resources required to transform data into actionable insights. As such, in the process of realising the value of BDA, the literature indicates the importance of organisational learning (Gupta & George, 2016; Mikalef et al., 2019) which characterises an organisation's concerted efforts to enhance existing capabilities and develop new ones (Lane et al., 2006).

Early evidence suggests that BDA value realisation requires an interplay between these socio-technical aspects (Akter et al., 2016; Wamba et al., 2017). To conceptualise this integration, scholars have introduced the term BDA capability, defined as a firm's ability to assemble, integrate, and deploy big data-specific resources (Gupta & George, 2016). BDA capability encompasses both tangible and intangible organisational resources that lead to performance-related outcomes (Mikalef et al., 2019) under the lens of the resource-based view (RBV). RBV proposes that a collection of valuable, rare, inimitable, and non-substitutable (VRIN) tangible and intangible resources generate a competitive advantage (Barney, 1991). Tangible resources include internal and external data, technological tools, and investment, while intangible resources include managerial and technical skills, as well as a data-driven culture that fosters decision-making based on evidence rather than intuition (Gupta & George, 2016; Mikalef et al., 2019). Studies adopting the RBV suggest that these capabilities, when strategically combined, lead to superior organisational performance across financial, operational, and market domains (Akter et al., 2016; Mikalef et al., 2019).

### 2.2. BDA affordances

Building on the perspective of BDA capabilities, **BDA affordances** further elucidate how BDA capabilities are actualised to create value. Affordances, conceptualised as action possibilities arising from the interaction between BDA features and goal-directed actors, provide a mechanism for understanding how organisations translate potential into outcomes (Liu et al., 2022; Strong et al., 2014). BDA technologies and tools provide the means to organisational actors to collect, store, and process a large volume of data, leading to affordances that can be actualised to achieve desired outcomes. While BDA capability focuses on the availability and integration of resources, affordances explore the contextual and situational interactions that enable these resources to be utilised effectively.

Scholars have used affordances to explore the process of realising the value of BDA on an organisational level (e.g. Tim et al., 2020). Following (Karahanna et al., 2018) in synthesising affordances from; (1) prior research examining BDA affordances and (2) affordances emerging from a review of BDA studies Table 1 lists a comprehensive but not an exhaustive set of BDA affordances.

**Table 1**  
BDA Affordances.

BDA Affordances	Definition	Related Literature
Visibility	BDA provides the potential to have access and a comprehensive view of the landscape of interest, for example, customer behaviour in the market, supply chain activities, and various business processes.	(Dremel et al., 2020; Dubey et al., 2019; Gunasekaran et al., 2017; Srinivasan & Swink, 2018; Tim et al., 2020; Zeng et al., 2020)
Transparency	BDA provides insights into individual needs and demands, thus allowing the thorough analysis of individual customers' preferences and segmentation.	(Dremel et al., 2020; Lehrer et al., 2018; Tim et al., 2020; Zeng et al., 2020)
Optimisation	BDA provides the potential to recalibrate, improvise and enhance internal business processes for better productivity.	(Dremel et al., 2020; Gunasekaran et al., 2017; Srinivasan & Swink, 2018; Tim et al., 2020)
Innovation	BDA provides the potential for developing new products and services that suit the current and future needs of customers.	(Dremel et al., 2020; Duan et al., 2018; Lehrer et al., 2018; Mikalef et al., 2019; Tim et al., 2020; Zeng et al., 2020)

These affordances—visibility, transparency, optimisation, and innovation—serve as foundational constructs within the process of affordance actualisation. Each affordance represents a potential that must be realised through deliberate organisational actions and contextual alignments. BDA affordances are powerful action possibilities that arise from the interaction between technological features and goal-directed actors (Strong et al., 2014). These affordances enable organisations to extract actionable insights and drive value creation. However, affordances are merely potentials that must be actualised through deliberate organisational actions to achieve desired outcomes. This theoretical perspective emphasizes the socio-technical interplay essential for leveraging BDA capabilities effectively.

The visibility affordance illustrates how the vast amount of real-time data from diverse sources provides organisations with a comprehensive view of their landscape of interest (Gunasekaran et al., 2017; Srinivasan & Swink, 2018; Tim et al., 2020). For businesses, this landscape may include market dynamics or internal processes, while for government agencies, it could involve jurisdictions or urban environments. For instance, a case study of a video gaming company demonstrated that BDA enabled actors to analyse market sentiment, competitors' products, and gamer behaviour, thereby informing strategic decisions (Tim et al., 2020). Similarly, in smart city transformation projects, BDA technologies such as data lakes and APIs afforded visibility into urban elements, enabling the development of actionable transformation blueprints (Zeng et al., 2020). These examples highlight how visibility affordance reduces uncertainty and facilitates adaptive planning, particularly in complex and volatile environments (Cao et al., 2015; Dubey et al., 2019b).

Transparency affordance emerges from the integration and visualisation of data, providing clarity into individual needs and business processes. This affordance is exemplified in the automotive industry, where the creation of real-time customer profiles across multiple platforms enabled personalised marketing and efficient sales funnel management (Dremel et al., 2020). Similarly, a video game company leveraged transparency to improve inter-departmental coordination, leading to better product development (Tim et al., 2020). Transparency also enhances customer-centric services in diverse industries such as banking, telecommunications, and insurance by enabling tailored offerings based on insights from stream, web, and mobile analytics (Lehrer et al., 2018).

The optimisation affordance allows organisations to recalibrate and

improve their business processes through predictive and prescriptive analytics. For example, BDA in the automotive sector facilitates predictive maintenance, reducing downtime and improving production efficiency (Dremel et al., 2020). Even studies that do not explicitly adopt the affordance perspective demonstrate how BDA features enhance production processes and reduce operating costs, underscoring the optimisation potential of BDA (Ashrafi et al., 2019; Chae et al., 2014).

Lastly, the innovation affordance highlights BDA's role in fostering new product development and service differentiation. By leveraging BDA technologies, organisations can trigger real-time adjustments to interactions, enabling personalised and innovative solutions (Lehrer et al., 2018). For example, automotive firms have utilised BDA to develop safer cars, while gaming companies have designed new offerings tailored to consumer preferences (Dremel et al., 2020; Tim et al., 2020). These findings align with broader evidence indicating that the analysis of large data volumes can inspire transformative innovations (Duan et al., 2018; Mikalef et al., 2019b).

### 2.3. Conceptual framework

While affordances provide the potential for value creation, their actualisation depends on organisational actions and contextual alignment. BDA affordances, such as visibility, transparency, optimisation, and innovation, represent potential actions that must be actualised through deliberate organisational efforts. Organisational processes, structural rearrangements, and collaborative mechanisms play a pivotal role in enabling affordance actualisation. For instance, Dremel et al. (2020) demonstrated that organisational actions in the automotive sector were critical for realising BDA's potential. Similarly, Zeng et al. (2020) showed how lower-level affordances, once actualised, create conditions for higher-order affordances to emerge.

These theoretical insights underscore the dynamic nature of affordance actualisation, which requires organisations to adapt processes and leverage contextual opportunities. Building on this perspective, the process of affordance actualisation has gained attention as a framework for examining how affordances transition from potential to realised outcomes. By embedding the synthesized affordances into the process of actualisation, this study contributes to the broader understanding of BDA value realisation and offers a nuanced framework for exploring how socio-technical interactions shape organisational outcomes. Building on affordance actualisation theory, this study views visibility, transparency, optimization, and innovation as emergent affordances that are actualised through the interaction of BDA features, organisational actors, and contextual mechanisms. These affordances represent potentials that must undergo a process of actualisation to deliver value. Additionally, this study emphasizes that affordances serve as a bridge between technological possibilities and organisational goals, contextualising how BDA features contribute to iterative and emergent organisational transformation. This study explores the affordance actualisation process within the banking industry, where BDA plays a critical role in enabling strategic decision-making (Barroso & Laborda, 2022; Korherr et al., 2022), operational efficiencies, and customer-centric innovation.

The process of affordance actualisation involves the dynamic interplay between BDA features, organisational actors, and contextual mechanisms. This study conceptualises affordances such as visibility, transparency, optimisation, and innovation as starting points within a cascading process. For instance, visibility affordance often emerges first, enabling transparency, which facilitates optimisation, and eventually innovation. By tracing this progression, the study explores how these affordances are actualised through iterative actions, organisational adjustments, and contextual alignments.

The conceptual framework integrates insights from the literature with preliminary findings from the case study to map the affordance actualisation process in the banking sector. It adopts the stratified lens of critical realism, emphasising the interplay of three dimensions—real,

actual, and empirical—as well as the horizontal (temporal) and vertical (emergent) dynamics of affordance actualisation (Fig. 1).

While the affordances represent the potential for actions, actions taken to actualise them reside in the actual domain as they are specific to individual cases. These actions include actions to actualise BDA affordances. The affordance effects, i.e., outcomes of the actualisation process (immediate concrete outcomes, actualisation outcome), are in the empirical domain as they can be directly observed.

Second, considering the horizontal (temporal) dimension of stratification, the framework differentiates between agency (e.g., users) and structure (e.g., organisation, institutional environment and technology) and captures how affordance actualisation materialises from their interplay over time. The framework embraces a multi-layered account of how the affordance actualisation process evolves. The explication of events and the structural entities of BDA affordances and the context allows a two-fold structural analysis 1) retroductive reasoning allows the identification of BDA affordances, and 2) investigation of the relationship between BDA affordances and the context allows the identification of other contextual mechanisms. The relationship between the focal affordance and other mechanisms demonstrates how higher-level structures and contextual conditions influence actors (macro-micro arrow), actors' response to these influences (micro-micro arrow), and a collection of actors interact to produce higher-level effects (micro-macro arrow) (Bygstad et al., 2016; Hedström & Swedberg, 1996; Williams & Karahanna, 2013).

Finally, in relation to the vertical (emergent) dimension of the stratification of critical realism, the framework embeds the concept of emergence, which manifests in the idea that affordances unfold over time. While affordance arises from the relationship between BDA and a goal-directed actor, "both of those have themselves emerged from the relations between constituent parts" (Volkoff & Strong, 2013, p. 824). As such, various affordances may arise from different parts of the structure. For example, new affordances can emerge from 1) an actualisation of previous affordances, 2) additional infrastructure capability, 3) acquisition of new skills and learning by the actors, 4) new organisational routine, 5) new physical environments, and 6) new organisational goals (Bygstad et al., 2016; Leidner et al., 2018; Strong et al., 2014; Volkoff & Strong, 2013).

## 3. Research design and method

### 3.1. Case study design and description

We use a critical realist case study approach to investigate affordance actualisation, in relatively clearly bounded but complex settings (Wynn & Williams, 2012). We employ a single, 'intensive' case study approach because of its focus on causal explanations that underpin the behaviour of phenomena (Flyvbjerg, 2006). According to Yin (2014), a single case study is appropriate when the case (1) represents the critical situation in testing a well-formulated theory, (2) represents an extreme or unique instance, (3) is a revelatory inquiry, (4) a common case to capture the circumstances and conditions of an everyday situation, or (5) longitudinal case that studies the same single-case at two or more different points in time. The study of affordance actualisation in the banking industry fits Yin (2014) third situation, as it seeks to unpack the various contextual conditions in the affordance actualisation process. Hence, the choice of a single, in-depth case study is well suited for examining BDA affordance actualisation in the banking industry, predicated on this thesis' ontological and epistemological assumptions about the interplay of structure, agency and contextual conditions. This strategy made possible explications about the organisational context within which the affordance actualisation occurs and enabled a critical examination of micro-level activities involving technology that reshapes the macro-level environment. Single case studies present new insights and offer a deep understanding of ISs in use in socially embedded contexts (Orlikowski & Iacono, 2001).

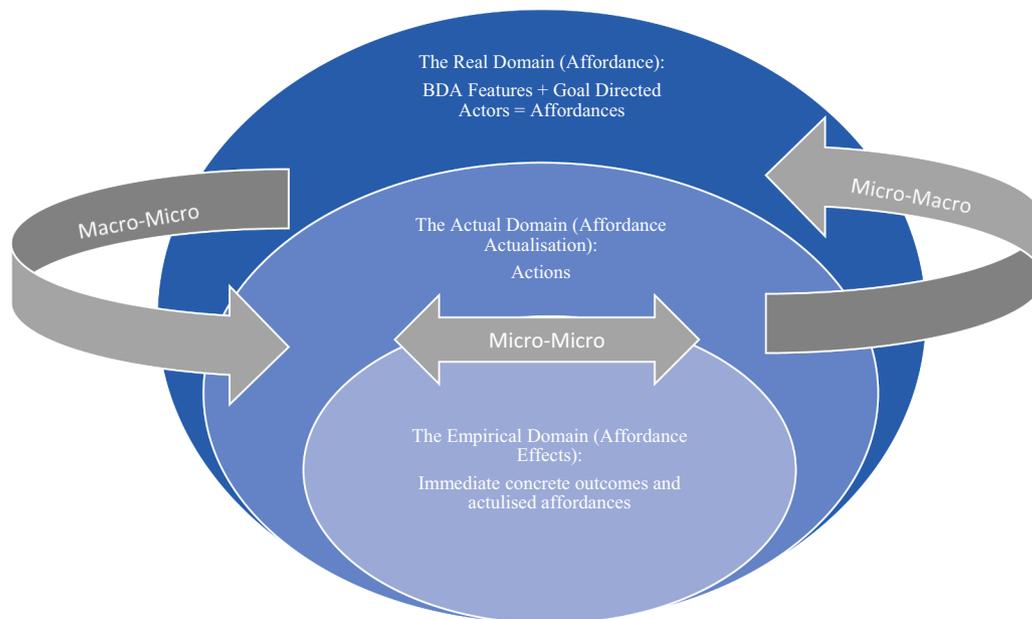


Fig. 1. Research Conceptual Framework.  
(Source: Williams & Karahanna, 2013)

Our contextual focus, the Malaysian banking sector, is an emerging Southeast Asian economy with many unbanked populations (PWC, 2016b). Globally, 31 % of adults are unbanked, and two-thirds of them own a mobile device (Demirgüç-Kunt et al., 2018). FinTech, the synergy between the two worlds of financial services and technology, is considered to be one of the major disruptors in the banking industry, particularly in the consumer banking sector (PWC, 2016a). An intensive case study of the actualisation of BDA affordances in Malaysian banks offers a window into future events on the value realisation of cutting-edge technology such as BDA.

We selected BankX, a leading ASEAN bank, as it is a well-established financial institution with diversified operational activities and has formal BDA-related activities with innovation as its focal strategy. Having completed its four-year target to enrich its ASEAN presence and drive sustainable growth in 2018, it embarked on a new strategy to accelerate growth and future-proof itself. One of its key strategies in future-proofing the business is to leverage BDA in every aspect of decision-making to enable a differentiated approach to providing financial services.

### 3.2. Data collection methods

This study pertains to BDA affordances and their actualisation and focuses on the interplay between technology, goal-directed actors and the contextual environment. In line with critical realist metatheory, the research commenced with certain a priori conceptions (Njihia & Merali, 2013) while allowing for these conceptions to evolve and develop during the fieldwork.

The most commonly used data collection methods in qualitative case study research are observations, interviews and documentation (Eisenhardt & Graebner, 2007). While this was the original plan for data collection in this study, the worldwide COVID-19 pandemic, which coincided with the data collection period, altered the original plans. Therefore, data collection methods were revised to an open-ended exploratory survey (via Google Form), online interviews and secondary source analysis (Table 2) and the data collection plan for this study was emergent. While interviews were the primary data source for this study and generated rich data about the research phenomena, several limitations need to be considered. Interviews can be subject to bias from the researcher and participants (Hammersley & Atkinson, 2019; Keats,

2000). Moreover, the respondent's behaviour can involve inconsistency and inaccuracy in recalling the events hence distorting answers and affecting the quality of data collected (Keats, 2000; Yin, 2014). These issues are addressed in this research by i) assessing and comparing data gathered from different interviews participants and other research methods (Hammersley & Atkinson, 2019), ii) adopting a feedback loop during the interview, where participant's responses were further probed in following questions (Keats, 2000), and iii) using member checking whereby during the interviews the researcher restated or summarised information and then questioned the participant to determine accuracy (Birt et al., 2016; Bloor & Wood, 2006; Lincoln & Guba, 1985).

- i. Thirty-seven interviews with 30 participants were conducted (Appendix A). Seven out of the 30 participants were open-ended survey participants. Following critical realist logic, the focus was the depth of data rather than quantity (Manzano, 2016). Sampling was adjudged adequate when data saturation was reached (Saunders et al., 2018). We also employed a documentary review of external data (e.g. annual reports, BNM guidelines, company website, and press releases, from 2018 to 2020) to obtain retrospective data about actualisation events and outcomes, corroborate data gathered from different sources (open-ended surveys and interviews) and confirm or counter data interpretations (Henfridsson & Bygstad, 2013). These external documents were accessed online and analysed continuously before, during and after fieldwork to corroborate and enrich interview data (Mutch, 2014).

### 3.3. Data analysis

There were two phases of data analysis: description and analysis that mainly focused on events, issues and the case context; and semantic and latent data analysis in explaining the mechanisms driving affordance actualisation. For analysing critical realist case study data, we adopted the step-wise framework for critical realist data analysis (Bygstad et al., 2016). Thematic analysis (Braun & Clarke, 2006) and Saldana's (2009) coding were also used to analyse data.

## 4. Findings

This study's events and empirical findings were analysed to address

**Table 2**  
Data Collection Methods.

Method	Stage	Quantity	Use in analysis
Open-ended online survey 8 May-15 Sept 2020	Pilot Study	4 participants	Familiarise with BDA - features, usage, affordances and related constraints in value realisation.
	Main Study	35 participants: 26 bank employees	
Follow-up phone call: September 2020	Main Study	9 service providers and partners	Identify formal processes and informal routines through which BDA gets translated into a favourable outcome.
		3 participants	
Online Interview: September 2020-June 2021 <i>Needham, 2021</i>	Pilot Study	2 interviews	Assist in the theory-gleaning process ( <i>Manzano, 2016</i> ).
	Main Study	36 interviews: 25 bank employees, 5 service providers	
Secondary source analysis May 2020-July 2021 <i>Needham, 2021</i>	Main Study	Annual reports-2018 to 2020	Improve understanding of the BDA actualisation process and constraint-mitigating activities. Theory refinement and consolidation in mid-range theory building based on mechanism-context-outcome ( <i>Pawson, 2000</i> ). Triangulate and integrate with evidence from the open-ended survey and secondary data.
		Industry reports Bank Negara Malaysia (BNM) Guidelines Press releases Newspaper reports	
TOTAL CASE DATABASE		59 participants 410 pages of interview transcripts 20 industry reports 3 annual reports 18 press releases 6 BNM guidelines	Corroborate data acquired from the survey and interviews. Gain an understanding of corporate mission and vision, and insights into organisational strategy and aspirations regarding BDA use and outcomes. Identification of contextual constraints affecting BDA affordance actualisation.

the phenomenon of interest: the process of BDA affordance actualisation. Following critical realist conventions (*Bygstad et al., 2016; Henfridsson & Bygstad, 2013; Wynn & Williams, 2012*) findings are presented in three parts: 1) key events, 2) key entities and 3) retroduction.

#### 4.1. Key events

The main events in the study constitute the various actualisation activities by the actors to actualise BDA affordances. We define events as specific happenings enacted within the organisation, as perceived by and reported by actors (interview participants). Refer to [Table 3](#) for a summary of key events, sub-events and actions.

With respect to event 1 (initial implementation), BDA was framed as a four-year project by senior managers. Event 2 (engagement with regulators) was viewed as crucial to achieving organisational goals. Related to event 2, in event 3 (inbound open innovation) BankX partnered with FinTech start-ups to capitalise on their relative freedom from strict regulatory oversight, freeing their innovative capability. Related to event 3, event 4 (partnering with knowledge-rich partners) involved co-creating value with unrelated rather than related complementary players.

Events 5–10 were internally focused initiatives. Event 5

**Table 3**  
Summary of Key Events, Sub-Events and Actions.

Events	Sub-events and actions
<b>EXTERNALLY FOCUSED EVENTS</b>	
1:Initial implementation	Establish new roles, teams, and departments; technical and managerial training. Expand infrastructure to provide tools and technological support. Invest in new technologies and tools
2:Engagement with regulators (BN)	Regular and frequent meetings between BankX’s top management and regulators (Bank Negara (BN)) to clarify and co-create what is and is not allowable.
3:Inbound open innovation	Partnering with FinTech start-ups. Develop an incubator programme to provide a safe environment for testing new ideas. Running hackathons to re-position BankX as technology-driven, and to attract new talent.
4. Partnering with knowledge-rich partners	Partnering with complementary players to provide a strategic view of consumer behaviour.
<b>INTERNALLY FOCUSED EVENTS</b>	
5: Workaround for legacy systems	Staged migration (multiple systems, hybrid mode, new integrated mode). Address legacy issues from multiple systems by building an analytic layer. Pipe and clean legacy system data to ensure 360-degree customer information.
6: Establish centralised analytics teams	Form new teams to address data fragmentation and monetise data through new product development.
7: Increase cross-functional alignment	Create a new structure by forming business enabler units to support strategic business units (SBUs), create new roles (translators) and align Key Performance Indexes’ (KPI).
8: Create an agile structure	Experimentation with multi-disciplinary teams for product development and operational project decisions. Create policies and capabilities enabling rapid response to external change.
9: Experimentation and “quick wins”	Testing of new ideas in smaller markets, trial and error. Identifying projects that are visible, with immediate benefit and modest resourcing requirements. Communicating positive results to top management, and building trust in project effectiveness.
10: Creating a data-aware culture	Company-wide education programme implemented on multiple platforms, rewards for data course completion. Active employee engagement – establishment of internal communications platforms, discussions, and open sharing of views. Careful integration of new people into departments and processes.

(workarounds for legacy systems) addressed infrastructure imperatives. Linked with event 5, event 6 (establish centralised analytics teams) reflected a change in the organisational structure necessary to implement the workarounds. Event 7 (increase cross-functional alignment) reflected the importance of internal collaboration. Event 8 (create an agile structure) had linkages with Event 2 in that complex governance processes and tight regulation impede innovation; and with events 5–7 as antecedents. Experimentation initiatives (event 9) were mounted, whereby relatively simple, low-risk projects with a high likelihood of success were actioned first to prove returns and garner support for future projects. Event 10 (creating a data-aware culture) was crucial to effective change management, supporting buy-in to the new BDA strategy.

#### 4.2. Key entities

Both technical and social entities supported BankX’s BDA affordance actualisation efforts ([Fig. 2](#)).

Technical entities included data, tools, technology, and analysis procedures; the processes, features, systems, or tools that enable data acquisition, integration, data storage, and analysis. Within the technical entities, data, analytics and tools are interdependent. Data serves as the foundation while tools enable the collection, processing and storage of data. Analytics transforms the data into actionable insights, using tools

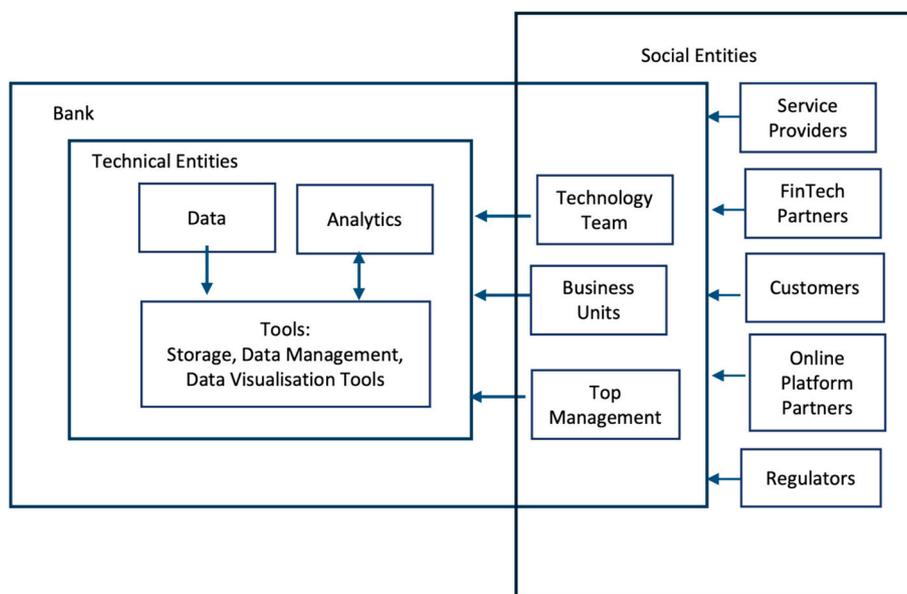


Fig. 2. Key entities in BDA affordance actualisation in the financial services industry. (Source: Authors)

to execute models and present findings. This creates a feedback loop where insights from analytics may influence the tools or data processes, ensuring the system continuously evolves to support the bank’s objectives. The social entities, comprising of internal actors within the bank—such as technology teams, business units, and top management—and external actors like service providers, FinTech partners, customers, online platform partners, and regulators, interact in distinct ways. The internal social entities engage closely with the technical entities to ensure smooth operations and extract value from the data and analytics. External actors, such as regulators and customers, interact with the bank at an organisational level, influencing how data is used, analysed, and managed. Together, these interactions play a crucial role in the affordance actualisation process of Big Data Analytics (BDA), as

outlined in Table 4. Organisational ‘enabler’ units were responsible for BDA strategy and coordination with multiple internal and external parties, ranging from central bank regulators to platform partners and customers.

4.3. Retroduction

The case events were analysed and engaged with the chosen theory but with an understanding that the chosen theory may be fallible. The events are also engaged with possible alternative theories exploring different theoretical perspectives and explanations. The engagement of case events with relevant theories allows the explanation of the events within their context (Danermark et al., 2002). As a result, four affordances were retroduced. Table 5 describes four general BDA features, showing details of the application in BankX, the accompanying affordances and actual outcomes.

Four BDA affordances (visibility, transparency, optimisation and innovation) were supported by interrelated entities and events including technologies, actualisation actions, and organisational changes. These affordances created options for building the internal capabilities required to achieve desirable competitive outcomes. Deriving from customer insights (visibility affordance) supported by effective use of analytic tools such as customer life-cycle analysis (transparency and optimisation affordance), actors integrate resources and mitigate constraints to create new offers (innovation affordance). However, these affordances are mere potentials and the actualisation effort was mitigated by nine constraints (Table 6). Unactualised or partially actualised preceding affordance inhibits the actualisation of subsequent affordances.

Table 6 shows six main contextual constraints in BDA affordance actualisation in the banking industry: 1) employee attitude and belief, 2) employee capabilities, 3) traditional work practice, 4) cultural resistance, 5) technology structures and systems, and 6) regulatory environment. These constraints affected BDA affordance actualisation. The explicated events show that BankX’s managers acted to mitigate these constraints by investing in resources and capabilities including increased infrastructure capacity and budgets, improved structures and systems, acquisition of necessary skills and talent, and inculcating a data-driven culture. These activities lead to observable outcomes in the empirical domain. The main empirical outcome in this project is the

Table 4 Detail of key social entities in BDA affordance actualisation in BankX.

INTERNAL TEAMS	
Actor	Description
Technology team	Technology specialists are responsible for strategic and operational activities. Also known as the Enabler Unit
Business team	Functional specialists are responsible for strategic and operational revenue-generating activities. Includes loans, credit cards, wealth management and investment departments
Top management	Senior executives with strategic decision-making capacity
EXTERNAL TEAMS	
Actor	Description
Regulators	Senior policymakers and central bank employees are responsible for devising and enforcing rules and regulations
Service providers	Consulting firms providing independent technical advice and support; e.g. independent contractors, ‘Big 4’, telecommunication partners, airlines and strategic communications partners
FinTech partners	Established financial technology companies or start-ups providing resource inputs (knowledge, networks)
Online platform partners	Online shopping platforms engage in value co-production through knowledge sharing
Customers	Individuals, small and large businesses. Sources of primary data, new and existing end users of financial services, and co-creators of data through transactional activities

**Table 5**  
Four BDA affordances: Visibility, transparency, optimisation and innovation.

BDA Affordances	Generic BDA capabilities	As applied in BankX	BankX Outcomes
<b>Visibility:</b> The potential to access and analyse customer behaviour	5Vs-enabled processing of sequential and non-sequential data	Create detailed customer profiles	<b>Customer insight</b>
<b>Transparency:</b> The potential to be aware of individual customer needs	Data visualisation with dashboard, descriptive analytics, diagnostic analytics	Sensemaking - customer demographic and behavioural analysis Strategy - customer profiling, segmentation and targeting activities	<b>Enhanced customer experience:</b> Customer life-cycle analysis, proactive financing Targeted marketing, up-selling, cross-selling, micro-targeting and personalisation
<b>Optimisation:</b> The potential to enhance business processes	Data mining and training with a large amount of data from multiple sources, predictive analytics	Statistical modelling and machine learning	<b>Business process transformation:</b> Improved KYC capability, efficient onboarding of customers, HR management, enhanced auditing; data-driven risk management and enhanced compliance, EWI, improved credit risk assessment, improved pricing strategy, process improvements
<b>Innovation:</b> The potential to create new products, services, processes and organisational forms supporting competitive advantage.	Analysis of multiple forms of data from multiple sources, predictive and prescriptive technology	Data-driven decision-making	<b>Product &amp; process innovation:</b> New services e.g. online account opening Straight-through processing, alternative credit scoring Innovative organisational forms e.g. stand-alone digital bank

affordance effects: 1) immediate concrete outcomes of actualisation activities and 2) the BDA affordance actualisation outcome.

One of the immediate concrete outcomes of actualisation activities observed in the case study was the improved configuration of BDA-related resources. The configuration of BDA-related resources includes increased infrastructure capacity, more budget allocation for BDA projects, wider data availability with improved integration, acquisition of necessary skills and talent, and inculcation of a data-driven culture in the bank. Extant RBV-based literature proposes that the interplay between tangible and non-tangible organisational resources and organisational capabilities is necessary to realise BDA value (Wamba et al., 2017). This RBV-based literature conceptualises the configurations of human, tangible and intangible resources and the BDA capability of the firm that lead to the realisation of BDA value (e.g. Mikalef et al., 2019). Likewise, other studies posit BDA capability as a dynamic capability that allows the sensing, seizing and transforming of opportunities into business value (Torres et al., 2018; Wamba et al., 2017).

While the configuration of resources by RBV and dynamic capability does explain the value realisation of BDA (Akter et al., 2016), it does not explain the process or the actions of actors in the configuration of resources and the various constraints they have to overcome in the

**Table 6**  
Constraints in BDA affordance actualisation in BankX.

Constraints	Explanation	Illustrative Quotes
Employee attitudes & beliefs	Limitations to strategy and operations imposed by employee resistance to change, negative attitudes and beliefs; including industry stereotyping (the belief that the financial services industry is not a technological industry), change as an added burden to workload, and fear of job loss.	<i>The bank's BAU [Business As Usual] continues. So, many of these new initiatives, data related especially, it's additional work for most people"</i> (P5, Assistant VP, Modelling & Portfolio Analytics).
Employee capabilities	Limitations to strategy and operations imposed by current knowledge, skills and capabilities. Traditional bankers and data engineers are not trained or experienced in sophisticated data technologies.	<i>"... those engineers in the bank, they are probably old school. You know, they code in Java, C sharp for example"</i> (P8, Senior Management- Data Strategy and Model Risk).
Traditional work practises	Limitations to operations imposed by tight regulatory controls, 'silo' departmental structures, organisational politics and tightly defined work practices. Lengthy approval procedures hamper collaboration. Ponderous process improvement and lengthy time-to-market.	<i>"... you need to go through the bank process. It may take a few months"</i> (P6, CEO). <i>"... there are a lot of business units, and each unit has its priority and objectives"</i> (P19, Director- Lead Analytics Architect).
Cultural resistance	Limitations to strategy and operations imposed by a conservative and risk-averse culture. Errors can have major financial and reputational consequences. The industry is risk-averse, particularly in view of scandals such as 1MDB and Barings Bank.	<i>... if we mistakenly push a bad model into production, a single portfolio could be losses with millions"</i> (P5, Assistant VP, Modelling & Portfolio Analytics). <i>"The problem with banks is that they don't want to take risks"</i> (P19, Director, Lead Analytics Architect).
Technology structure and systems	Limitations to strategy and operations imposed by the functionality of existing software and hardware systems. BankX is the product of multiple mergers, resulting in multiple legacy data systems based on differing business logic. Systems lock-ins result from sunk costs, irreplaceable functionality and components.	<i>"So, we have to deal with our mainframe system, our AS400, an old-fashioned system ... our very traditional databases... I don't think in a day you can change all the mainframes to new"</i> (P19, Director- Lead Analytics Architect).
Regulatory environment	Limitations to strategy and operations imposed by tight regulatory control or ambiguous regulations relating to data privacy and security. Innovation is constrained by the need for central bank approvals for the development process, for example, algorithms designed to evaluate consumer credit. International data mobility is restricted owing to money laundering and privacy concerns, hampering Cloud migration.	<i>... you can use big data any fancy way ... you think you are a genius, but you are not necessarily allowed to do so because all this is new.</i> (P20, Director- Investment Banking). <i>... AI models need to be fair as they are going to the regulators. I cannot build discriminatory models...</i> (P5, Assistant VP, Modelling & Portfolio Analytics) <i>... on-premise, you need a super big server, super big data capacity, super good memory and [etc.] buying all these hardware installations would take months, [while] if we move to the cloud, it's just a matter of maybe days or a week</i> (P28, Director, Analytics Service Provider)

configuration of BDA related resources. Hence the affordance actualisation theory is better suited to explain the phenomenon of interest as affordance is just potential (Volkoff & Strong, 2013). While the extant literature also demonstrates the importance of organisational actions, which constitute the rearrangement of organisational structure and processes in developing BDA-related resources (Dremel et al., 2020), it does not constitute the engagement of the organisation within its context. The consideration of the contextual environment should be one of the central explanations of the BDA affordance actualisation, particularly in BDA resource mobilisation. The influence of the context in resource mobilisation impacts the thoughts, feelings, and behaviour of individual and collective actors (Scott, 2014) and is central to examining BDA affordance actualisation.

5. Discussion

The finalised model of this research is proposed as the BDA affordance actualisation process. This process is the result of the consolidation of findings from this research. The model encapsulates the answer to the research question: How does the process of BDA affordance actualisation occur?

BDA affordance actualisation is dynamic, a multi-level process that involves macro-level structures and context that influence actors, micro-level interaction of actors that respond to these influences, and collective actor actions that produce macro-level effects and outcomes. Further analysis of affordance actualisation as a process steered the empirical investigation of various actualisation activities by the actors' related outcomes (immediate concrete outcomes, actualisation outcomes). Finally, the research understanding of actualisation as a process has allowed the unpacking of BDA affordance actualisation and the contextual mechanisms that constrain and enable the actualisation process.

The framework (Fig. 3) depicts the process of affordance actualisation per critical (Jørgensen & Messner, 2009) stratification: real-actual-empirical dimensions, horizontal (temporal) and vertical (emergent) (Volkoff & Strong, 2013).

First, applying the critical realism stratification of reality into the domains of real, actual and empirical, the real domain incorporates the mechanisms driving the process of actualisation (Imrie, 2013), such as the affordances and elements giving rise to them. While the affordances represent the potential for actions, actions taken to actualise them reside

in the actual domain as they are specific to individual cases. These actions include planned action and resource-mitigating actions to actualise BDA affordances. The affordance effects are in the empirical domain as they can be directly observed.

Second, considering the horizontal (temporal) dimension of stratification, the framework differentiates between agency (e.g. users) and structure (e.g. organisation, contextual environment and technology) and captures how affordance actualisation materialises from their interplay over time. The framework embraces a multi-layered account of how the affordance actualisation process evolves. The explication of events and the structural entities of BDA affordances and the context allows a two-fold structural analysis: 1) retroductive reasoning allows the identification of BDA affordances, and 2) investigation of the relationship between BDA affordances and the context allows the identification of other contextual mechanisms. The relationship between the focal affordance and other mechanisms demonstrates how higher-level structures and contextual conditions influence actors (macro-micro), actors' response to these influences (micro-micro), and a collection of actors interact to produce higher-level effects (micro-macro) (Bygstad et al., 2016).

Finally, the framework embeds the concept of emergence, which manifests in the idea that affordances unfold over time. Various affordances may arise from different parts of the structure. For example, new affordances can emerge from 1) an actualisation of previous affordances, 2) additional infrastructure capability, 3) acquisition of new skills and learning by the actors, 4) new organisational routine, 5) new physical environments, and 6) new organisational goals (Bygstad et al., 2016).

The arrows in Fig. 3 illustrate the dynamic and iterative relationships across the macro (real), micro (actual), and empirical (observable) layers of BDA affordance actualisation. **Horizontal arrows** depict the sequential progression of actions and events, showing how affordances emerge and evolve through planned implementation actions and improvisations to mitigate constraints. **Vertical arrows** highlight the causal mechanisms driving affordance actualisation across the domains, beginning with interactions at the real domain (goal-directed actors and BDA features), transitioning through events in the actual domain, and culminating in observable outcomes in the empirical domain.

Additionally, **bi-directional arrows** emphasise the iterative nature of affordance actualisation, as actions and outcomes feed back into the process to influence subsequent affordances and events. For instance, the successful realisation of visibility affordance can facilitate the

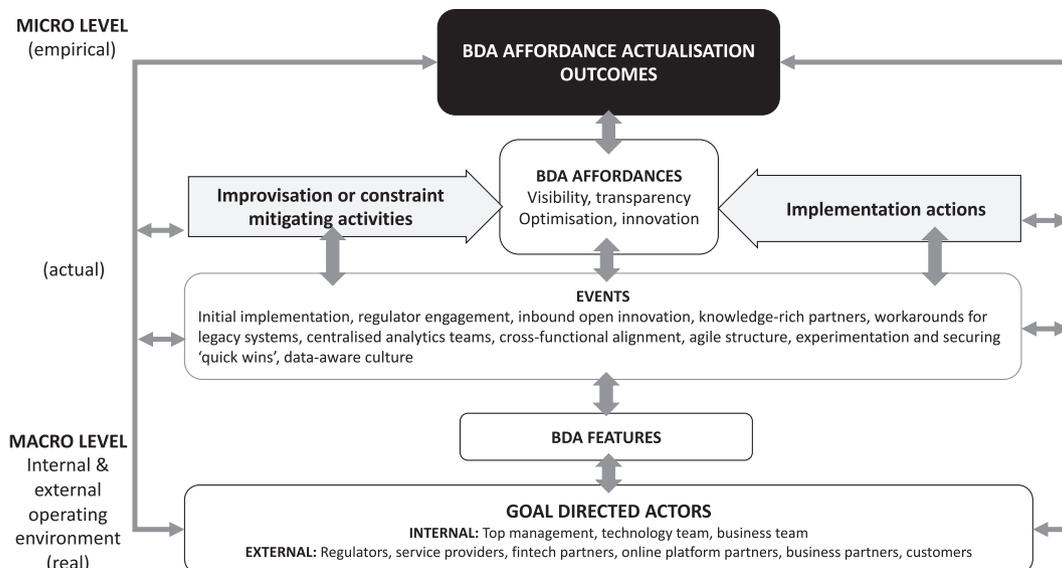


Fig. 3. Research Theoretical Framework: Key findings from the study of BDA Affordance Actualisation. (Source: Authors)

emergence of transparency affordance, fostering further optimisation and innovation affordances. Finally, the **macro-to-micro arrows** underscore how the internal and external operating environment shapes the actions of goal-directed actors and influences the realisation of BDA affordances.

By integrating these dimensions, the figure visually represents the socio-technical interplay, iterative feedback loops, and contextual dependencies that define the affordance actualisation process. This comprehensive representation supports the framework’s focus on capturing the complexity and dynamism of the affordance actualisation process.

5.1. BDA affordance actualisation process

This research resulted in important findings regarding the process of BDA affordance actualisation. The process of affordance actualisation emerges from the interplay between goal-directed actors and BDA. While the actualisation journey begins with this interplay, it may take different routes if the actors face constraints. Case study data shows that BankX actors encountered several contextual issues that were constraints in their actualisation journey. When faced with constraints in affordance actualisations, goal-directed actors engaged in constraint-mitigating actions in BDA affordance actualisation. These actions were both individual actions and collective organisational actions. Actors collectively engaged in a workaround to layer the system and piped data from the legacy system into the new layer for analytical activities to be conducted. The workarounds used to layer the legacy system suggest that when the actualisation journey cannot proceed due to constraints, improvisation activities take place to mitigate constraints. This finding is consistent with previous studies that indicate how people learn to manoeuvre around technology by using its features for purposes other than what designers intended and changing some other aspects of their environment to attain their goal (e.g. Leonardi, 2011).

The research indicates that while actors engage in constraint-mitigating activities to actualise BDA affordances, they collectively trigger organisational changes that act as releasing and stimulating conditions. As a result, the effects of these constraint-mitigating activities are two-fold: 1) removal of actualisation barriers and 2) contextual changes. This finding is consistent with Dremel et al. (2020) case study that showed that the coordinating mechanism explains the interworking between departments to actualise BDA affordances.

The case study findings also exemplify how the constraint-mitigating activities induced regulation changes. This finding is consistent with studies on institutional work that argue that while institutions may have a persistent behaviour pattern, they are not immune to change. The finding is also consistent with previous studies that exemplify how micro-level activities involving technology reshape macro-level structures (Barrett et al., 2013). In addition to being consistent with institutional work studies, the finding is consistent with the multi-level perspective (MLP) of innovation (Geels, 2002), where niche innovation eventually trickles up to the macro level.

The findings of this study also show how BDA affordance actualisation efforts support organisational objectives. The realisation of BDA affordances allowed BankX to achieve its overall objectives of providing differentiated services, cost-reduction, and increased customer satisfaction. This finding corroborates the conclusions of previous research, indicating that immediate concrete outcomes of actualisation activities support the attainment of organisational goals (Leonardi, 2013; Liu et al., 2022; Volkoff & Strong, 2013).

Finally, the findings explain how affordances emerge and unfold over time due to internal and external events. Consistent with previous studies, the findings show that affordances can emerge from 1) an actualisation of previous affordances, 2) additional BDA capability, 3) an increase in other organisational capabilities, and 4) new organisational work practice (Bygstad et al., 2016; Zeng et al., 2020). Supporting the concept of affordance dependency, positing that the actualisation of

a preceding affordance creates stimulating conditions for subsequent affordances (Volkoff & Strong, 2013; Zeng et al., 2020), this research highlighted an evolutionary perspective whereby the actualisation of visibility affordance led to the emergence of other affordances. The findings also explain how affordances emerge as a result of organisational changes; i.e., the increase in BDA capability, integrated teams and improved agility allowed the emergence of the innovation affordance.

5.2. Theoretical implication

Table 7 summarises the theoretical implication of the present study compared to previous studies. The BDA process theorisation generates important implications as it provides an overarching comprehensive framework for the affordances of BDA as a whole and the related mechanisms in its value realisation. First, it provides a more detailed account of BDA value realisation as compared to variance-based studies, as technology implementation is not a straightforward matter between a few independent variables and a dependent variable. Second, it explains the process of building BDA capability in the organisation as called for by Mikalef et al. (2020). While previous studies provided useful demonstrations of how the orchestration of BDA-related resources contributes to the BDA capability of the organisation and consequently increases performance, this study explicates the actors’ actions in the process of BDA capability development. Finally, it allows the explanation of how the organisation matures from the initial stages of experimenting with new technology, dealing with the constraining factors to routinisation and countermeasures.

The model developed from the findings of this study does not represent a complete theory of organisational change related to information technology. Rather, it represents a mid-range theory, a theory of explanation (Gregor, 2006), detailing affordance actualisation within a particular context. Accordingly, this study builds on the affordance actualisation theory by Strong et al. (2014) by adding the contextual perspective that helps explain how and why affordances are actualised within a particular context. This study shows that the realisation of value from BDA is an ongoing process. The affordance actualisation process unveiled in this study illustrates that new affordances emerge from the actualisation of preceding affordances and the increase in BDA and other organisational capabilities.

5.3. Managerial implications

Banking and other practitioners should proactively actualise affordances and build BDA capabilities to trigger further opportunities enabling the value realisation of BDA. In addition, special attention should be given to the implementation problems as an escalation of issues without appropriate countermeasures may lead to the non-actualisation of affordances and eventually cause implementation failures. The study’s findings show that the mismatch between the actualisation context and the expected actualisation context is the main barrier to affordance actualisation. The case organisation managed to identify

**Table 7**  
Summary of comparison between this study and previous studies.

Aspect	This Study	Previous Studies
Framework	Provides a comprehensive process-oriented framework for BDA affordance actualisation	Primarily variance-based studies focusing on relationships between variables
Capability Building	Explicates actors’ actions in building organisational BDA capability	Demonstrates the orchestration of BDA resources contributing to capability
Organisational Maturity	Explains progression from experimentation to routinisation while dealing with constraints	Lacks detailed accounts of organisational progression stages

the mismatch between the actualisation context and initiated work-around, they managed to initiate workaround strategies to overcome constraints. Implementing effective countermeasures is imperative in BDA value realisation.

Organisations should not just concentrate on building novel BDA-related resources but on improvisation on what is available within the context and expanding their external network to realise BDA value. The focus in BDA implementation projects should be on long-term outcomes as a more significant BDA value is realisable in the long run. One of the barriers mentioned in the realisation of BDA value is the short-sighted value expectation of middle managers. The case organisation’s shift towards the focus on long-term BDA potentials while actualising lower-level affordances enabled a more successful BDA implementation. Focusing on long-term results would also encourage the longevity of BDA, avoiding project halts in the early stages. Focusing on long-term results entails embracing organisational changes. As BDA is not a single system change, it requires the holistic transformation of the entire organisation. The case organisation integrated changes across the organisation through transformational programs as BDA implementation required cultural and structural adaptation. As such, the implementation of BDA should be regarded as a transformation process in banks and other organisations.

## 6. Conclusion

This research fills a gap in the literature on the process of BDA affordance actualisation in the banking industry (Korherr et al., 2022). Prior literature on BDA has primarily focused on the potential value of BDA (e.g. Müller et al., 2018) or on the configuration of organisational resources and capabilities for BDA (e.g. Akter et al., 2016). The association between the effective implementation of BDA and the necessary contextual conditions is still in a nascent stage. This association, however, is essential in expanding knowledge on generating business value through BDA. This study contributes to the current body on the value realisation of BDA by identifying BDA affordances and how it is realised in the banking industry, presenting a situated view of BDA value realisation. Moreover, the research develops an industry-specific process of affordance actualisation from BDA implementation from a critical realist perspective in three dimensions: real-actual-empirical, horizontal (temporal) and vertical (emergent) (Volkoff & Strong, 2013). Finally, in relation to the framework’s vertical (emergent) dimension, the framework embeds the concept of emergence, which manifests in the idea that actualisation is an ongoing process. This study extends the current understanding of BDA affordances by leveraging the concept of affordances and explicating actualisation mechanisms that drive outcomes in the banking industry.

Like any research undertaking, this study contains several limitations

## Appendix A. Appendix

### A.1. Interview participants

Participant	Position	Number of Interviews and Duration
P1	Retail Business Senior Manager	56 min
P2	HR Senior Manager	38 min
P3	Data Management Senior Manager	30 min
P4	Senior Management, Strategy	39 min
P5	Assistant Vice President, Modelling & Portfolio Analytics	1 h, 53 min, 47 min
P6	CEO	1 h, 45 min,
P7	Senior Manager- Data Strategy	49 min
P8	Senior Management- Data Strategy and Model Risk	51 min
P9	Senior Management- Corporate Affairs	1 hour 48 min
P10	Senior Management- Retail Banking	33 min
P11	Director- Analytics Service Provider	45 min, 35 min
P12	Senior Manager- Analytics Service Provider	38 min

(continued on next page)

that can be addressed in future research. The first limitation to be addressed stems from the adoption of critical realist ontology where the key premise holds that knowledge is fallible and mediated by the researcher’s interpretations and theoretical lenses adopted (Sayer, 2010). Therefore, the study does not claim that the identified generative mechanisms explain BDA affordance actualisation fully. Second, the study findings are based on the context of a developing country where the legal technology framework is not fully advanced. While this is an important contribution as developed Western countries’ context dominates the literature, the actualisation practices derived in this context can differ from those organisations in a developed nation. As the literature lacks an empirical-based investigation of BDA affordances and their actualisation in the banking industry, future research could conduct a similar study on banks in developed economies and compare the findings. Furthermore, the BDA affordances identified in this study through literature synthesis and retroduction can be applied in other industries.

Furthermore, data collection conducted in the traditional bank setting may raise concerns about the possibility of bank employees being cautious in their responses being “politically correct”, especially regarding organisational and institutional issues, as they may not want to be seen as “complaining” about the bank or regulators. However, the assurance that this scholarly work aimed at improving technology implementation and its anonymity enabled the solicitation of views and responses to reflect objective reality.

Finally, the methodological choice of a single-case study design may limit the generalisability of the findings. While this approach allows for an in-depth exploration of the affordance actualisation process within a specific context, future research could adopt multiple-case study designs to compare affordance actualisation practices across different organisations and industries. This approach could strengthen the external validity of findings and identify commonalities or divergences in BDA implementation practices.

## CRediT authorship contribution statement

**Firdous Mohd Farouk:** Writing – original draft, Methodology, Data curation, Conceptualization. **Christophe Schinckus:** Writing – review & editing, Validation, Methodology. **Sandra Smith:** Writing – original draft, Visualization, Methodology, Investigation.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

(continued)

Participant	Position	Number of Interviews and Duration
P13	Senior Manager- Risk Management	55 min
P14	Associate Director- Business Management	30 min
P15	Managing Director	58 min, 20 min
P16	Head of Innovation	49 min
P17	Head of Retail	39 min
P18	Director- Lead Analytics Architect	1 h 9 min, 42 min
P19	Director- Investment Banking	47 min
P20	Senior Manager- Web Analytics	45 min
P21	Senior Manager- Marketing	30 min
P22	Senior Management- Business Data Analyst	30 min
P23	Senior Manager- Data Governance	53 min
P24	Senior Manager-Internal Audit	37 min
P25	Owner- AI Service Provider	56 min
P26	Senior Manager- Platform Partner	45 min
P27	Director- Analytics Service Provider	58 min, 30 min
P28	Lead Engineer- Service Provider	40 min
P29	Owner- Platform Partner	30 min
P30	Senior Manager- Platform Partner	35 min
TOTAL	30 participants: 25 bank employees 5 service providers/partners	28 h

## Data availability

Data will be made available on request.

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